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VOLUME 1

THIRTY-FIRST ANNUAL REPORT

OF THE

Maine Agricultural Experiment Station

ORONO, MAINE

1915

STATE OF MAINE

1916

MAINE
AGRICULTURAL EXPERIMENT STATION
ORONO, MAINE.

Organization January to June, 1915.

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	CHARLES C. INMAN,	*Assistant*

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	WALTER E. CURTIS,	*Scientific Aid*
ROYDEN L. HAMMOND,		*Seed Analyst and Photographer*
CHARLES C. INMAN,		*Assistant*

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*Absent on leave.

The publications of this Station will be sent free to any address in Maine. All requests should be sent to

Agricultural Experiment Station,

Orono, Maine.

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ANNOUNCEMENTS.

ESTABLISHMENT OF THE STATION.

The Maine Fertilizer Control and Agricultural Experiment Station, established by Act of the Legislature approved March 3, 1885, began its work in April of that year in quarters furnished by the College. After the Station had existed for two years, Congress passed what is known as the Hatch Act, establishing agricultural experiment stations in every state. This grant was accepted by the Maine Legislature by an Act approved March 16, 1887, which established the Maine Agricultural Experiment Station as a department of the University. The reorganization was effected in June, 1887, but work was not begun until February 16, 1888. In 1906 Congress passed the Adams Act for the further endowment of the stations established under the Hatch Act.

The purpose of the experiment stations is defined in the Act of Congress establishing them as follows:

"It shall be the object and duty of said experiment stations to conduct original researches or verify experiments on the physiology of plants and animals; the diseases to which they are severally subject, with the remedies for the same; the chemical composition of useful plants at their different stages of growth; the comparative advantage of rotative cropping as pursued under a varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soils and water; the chemical composition of manure, natural and artificial, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly on the agricultural industry of the United States as may in each case be deemed advisable, having due regard to the varying conditions and needs of the respective states or territories."

The work that the Experiment Station can undertake from the Adams Act fund is more restricted and can "be applied only to paying the necessary expenses for conducting original researches or experiments bearing directly on the agricultural industry of the United States, having due regard to the varying conditions and needs of the respective states and territories."

INVESTIGATIONS.

The Station continues to restrict its work to a few important lines, believing that it is better for the agriculture of the State to study thoroughly a few problems than to spread over the whole field of agricultural science. It has continued to improve its facilities and segregate its work in such a way as to make it an effective agency for research in agriculture. Prominent among the lines of investigation are studies upon the food of man and animals, the diseases of plants and animals, breeding of plants and animals, orchard and field experiments, poultry investigations, and entomological research.

The Legislature of 1913 provided for investigations by the Station in animal husbandry which make Chapter 141 of the Public Laws for 1913. The following quoted from the act outlines the purpose of the act. "The Maine Agricultural Experiment Station in addition to the investigations now conducted by it, shall conduct scientific investigations in animal husbandry, including experiments and observations on dairy cattle and other domestic animals. Said investigations shall be carried out under control of the director of the Maine Agricultural Experiment Station. There shall be appropriated annually from the State Treasury the sum of five thousand dollars to be paid to the Maine Agricultural Experiment Station and the same shall be expended by the director of said Station in executing the provisions of this act."

INSPECTIONS.

Up to the close of the year 1913 it had been the duty of the Director of the Station to execute the laws regulating the sale of agricultural seeds, apples, commercial feeding stuffs, commercial fertilizers, drugs, foods, fungicides and insecticides, and the testing of the graduated glassware used by creameries. Beginning with January 1914 the purely executive part of these laws is handled by the Commissioner of Agriculture. It is still the duty of the Director of the Station to make the analytical examination of the samples collected by the Commissioner and to publish the results of the analyses. The cost of the inspections is borne by fees and by a State appropriation.

Offices and Laboratories.

The offices, laboratories and poultry plant of the Maine Agricultural Experiment Station are at the University of Maine, Orono. Orono is the freight, express, post, telegraph and telephone address for the offices and laboratories.

Visitors to the Station will find it convenient to leave the steam cars at Bangor or Old Town, as the railway station at Orono is a mile from the University. Bangor and Old Town trolley cars pass through the campus. They pass the railway station in Bangor 5 minutes after the hour and half hour, and the railway station in Old Town, 20 minutes after and 10 minutes before the hour.

Aroostook Farm.

By action of the Legislatures of 1913 and 1915 a farm was purchased in Aroostook County for scientific investigations in agriculture to be under "the general supervision, management, and control" of the Maine Agricultural Experiment Station. The farm is in the town of Presque Isle, about two miles south of the village, on the main road to Houlton. The Bangor and Aroostook railroad crosses the farm. A flag station, "Aroostook Farm," makes it easily accessible by rail.

The farm contains about 275 acres, about half of which is cleared. The eight room house provides an office, and home for the farm superintendent. The large barn affords storage for hay and grain and has a large potato storage house in the basement.

Highmoor Farm.

The State Legislature of 1909 purchased a farm upon which the Maine Agricultural Experiment Station "shall conduct scientific investigations in orcharding, corn, and other farm crops." The farm is situated in the counties of Kennebec and Androscoggin, largely in the town of Monmouth. It is on the Farmington Branch of the Maine Central Railroad, two miles from Leeds Junction. A flag station, "Highmoor," is on the farm.

The farm contains 225 acres, about 200 of which are in orchards, fields, and pastures. There are in the neighborhood of 3,000 apple trees upon the place which have been set from 20 to 30 years. Fields that are not in orchards are well adapted to experiments with corn, potatoes, and similar general farm crops. The house has two stories with a large wing, and contains about 15 rooms. It is well arranged for the Station offices and for the home of the farm superintendent. The barns are large, affording storage for hay and grain. The basement affords limited storage for apples, potatoes and roots.

The Aim of the Station.

Every citizen of Maine concerned in agriculture has the right to apply to the Station for any assistance that comes within its province. It is the wish of the Trustees and Station Council that the Station be as widely useful as its resources will permit.

In addition to its work of investigation, the Station is prepared to make chemical analyses of fertilizers, feeding stuffs, dairy products and other agricultural materials; to test seeds and creamery glassware; to identify grasses, weeds, injurious fungi and insects, etc.; and to give information on agricultural matters of interest and advantage to the citizens of the State.

All work proper to the Experiment Station and of public benefit will be done without charge. Work for the private use of individuals is charged for at the actual cost to the Station. The Station offers to do this work only as a matter of accommodation. Under no condition will the Station undertake analyses, the results of which cannot be published, if they prove of general interest.

PUBLICATIONS.

The Station is organized so that the work of investigation is distinct from the work of inspection. The results of investigation are published in the bulletins of the Station and in scientific journals, both foreign and domestic. The bulletins for the year make up the annual report. The results of the work of inspection are printed in publications known as Official Inspections. These are paged independently of the bulletins and are bound in with the annual report as an appendix thereto. Miscellaneous publications consisting of newspaper notices of bulletins, newspaper bulletins and circulars which are not paged consecutively and for the most part are not included in the annual report are issued during the year.

All the bulletins issued by the Station are sent to the members of the staffs of other Stations and the U. S. Department of Agriculture who ask for them, to all newspapers in Maine, to libraries and to agricultural exchanges. Bulletins which have to do with general agriculture and the Official Inspections which bear upon the feeding stuffs, fertilizer and seed inspections are sent to a general mailing list composed chiefly of farmers within the State. The publications having to do with the food and drug inspection are sent to a special list including all dealers in Maine and other citizens who request them. The annual report is sent to directors of experiment stations and to libraries. Copies of all publications are sent to the newspapers within the State and to those on the exchange list outside of the State.

BULLETINS ISSUED IN 1915.

No. 235. Studies on Oat Breeding. II—Selection Within Pure Lines. 40 pages, 2 illustrations.
No. 236. Field Experiments in 1914. 24 pages.
No. 237. The Assumption of Male Secondary Characters by a Cow With Cystic Degeneration of the Ovaries. 16 pages, 10 illustrations.
No. 238. Leafhoppers of Maine. 80 pages, 25 illustrations.
No. 239. Studies on Bean Breeding. I. Standard Types of Yellow Eye Beans. 16 pages, 9 illustrations.
No. 240. Apple Spraying Experiments in 1914. 20 pages.
No. 241. Woolly Aphid of Elm and Juneberry. 8 pages, 2 illustrations.
No. 242. Pink and Green Aphid of Potato. 20 pages, 3 illustrations.

No. 243. Further Data on the Measurement of Inbreeding. 24 pages, 6 illustrations.
No. 244. Blueberry Insects of Maine. 40 pages, 7 illustrations.
No. 245. Finances, Meteorology, Index, Abstracts of Papers Not in the Bulletins. 36 pages.

OFFICIAL INSPECTIONS ISSUED IN 1915.

No. 66. Opened Shell-fish. 8 pages.
No. 67. Milk and Cream. 20 pages.
No. 68. Fungicide and Insecticide Inspection. 28 pages.
No. 69. Cream and Milk. 12 pages.
No. 70. Vinegar. 12 pages.
No. 71. Cream and Milk. 20 pages.
No. 72. Feeding Stuffs Inspection. 96 pages.
No. 73. Seed Inspection. 28 pages.
No. 74. Fertilizer Inspection. 60 pages.

MISCELLANEOUS PUBLICATIONS ISSUED IN 1915.

No. 504. Abstract Bulletin 237. 7 pages.
No. 505. Special Report to Commissioner of Agriculture for 1914, 39 pages.
No. 506. Station Publications. 1 page.
No. 507. List of Available Publications. 4 pages.
No. 508. Abstract Bulletin 237. 4 pages.
No. 509. Experiments at Highmoor Farm in 1915. 8 pages.
No. 510. Suggestion of Breeding Yellow Eye Beans of Standard Type. 4 pages.
No. 511. Abstract Bulletin 240. 7 pages.
No. 512. Cooperative Experiments. 2 pages.
No. 513. Abstract Bulletin 238. 7 pages.
No. 514. Experiments at Aroostook Farm in 1915. 8 pages.
No. 515. Poultry Management at the Maine Station (Revised) 98 pages.
No. 516. Surplus Stock of Seed Oats at Aroostook Farm. 1 page.
No. 517. Surplus Stock of Seed Oats at Highmoor Farm. 1 page.
No. 518. Cultural Methods with Oats used by the Station. 8 pages.
No. 519. Report of Progress on Animals Husbandry Investigations in 1915. 27 pages.
No. 520. Growing Crops Without Potash in 1916. 16 pages.
No. 521. Potatoes without Potash (placard). 1 page.

BIOLOGY PUBLICATIONS 1915.

In the numbered series of "Papers from the Biological Laboratory:"

75. Studies on the Physiology of Reproduction in the Domestic Fowl. XI. On the Relation of Simultaneous Ovulation to the Production of Double-Yolked Eggs. By Maynie R. Curtis, Journal of Agricultural Research, Vol. III, No. 5, pp. 375-385.

76. Studies on the Physiology of Reproduction in the Domestic Fowl. XII. On an Abnormality of the Oviduct and Its Effect upon Reproduction. By Maynie R. Curtis. Biol. Bulletin, Vol. XXVIII, No. 3, pp. 154-162.
77. On the Refractive Index of the Serum in a Guinea-Chicken Hybrid. By Raymond Pearl and John W. Gowen, Proc. Soc. Exp. Biol. & Med., Vol. XII, p. 48.
78. On the Fitting of Logarithmic Curves by the Method of Moments. By John Rice Miner. With an Introductory Statement on the Use of Logarithmic Curves in Biological and Agricultural Investigations by Raymond Pearl, Journal of Agricultural Research, Vol. III, pp. 411-423.
79. Studies on Oat Breeding. II. Selection within Pure Lines. By Frank M. Surface and Raymond Pearl, Maine Agricultural Experiment Station Annual Report for 1915, pp. 1-40.
80. Interpolation as a Means of Approximation to the Gamma Function for High Values of n. By Raymond Pearl, Science, N. S. Vol. XLI, No. 1057, pp. 506-507.
81. Mendelian Inheritance of Fecundity in the Domestic Fowl, and Average Flock Production. By Raymond Pearl, American Naturalist, Vol. XLIX, pp. 306-317.
82. Sex Studies. VII. On the Assumption of Male Secondary Characters by a Cow Affected with Cystic Degeneration of the Ovaries. By Raymond Pearl and Frank M. Surface, Maine Agricultural Experiment Station Annual Report for 1915, pp. 65-80.
83. Studies on the Physiology of Reproduction in the Domestic Fowl. XIII. On the Failure of Extract of Pituitary Body (Anterior Lobe) to Activate the Resting Ovary. By Raymond Pearl and Frank M. Surface, Journal of Biol. Chemistry, Vol. XXI, No. 1, pp. 95-101.
84. Studies on Bean Breeding. I. Standard Types of Yellow Eye Beans. By Raymond Pearl and Frank M. Surface, Maine Agricultural Experiment Station Annual Report for 1915, pp. 161-176.
85. Studies on Inbreeding. VI. Some Further Considerations Regarding Cousin and Related Kinds of Mating. By Raymond Pearl. American Naturalist, Vol. XLIX, pp. 570-575.
86. The Frequency of Occurrence of Tumors in the Domestic Fowl. By Maynie R. Curtis. Journal of Agricultural Research, Vol. V, No. 9, pp. 397-404.
87. Seventeen Years Selection of a Character Showing Sex Linked, Mendelian Inheritance. By Raymond Pearl. American Naturalist, Vol. XLIX, pp. 595-608.
88. A System of Recording Types of Mating in Experimental Breeding Operations. By Raymond Pearl. Science, N. S., Vol. XLII, pp. 383-386.

89. The Measurement of the Winter Cycle in the Egg Production of the Domestic Fowl. By Raymond Pearl. Journal of Agricultural Research, Vol. V., pp. 429-437.
90. On the Degree of Exactness of the Gamma Function Necessary in Curve Fitting. By Raymond Pearl. Science, N. S., Vol. XLII, pp. 833-834.
91. Studies on the Physiology of Reproduction in the Domestic Fowl. XIV. The Effect of Feeding Pituitary Substance and Corpus Luteum Substance on Egg Production and Growth. By Raymond Pearl. Journal Biol. Chemistry. In press.
92. Report of Progress on Animal Husbandry Investigations in 1915. By Raymond Pearl. Maine Agricultural Experiment Station Circular No. 519.

Papers published but not in the numbered series:

a. Brief Report of Progress on Animal Husbandry Investigations in 1914. By Raymond Pearl. Maine Agricultural Experiment Station Circular 503, pp. 1-11.
b. A Case of Assumption of Male Secondary Sex Characters by a Cow. By Raymond Pearl and Frank M. Surface. Science, N. S., Vol. XLI., pp. 615-616.
c. Growth and Variation in Maine. By Raymond Pearl and Frank M. Surface. Proc. Nat. Acad. Sci., Vol. I, pp. 222-226.
d. Dynamic Evolution. By Raymond Pearl. Journal of Heredity, Vol. VI, pp. 254-256.
e. Breeding for Sex. By Raymond Pearl. Hoard's Dairyman, Vol. L., p. 71.
f. The Publication of the Results of Investigations made in Experiment Stations in Technical Scientfic Journals. By Raymond Pearl. Science, N. S., Vol. XLII, pp. 518-522.
g. Further Data on the Measurement of Inbreeding. By Raymond Pearl. Maine Agricultural Experiment Station Bulletin 243, pp. 225-248.

ENTOMOLOGICAL PAPERS FROM THE MAINE AGRICULTURAL EXPERIMENT STATION, 1915.

Ent. 75. Pond-Lily Aphid as a Plum Pest. By Edith M. Patch. Science, Vol. XLII, No. 1074, p. 164, July 30, 1915.
Ent. 76. Two Clover Aphids. By Edith M. Patch. Journal of Agricultural Research, Vol. III, No. 5.
Ent. 78. Leafhoppers of Maine. By Herbert Osborn. Bul. 238. Me. Agr. Exp. Station.
Ent. 79. Woolly Aphid of Elm and Juneberry. By Edith M. Patch. Bul. 241. Me. Agr. Exp. Station.
Ent. 80. Boisteres rhagoletis Richmond, sp. n., a parasite of Rhagoletis pomonella, Walsh. By William C. Woods. Canadian Entomologist, Vol. XLVII, pp. 293-295.

Ent. 81. Pink and Green Aphid of Potato. By Edith M. Patch. Bul. 242. Me. Agr. Exp. Station.

Ent. 83. Blueberry Insects in Maine. By William C. Woods. Bul. 244. Me. Agr. Exp Station.

Changes in Members of Council.

In January, 1915, Mr. William T. Guptill, Topsham, was elected Commissioner of Agriculture in place of Mr. John A. Roberts of Norway.

At the annual meeting of the State Pomological Society in November, 1915, Wilson H. Conant, Buckfield, was elected as their representative on the Council in place of Mr. Howard L. Keyser of Greene.

Changes in Station Staff.

The Station counts itself as particularly fortunate in that it has been able to retain the services of the heads of the departments through so many years.

Mr. Bartlett has served the Station as Chemist continuously since 1885, Mr. Woods as Director since 1896, Miss Patch as Entomologist since 1904, Mr. Hanson as Associate Chemist since 1905, Mr. Morse as Plant Pathologist since 1907, Mr. Pearl as Biologist since 1908. Mr. Surface came to the Station as Associate Biologist in 1908. He was away with the Kentucky Experiment Station for two years but came back to this Station as biologist in 1913. It is only those who are familiar with the work of a Station that can appreciate the increased value that comes to a Station by having the continuous service of the heads of the departments. Such continuous service makes possible the carrying out of projects extending over long periods of time. While the Maine Station has an unusual staff in ability its marked success as a contributor to new facts underlying agricultural practice and as a high research institution is largely due to the continuity of effort possible only by the permanency of its staff.

April 1, Mr. Walter E. Curtis and Mr. C. Harold White were appointed Scientific Aids at the experiment farms.

June 1, Mr. Vernon Folsom resigned as Laboratory Assistant in Plant Pathology and Mr. Donald S. Clark was appointed in his stead.

July 1, Mr. John W. Gowen resigned as Assistant Biologist.

July 1, Mr. Hoyt D. Lucas resigned as Assistant Chemist and Mr. Walter H. Rogers was appointed in his stead.

Miss Janie L. Fayle, Stenographer, was absent on leave from August 1, and Miss Ella M. MacKenzie was employed in her stead.

BULLETIN 235.

STUDIES ON OAT BREEDING. II. SELECTION WITHIN PURE LINES.[1]

By FRANK M. SURFACE and RAYMOND PEARL.

Previous to 1910 it was almost universally assumed that small fluctuating variations were, to some extent at least, inherited. It was further believed that such variations were cumulative in effect and that substantial progress in breeding in a desired direction could be made by selecting, in successive generations, those individuals showing the given character in the most pronounced fashion. Since the appearance of de Vries's Mutation Theory and the great impetus given to genetic studies by the rediscovery of Mendel's Law this conception of the process of inheritance has been materially changed.

De Vries produced a large amount of experimental evidence tending to show that there are two sharply defined classes of variation. The one called fluctuating or continuous variation (*Modifikation* of the Germans) is due entirely to differences in the environmental influences. These variations, caused by external conditions, he believed were not transmitted, in any degree, from one generation to the next. The second class called discontinuous variations, mutations, etc., have their origin in variations in the germinal substance. These variations *are* transmitted from generation to generation. The distinction, then, is between variations which arise in the germ plasm and hence are inherited and variations which arise in the soma and are not inherited. This distinction was pointed out years before by Weismann on purely theoretical grounds.

Mendelian results in countless experiments with various plants and animals have shown that individual characters are inherited

[1]Papers from the Biological Laboratory of the Maine Agricultural Experiment Station, No. 79.

as units. It is clear that there is something in the germ cell that is transmitted in its entirety and apparently unchanged from one generation to the next. When organisms with two opposing (allelomorphic) characters are crossed, each of these characters is recovered in the second generation and each will breed true in subsequent generations. Apparently such characters are essentially unchanged by having gone through the cross.

Hence the present conception of the germ plasm is *not* that of a plastic substance which can be moulded by the environment or by selection but rather that of a mosaic made up of a vast number of definite, stable units, each perfectly fitting into its appropriate place. The hereditary process can be altered only by changing or interchanging one or more of these units. Interchange of units can be easily affected by hybridization. How experimentally to affect one of these units is one of the great problems of modern biology.

The ordinary fluctuating variations due to changes in environment in no way influence these independent units (factors or genes) of the germ plasm and hence are not inherited. Only changes which affect these germ plasm units can be transmitted to the following generation.

So much for the modern conception of the hereditary process. It is clear that if this theory of inheritance is the true one, the selection of fluctuating (somatic) variations will not influence the characteristics of the offspring.

In 1903 Johannsen[2] announced that in self-fertilized plants there was no effect of selection within a "pure line." He defined a "pure line" as the offspring of a single, self-fertilized, homozygotic individual. In such a line all of the individuals would possess exactly the same germinal constitution. Hence except for the fluctuations caused by external conditions every individual would be like every other individual. Johannsen supported his theory by a large amount of experimental evidence from beans.

This experimental result harmonized so well with the conception of the germ plasm outlined above and derived from other sources that it readily gained credence among biologists. Since

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[2]Johannsen, W. Ueber Erblichkeit in Populationen und in reinen Linien. Jena, 1903, pp. 68.

the appearance of Johannsen's work numerous other investigators have studied the same problem in other organisms. In 1908 Jennings[3] published his results on the selection within pure lines of paramecium. In this extensive work he was able fully to confirm Johannsen's results. Tower[4] selected for intensity of color in chrysomelid beetles for 12 generations without obtaining any permanent result. East and Hayes[5] found that selection to increase the number of leaves on self-fertilized tobacco plants gave no results. Hutcheson[6] has recently shown that thirteen years of selection to increase the yield of pure lines of wheat have resulted in no increase. Von Rümker[7] and his students have also pointed out that seven years of selection in pure lines of wheat have not changed the characters studied.

These and many other investigations along similar lines have tended to confirm Johannsen's theory and even to extend it to the results of cross-fertilization between individuals homozygous for the factors in question.[8]

On the other hand Castle[9] in a number of recent papers has taken exception to the pure line theory. He maintains that selection *is* able to change the unit characters or factors. As

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[3]Jennings, H. S. Heredity, Variation and Evolution in Protozoa, II. Proc. Amer. Phil. Soc., Vol. XLVII, No. 190, pp. 393-546, 1908.

[4]Tower, W. L. An Investigation of Evolution in Chrysomelid Beetles of the Genus Leptinotarsa. Carnegie Institution of Washington Publication No. 48, pp. 320, 1906.

[5]East, E. M. and Hayes, H. K. A Genetic Analysis of the Changes Produced by Selection in Experiments with Tobacco. Amer. Nat., Vol. XLVIII, pp. 5-48, 1914.

[6]Hutcheson, T. B. Thirteen years of Wheat Selection. Amer. Nat., Vol. XLVIII, pp. 459-466.

[7]V. Rümker, K., Lerdner, R. und Alexandrowitsch, J. Die Anwendung einer neuer Methode zur Sorten und Linienprüfung bei Getreide. Zeit. f. Pflanzenzucht. Bd. 2, pp. 189-232, 1914.

[8]Cf. Pearl, R. The Inheritance of Fecundity in the Domestic Fowl. Amer. Nat., Vol. XLV, pp. 321-345, 1911. Also The Mode of Inheritance of Fecundity in the Domestic Fowl. Jour. Exper. Zoöl., Vol. 13, pp. 153-268, 1912.

[9]Castle, W. E. The Inconsistency of Unit Characters. Amer. Nat., Vol. XLVI, pp. 352-363, 1912.

——————— and Phillips. Piebald Rats and Selection. Carnegie Institution of Washington Publication No. 195, 1914.

——————— Pure Lines and Selection. Journ. of Heredity, Vol. 5, pp. 93-97, 1914.

evidence he submits the results of six years (13 generations) of breeding hooded rats. Attempts were made both to increase and to decrease the hooded pattern. He was able to do both of these things and then by return selections to bring the character back to its original condition.

This work is open to the criticism that his rats may not have been homozygous for all the factors concerned in the pattern determination. The stock with which he started was derived from pedigreed animals used by MacCurdy in a Mendelian study of coat color.[10] If, as is implied in the text, these animals were extracted recessives from Mendelian crosses it is quite possible that they were heterozygous in respect to many characters. Castle maintains that the hooded pattern is a simple unit character and hence if the rats breed true to this they must be homozygous. However, it is entirely possible that there are various modifying factors closely associated with the hooded pattern for which the animals were not homozygous. Indeed the work of MacCurdy and Castle shows some evidence of this in that "the hooded pattern, when extracted from a cross with wild stock, shows a different variability, the pigmentation of the extracted recessives being increased in extent." Castle and Phillips discuss the theory of modifiers but discard it in favor of the effect of selection upon unit characters.

In the main the work of the last decade has supported the pure line hypothesis. As noted above this hypothesis is in full accord with the modern conception of inheritance. For this reason no doubt it has been much more readily accepted than if the reverse were the case. However, the possibility must not be lost sight of that, as has happened in the past, our present conception of the hereditary process may be materially altered in the future. In view of such a possibility it would seem well to make certain of the facts and to study these from various points of view.

The present paper is, in a way, a preliminary report. The selections have been carried on for only three generations. This

[10] MacCurdy, H. and Castle, W. E. Selection and Cross-breeding in Relation to the Inheritance of Coat-pigments and Coat-patterns in Rats and Guinea-pigs. Carnegie Institution of Washington, Publication No. 70, 1907.

time is admittedly very short. However, it has seemed advisable to analyze the results up to this point at the present time and to see if by the use of somewhat different methods new light could be thrown upon these problems. It is proposed to continue certain of these experiments with the object of applying still other methods of analysis to them.

In 1911 there was planned at this Station a series of experiments to test the effect of selection in pure lines of oats. This work has been continued so that now there are available for study the results of three successive selections. The work was originally planned by Dr. Pearl and was carried on under his general direction until the summer of 1913 when, along with other plant breeding work, it was turned over to the writer, (F. M. Surface). Various people have been associated with this work. In 1911 Dr. E. P. Humbert looked after the field work. In 1912 and part of 1913 Dr. M. R. Curtis and Mr. C. W. Barber were in charge of this work.

At the beginning of this work three general lines were planned. First, the attempt to determine the influence of selection when the plants were grown under exceptionally favorable conditions in regard to food material. Second, there was the attempt to determine the influence of selection, if any, upon plants grown under very unfavorable conditions in regard to food supply. Finally it was planned to see whether any permanent effect could be produced within a given pure line by growing it for a period of years under very good or under very poor conditions. It is the purpose of the present paper to deal only with the first of these categories, viz., the effect of selection upon pure lines grown under favorable conditions.

Materials and Methods.

The oat flower is almost always self-fertilized. Rimpau[11] says that in dealing with 19 different varieties of oats during a period of six years he observed only five spontaneous crosses. Our own observations would tend to show even a much smaller number than this. For several years garden rows of different

[11]Rimpau, W. Kreuzungsproduktion landw. Kulturpflanzen. Landw. Jahrb. 1891.

varieties of oats have been grown only one foot apart. At the time of blooming the heads of one row interlock with those of the adjacent rows. Although black, yellow and white oats, open and side heads have been grown next to each other, we have never observed a single natural cross. In no case were all the grains of any one row planted individually the next year, but in many cases a large per cent. of these have been grown. It seems certain that under our conditions, at least, natural crossing is extremely rare in oats.

If this is true it can be shown that practically every oat plant will be homozygous for all of its characters. Thus Jennings[12] has shown that starting with the heterozygotic condition the proportional number of pure homozygotes produced by continued self-fertilization is given by

$$X = \left(\frac{2^n - 1}{2^n}\right)^m$$

where X = the proportional number of pure homozygotes, n = the number of successive self-fertilizations and m = the number of pairs of characters. From this we find that if there are 10 pairs of characters and 10 self-fertilizations, X = 0.97057 or less than three heterozygotes in 100. If there are 20 pairs of characters and 20 self-fertilizations X = 0.999998 or only two heterozygotes in a million individuals.

Since it is extremely probable that the ancestors of any given oat plant have been self-fertilized for many generations, it may be assumed that every oat plant is homozygous for all of its characters unless, indeed, the number of separately inherited characters is very great (several thousand).[13] In this respect the oat plant furnishes excellent material for the study of selection within pure lines.

In 1910 a large number of individual plants were selected from the variety test plots of that year. Each of these plants was harvested and threshed separately. In 1911 the seed from each plant was grown in a single row in the oat garden. Each row contained 25 plants. The seed was planted by hand. The

[12] Jennings, H. S. The Production of Pure Homozygotic Organisms from Heterozygotes by Self-fertilization. Amer. Nat., Vol. XLVI, pp. 487-491, 1912.

[13] With 1000 characters and 20 self-fertilizations there would be less than 5 heterozygotes in 1000 individuals.

plants were three inches apart in the row and the rows in 1911 and 1912 were alternately one foot and two feet apart. That is, between the first two rows there was a one-foot space; between rows 2 and 3 there was a two-foot space; between rows 3 and 4 a one-foot space and then again a two-foot space. In this way each plant was allowed the same amount of space, viz., 54 square inches, or two and two-thirds plants to each square foot.

As soon as ripe the plants from each row were pulled and tied in bundles bearing a tag with the row number. These bundles were hung in the curing shed until thoroughly dry. Then each plant was threshed separately by hand and various data recorded concerning it. (cf. p. 8).

In most cases not more than 20 plants were threshed from a single row. These were taken entirely at random just as they came from the bundle. In no case were mutilated plants included.

For planting the next year individual plants with exceptionally high or exceptionally low characters were chosen. These were planted in the same kind of garden rows and were harvested and threshed as before. With the exception of one particular the procedure has been the same every year. The one exception is that in 1913 and 1914 the rows were all planted one foot apart instead of alternately one and two feet as used in 1911 and 1912. This change in the method of planting was made through a mistake in 1913. For certain reasons it seemed advisable to continue this method in 1914. This change in the amount of space allotted to each plant undoubtedly affected the absolute yield and other characters of the plants. However it is also found that seasonal variation so affected many of the characters of these plants that it is not possible to deal with the absolute figures from one generation to the next. Instead resort must be had to some measure which eliminates the absolute measurement to a large extent.

It is extremely difficult to get measurable characters of oat plants which are not materially affected by environmental conditions. In order to carry this work along with other problems it was necessary to take characters which could be fairly easily measured or counted. After a careful study of the available characters it was decided to use the more obvious characters but ones which would certainly be affected by the environment. It is necessary to deal with these data in such a way as to eliminate the effect of changes in the mean absolute value.

The characters chosen for study were (1) the total height from the crown to the tip of the tallest culm, (2) the number of culms which bear seed, (3) the weight of the whole plant including the roots, (4) the weight of the grain, and finally (5) the weight of the straw obtained by difference. All of these characters can be easily and rapidly obtained. One difficulty not clearly foreseen is that each of these characters is highly correlated with each of the other characters, so that, as a matter of fact, the results obtained by selection for any one character will be, to a large extent, duplicated in the case of another character in the same material.

Special progeny record sheets were used for recording the data. One of these sheets is reproduced in facsimile in Fig. 1.

Maine Agric. Expt. Station OAT BREEDING Progeny Record

VARIETY PLANTED PLOT ROW NO.
BLOSSOMED HARVESTED SISTER ROWS
MOTHER PLANT ROW NO. PLOT NO. CONTRAST ROWS

PLANT NO.	HEIGHT	NUMBER OF CULMS	WEIGHT OF PLANT	WEIGHT OF GRAIN	WEIGHT OF STRAW	PLANTED PLOT NO.	PLANTED ROW NO.	
								LINE NO.
A								MOTHER SELECTED FOR
B								
C								
D								NO. OF PLANTS
E								GENERAL NOTES
F								
G								
H								
J								
K								
L								
M								
N								
O								
P								
Q								
R								
S								
T								
U								
TOTAL								
MEAN								
ST. D.								

Fig. 1. Facsimile of progeny record blank used in the oat breeding work.

The system of records is such that it is possible to trace the complete pedigree of any individual either backwards or forwards. The system of records in use in the plant breeding work at this Station will be given in some detail in another paper and will not be repeated here.

The labor of threshing each plant separately was found to be so great when several hundred rows were grown that in some cases rows from which we did not expect to breed were threshed as a whole and the average yield per plant obtained as usual. In no case were plants included which were in any way mutilated. On this account the number of plants was sometimes less than 20.

In the following paper all results are based upon the average per plant of the given character for a given row. It is necessary to deal with one character at a time and, as has been mentioned above, all of the characters show essentially the same thing. We will deal first with the weight of grain per plant, or the yield. This character is as satisfactory as any of the others, and it has the advantage that it is of practical importance.

Selection for Yield of Grain.

Out of some 200 pure lines started in 1911, 28 lines representing 13 varieties were chosen for carrying on this selection work. Table 1 gives the line numbers by which they are designated, the variety from which they were selected and the average yield of grain per plant for each of the four years that they have been grown. A description of the varieties from which these lines came has been published in another place.[14] In general these pure lines show the characters typical of the variety from which they were selected. In one or two cases, as line Nos. 104 and 183, these pure lines are quite different from the commercial varieties from which they came. They are probably derived from mixtures of seed in the original varieties.

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[14]Surface, F. M. and Barber, C. W. Studies on Oat Breeding. I. Variety Tests, 1910-1913. Ann. Rept., Me. Agr. Exp. Sta. 1914, pp. 137-192. (Bull. No. 229).

TABLE I.

Showing the Source, Number of Rows, Number of Plants and Mean Weight of Grain for Each Line for Each Year.

Line No.	VARIETY.	1911.			1912.			1913.			1914.			Average yield for four years, gms.
		No. rows.	No. plants	Mean yield per plant. gms.	No. rows.	No. plants.	Mean yield per plant. gms.	No. rows.	No. plants.	Mean yield per plant. gms.	No. rows.	No. plants.	Mean yield per plant. gms.	
33	Early Champion	1	19	13.82	4	82	9.32	9	195	5.47	2	36	7 44	*9,01*
44	Imported Scotch	1	20	19.35	4	84	10.50	6	120	7.35	8	162	13.18	*12.60*
57	Senator	1	20	12.65	6	102	9.39	7	135	6.15	10	200	11.02	*9.80*
60	Senator	1	11	16.91	6	106	10.40	12	244	6.29	–	–	–	–
74	President	1	18	16.50	4	78	11.00	4	80	4.35	8	139	12.69	*11.14*
82	President	1	20	16.40	4	78	8.34	8	160	5.22	8	171	14.84	*11.20*
104	Swedish Select	1	20	12.00	6	128	10.37	7	140	2.91	7	138	13.39	*9.67*
125	Imported Scotch	1	20	9.98	6	113	9.35	7	141	4.41	8	170	12.29	*8.98*
128	Reg. Swedish Select	1	20	13.10	6	110	8.60	6	120	3.82	7	155	13.55	*9.77*
130	Swedish Select	1	20	13.45	4	81	8.23	6	119	5.23	2	30	12.88	*9.95*
133	Swedish Select	1	20	11.45	4	82	10.43	4	77	3.53	2	33	13.88	*9.82*
139	Reg. Swedish Select	1	20	13.50	8	126	10.42	11	219	6.88	8	174	12.17	*10.74*
152	Swedish Select	1	17	17.00	4	66	10.21	4	78	5.81	2	26	16.42	*12.36*
158	Reg. Swedish Select	1	20	17.50	3	48	13.18	5	119	5.79	–	–	–	*12.16*
183	Prosperity	1	12	23.70	4	81	9.53	5	102	1.68	2	35	15.69	*12.65*
204	Hamlin	1	20	16.30	4	77	13.14	17	367	5.92	2	40	10.82	*11.54*
217	Hamlin	1	20	13.93	9	174	12.71	12	260	4.75	2	40	14.75	*11.53*
238	Reg. Swedish Select	1	20	13.10	8	150	11.27	12	240	6.09	8	145	12.35	*10.70*
250	Imported Scotch	1	19	14.97	4	80	11.13	4	80	5.75	2	35	11.28	*10.78*
262	Victor	1	20	10.45	6	130	6.44	6	120	4.92	12	230	11.95	*8.44*
280	Unnamed White	1	20	11.85	4	85	6.45	4	81	4.40	2	31	14.58	*9.32*
286	Banner	1	20	16.00	18	363	11.35	44	871	4.87	34	716	13.21	*11.36*
307	Banner	1	20	15.27	6	122	12.10	12	242	7.03	19	439	11.54	*11.48*
330	Black Tartarian	1	20	10.43	6	121	4.75	12	252	4.36	2	39	10.85	*7.60*
334	Irish Victor	1	19	15.34	4	87	9.06	4	80	3.94	10	235	13.33	*10.42*
336	Irish Victor	1	20	16.65	4	82	12.14	6	118	4.49	2	39	13.45	*11.68*
337	Irish Victor	1	18	15.78	6	107	9.49	15	312	5.42	8	204	11.65	*10.48*
340	Irish Victor	1	15	17.77	4	87	10.87	9	178	3.71	2	31	15.41	*11.94*
	Total	28	528	415.15	156	3,030	280.17	258	5,250	140.54	179	3,693	334.61	*287.12*
	Average	1.0		14.89	5.3		10.01	9.0		5.02			12.87	*10.25*

From this table it is to be noted that there is a great difference in the average yield per plant for the same pure line in different years. These differences are due in all probability to differences in external conditions. The highest average yield for all the lines was obtained in 1911. In this year the conditions for the growth of garden plants was very favorable. The lowest yield was obtained in 1913. This was not a good oat year in many respects. However, two things contributed to make this year's yield particularly low. In the first place it has already been noted that the garden rows were planted only a foot apart in 1913, while in the two previous years the average distance between rows had been one and one-half feet. In the second place these garden rows were grown on the same piece of ground for the three years, 1911, 1912 and 1913. Whether soil toxins produced by the same crop in previous years operated to decrease the yield in 1912 and 1913 we are not able to say. At any rate this point should be mentioned as a possible factor. It should further be pointed out that the field plots during these years showed an increase in the average yield for 1913 over the two preceding years.[15]

Only a part of the decrease in the 1913 garden yield can be accounted for on the basis of the different spacing. In 1914 the rows were again planted one foot apart but the garden was moved to another plot of ground. The average yields in 1914 compare very favorably with those of 1911 and 1912. 1914 was an exceptionally good oat year and no doubt the average yield is somewhat better than can be expected for a series of years. However, this shows that conditions other than spacing may greatly influence the yield of garden plants. It is probable that the results as a whole would have been but little more uniform had the spacing been the same in each year.

The number of minus and plus selections has been about the same in each pure line each year. It is true that owing to the skew distributions of the plants about their means the plus selections averaged to deviate somewhat farther from the means than did the minus selections. However, in view of the results obtained in the latter portion of this paper it is not probable that these differences have had any influence upon the mean yields in the later years.

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[15] Surface and Barber. *Loc. cit.*

EFFECT OF SELECTION TESTED BY METHOD OF DEVIATIONS.

In view of the fact that external conditions are able to cause such great fluctuations in the mean yield from year to year it is not possible to compare directly the yields of one year with those of the next. In other words selection in the plus direction might very well have produced a marked effect, yet owing to environmental conditions the yield of these plus selections might be lower than the yield of the pure line in the previous year.

Further our pure lines have been selected from a number of different varieties. Many of these varieties show tendencies to yield at different rates. Consequently from such heterogeneous material it would not be possible to compare the direct effect of selection upon yield for all of the pure lines. Thus if we should approach the question by the correlation method and correlate the yield of selected plants with the average yield of the resulting rows we might very well obtain a significant correlation due entirely to the heterogeneity of the material.

For these reasons it is desirable to obtain some measure of the yield which is not so greatly affected by the seasonal fluctuations. The simplest way of doing this is the method of differences. Thus we may determine the mean yield for a pure line in a given year. We may then find the deviation, either plus or minus, of each row from this mean. The sum of all these deviations is of course equal to zero. Similarly we may find the mean of this same pure line in the previous year and then determine the amount and direction of the deviation of the selected plants from this mean. The sum of these latter deviations is not necessarily equal to zero. They are the deviations of a few selected plants from a mean determined from all the plants of that line grown in the same year.

These differences indicate the amount and direction that a given selected plant deviates from the mean of its line and likewise the amount and direction by which its daughter rows deviate from the mean of the same line in the year in which they were grown. Thus, if there is an effect of the selection a plus selection ought, on the average, to result in a row which also deviates in the plus direction.

These differences are to a large extent independent of the absolute size of the mean. They are, of course, dependent upon the size of the mean in the same sense that a standard deviation is dependent upon the size of the mean. The larger the absolute size of a character the greater are its chances for variation. It would be desirable to determine the standard deviation of each pure line and then divide each deviation by the standard deviation of its line. Thus expressed in terms of the standard deviation these differences would be entirely independent of any differences in the absolute means. However, the number of rows in each line is often entirely too small to determine a reliable standard deviation.

By the use of these differences it is possible to treat all of the data together. Thus so long as each deviation is measured from the mean of its own pure line we can put together the results from all the lines regardless of the variety from which they came.

As a first approach to the question of the influence of selection within the pure line, tables have been formed for each line as follows:

TABLE 2.

Table for One Pure Line Showing the Effect of the 1911 and 1912 Selections upon the Rows Grown in 1913. The Figures within the Table Represent Deviations from the Mean of this Pure Line for the Year Indicated.

LINE NUMBER.	1913 row No.	SELECTED PLANTS.				ROWS OF 1913.							
		1911.		1912.		Selection in 1911 +, 1912 +		Selection in 1911—, 1912—.		Selection in 1911 +, 1912—.		Selection in 1911—, 1912 +.	
		+	—	+	—	+	—	+	—	+	—	+	—
82	163	11.60	-	15.66	-	-	1.21	-	-	-	-	-	-
	162	11.60	-	10.16	-	2.66	-	-	-	-	-	-	-
	164	11.60	-	-	4.34	-	-	-	-	-	1.22	-	-
	165	11.60	-	-	5.34	-	-	-	-	0.38	-	-	-
	160	-	6 90	7.66	-	-	-	-	-	-	-	-	0.12
	158	-	6.90	10.66	-	-	-	-	-	-	-	-	0.09
	161	-	6.90	-	3.34	-	-	-	0.22	-	-	-	-
	159	-	6.90	-	3.84	-	-	-	0.17	-	-	-	-
Total		46.40	27.60	44.14	16.86	2.66	1.21		0.39	0.38	1.22		0.21

From this table it is seen, for example, that the first row (No. 163) resulted from a plus selection in 1911 which was 11.6 grams above the mean of that year and from a plus selection of 15.66 gms. in 1912. The average yield of this row itself, however, showed a minus deviation of 1.21 gms. Thus this row deviated in the opposite direction from that for which it had been selected. The next row No. 162 with practically the same kind of selection gave a plus deviation of 2.66 grams.

The first question to arise is whether plus selections have, *on the average,* resulted in rows with a greater plus deviation and likewise whether the minus selections have given an excess of negative deviations. In order to make clear the method of procedure we will first examine the results of the single small line given in Table 2.

In this table is will first be noted that the total plus deviation of the selected plants (1911 and 1912) is in each year considerably in excess of the total minus deviation. As noted above this arises from the skew distribution of the individual plants about their means. The range extends much farther in the plus direction than in the minus and hence allows the selection of larger plus deviations.

From the sums of the columns in the second part of the table (1913 rows) the effect of either the 1911 or the 1912 selection can be determined and likewise the combined effect of two plus or two minus selections. Thus the 1913 rows resulting from plus selections in 1911 show a total plus deviation of 3.04 gms. and a total minus deviation of 2.43 grams. The 1911 minus selections show zero plus deviations and 0.60 minus deviations. Thus the deviations of the 1913 rows show a tendency to follow the line of the 1911 selections. The 1912 plus selections give a total plus deviation of 2.66 gms. and a total minus deviation of 1.42 gms. The 1912 minus selections give 0.38 gms. plus and 1.61 gms. minus, again showing a marked tendency to follow the direction of the selection in 1912. We further note that where the selection has been plus in both years there is an excess of plus deviations and with two minus selections an excess of minus deviations.

Of course the number of rows in this one line is too small to have any significance in itself but it serves to show the method used. It has been pointed out above that by using the deviations from the means of the respective lines it is possible to lump together all of the pure lines regardless of variety or absolute yield and thus obtain sufficient data upon which to base more definite conclusions.

On account of the lack of space the detailed tables for each pure line will not be given. Instead summary tables showing the effect of the plus or minus selections of each year upon the yield of each of the succeeding years will be given.

It must be remembered that in dealing with these data in the present way two factors are entirely neglected. (1) No account is taken of differences in the size of the deviations of selected plants. All plus deviations whether of 20 grams or one-tenth of a gram are given equal weight and similarly for the minus selections. (2) No account is taken of possible differences in the relative variability of the different pure lines. These two factors will be taken into account in a later section of this paper. It is desirable to consider first the results obtained by the method outlined in the preceding paragraphs.

Table 3 shows the effect of the plus and minus selections made in 1911 upon the rows grown in each of the three succeeding years. Thus the 1912 rows show the immediate effect of the selection. The rows of 1913 and 1914 have each been subjected to other plus and minus selections in the later years. It is to be expected that the results, if any, of the 1911 selection would be somewhat obscured in these latter years. The results of successive plus and of successive minus selections will be discussed in a later paragraph.

Table 4 shows the effect of the 1912 plus and minus selections upon the rows grown in 1913 and 1914. Similarly Table 5 shows the effect of the 1913 selection upon the 1914 rows.

Table 3.

Showing the Effect of the 1911 Plus and Minus Selections upon the Rows in Each of the Three Succeeding Years.

Rows grown in		Selected Plants.		Daughter Row.			
				+Selections.		—Selections.	
		+	—	+ Deviations.	— Deviations.	+ Deviations.	— Deviations.
	Number of rows	82	74	44	38	33	41
1912	Total deviation	739.88	437.97	58.42	42.53	37.62	53.33
	Average deviation per row	9.023	5.919	1.328	1.119	1.140	1.301
	Number of rows	126	132	53	73	58.5	73.5
1913	Total deviation	1272.71	821.60	58.38	56.24	54.03	56.19
	Average deviation per row	10.101	6.224	1.102	.770	.924	.765
	Number of rows	84	94	38.5	45.5	45	49
1914	Total deviation	909.88	590.18	50.88	56.84	66.91	61.04
	Average deviation per row	10.832	6.279	1.337	1.249	1.487	1.246

Table 4.

Showing the Effect of the 1912 Plus and Minus Selections upon the Rows in Each of the Two Succeeding Years.

Rows grown in		Selected Plants.		Daughter Row.			
				+Selections.		—Selections.	
		+	—	+ Deviations.	— Deviations.	+ Deviations.	— Deviations.
	Number of rows	134	124	62.5	71.5	49	75
1913	Total deviation	1098.80	715.42	64.75	54.49	47.66	57.94
	Average deviation per row	8.200	5.769	1.036	.762	.973	.773
	Number of rows	92	86	41	51	42.5	43.5
1914	Total deviation	857.35	530.80	55.97	61.49	61.82	56.29
	Average deviation per row	9.319	6.172	1.365	1.208	1.455	1.294

Table 5.

Showing the Effect of the 1913 Plus and Minus Selections upon the Rows in 1914.

Rows grown in		Selected Plants.		Daughter Row.			
				+Selections.		—Selections.	
		+	—	+ Deviations.	— Deviations.	+ Deviations.	— Deviations.
	Number of rows	92	86	41.5	50.5	42	44
1914	Total deviation	499.83	248.92	59.66	53.96	58.13	63.92
	Average deviation per row	5.433	2.894	1.438	1.069	1.384	1.453

These tables show in the two columns to the left of the double ruling the data regarding the selected plants. The four columns on the right show the data regarding the rows which descended from the selected plants.

By way of example we may note in some detail the data relative to the effect of the 1911 selection upon the 1912 rows. (Table 3, upper part). First, it is seen that in 1912 there were 82 rows grown from plus selections, i. e., from plants whose yield of grain was above the average of their respective pure lines. Likewise there were 74 rows from minus selections. The 82 plus selections showed a total deviation above the means of their lines of 739.88 grams, or an average plus deviation of 9.02 grams per plant. Likewise the 74 minus selections showed a total deviation of 437.97 grams below the respective means, or an average minus deviation of 5.92 grams per plant. In these selections more than one row was frequently grown from the same plant. In such cases the same plant enters into the total deviation as many times as there are rows from it.

Turning to the second part of the table it is seen that of the 82 rows grown from plus selections, 44 showed deviations above the mean of their line and 38 gave deviations in the minus direction. The total deviation of the 44 plus rows was 58.42 grams against 42.53 grams for the 38 minus rows. There is thus a difference of 15.89 grams in favor of the selection. The average deviation per plant for the plus rows is 1.328 grams and for the minus rows 1.119 grams.

Again, of the 74 rows from the minus selections 33 showed plus deviations and 41 minus deviations. The total plus deviations were only 37.62 grams while the total minus deviations were 53.33 grams.[16] In the case of these minus selections the average deviation per plant for the plus rows is 1.140 grams and for the minus rows 1.301 grams.

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[16]Since for all the rows in any one year the sum of the plus deviations must equal the sum of the minus deviations it follows that an excess in either direction in the rows from plus selections must be offset by an equal excess in the opposite direction in the minus selections. Thus the difference between 37.62 and 53.33 is 15.71 grams, practically the same as in the case of the plus selections. In most of the distributions these differences are not exactly equal because the deviations of the rows from their line means were carried to only two places of decimals. The errors are always less than one gram and are neglible.

There is then apparently, a decided effect of the selection made in 1911 upon the plants grown in 1912. As shown in table 3 the apparent effect of the 1911 selection upon the rows of 1913 and 1914 is very much less. The 1914 rows show an excess total deviation in the opposite direction to that of the selection. The average deviation per row shows some differences in the different years. Thus in 1912 the average deviation per row was noticeably greater in the direction of the selection. In both 1913 and 1914 (Table 3) the plus rows resulting from the plus selections show a larger average deviation. However, in the case of the minus selections the minus deviating rows showed a smaller average deviation than the plus rows.

Turning to table 4 it is seen that in the 1913 rows there is again a marked effect of the selection. However in the 1914 rows there is an excess of the total deviation in the opposite direction to that of the selection in 1912. Here there is, in fact, a decrease in the yield of the plus selections over that of the minus selections.

In table 5 it is seen that there is an excess of the deviation, in the direction of the selection.

Considering all three tables it is to be noted that in the year immediately following the selection there is a more or less pronounced effect of the selection as indicated by the total deviations. In each case the plus selections have resulted in a larger total plus deviation of the daughter rows and the minus selections in a larger total minus deviation. The effect of the selection upon the rows grown two and three generations after the selection is very much less marked. In two of the three cases the total deviations show an excess in the opposite direction to that of the selection. These rows have of course been subjected to secondary and tertiary plus and minus selections and it is possible that these latter have outweighed the original selection.

It is also seen that in the year following the selection the average deviation is usually larger in the direction of the selection. The one exception to this is in table 4 in the minus selections grown in 1913. As measured by the average deviation, there does not appear to be a very marked effect of the selection.

STATISTICAL SIGNIFICANCE OF DEVIATIONS.

The question next arises—are any of these deviations in the direction of the selection greater than might be expected in random samples drawn from a similar population? In other words, are these deviations statistically significant?

In the first place it is clear that unless there is some influence of the selection the number of rows showing plus and minus deviations should be the same. This should be true not only of all the rows grown in any one year, but also of the rows from the plus selections and from the minus selections taken separately. From tables 3 to 5 it is seen that in many cases the observed number of rows is not far from the expected. Thus in table 3 for the rows grown in 1912 there are in all 77 rows showing plus deviations and 79 rows showing minus deviations. It can also be shown that in the plus selections or in the minus selections the number of rows does not deviate sensibly from the number expected if there was no influence of the selection.

The same conclusion can be drawn from inspection of the number of rows in each year, except those for 1913 (Tables 3 and 4). In this year there is obviously an excess of rows showing minus deviations. In 1913 there were 111.5 rows showing plus deviations and 146.5 rows showing minus deviations. The expected number is 129 rows in each case. The deviation from the expected is 17.5 rows. The question as to whether such a deviation could arise in random sampling may be determined by comparing the deviation with the standard deviation of simple sampling. The standard deviation of simple sampling is given by

$$S.\ D. = \sqrt{n\ p\ q}$$

In this case $n = 258$, $p = q = \frac{1}{2}$ and

$$S.\ D. = 8.03$$

The actual deviation is just a little over two times the standard deviation and could arise from random sampling. But from tables of the probability integral it is found that in random sampling a deviation as great or greater could be expected only about 2 times in 100 trials. The odds against the occurrence of a deviation as great or greater than this one are about 49 to 1. Thus it is extremely unlikely that the distribution of rows showing plus and minus deviations in 1913 was due to chance alone.

It has already been pointed out that in 1913 the absolute yield of grain was much lower than in any of the other years (Table 1). This was caused by environmental conditions which have been discussed (p. 11). Apparently these conditions caused a larger number of rows to fall below the mean than would ordinarily be the case. It follows that the rows which were above the mean must have shown much larger average deviations than the minus rows. Just why this should occur is not entirely clear. It appears that some rows were not at all or very slightly affected by the adverse conditions, while the majority of rows were much more seriously affected. Perhaps this is due to non-uniformity of the soil. If the decrease was due to soil toxins, these may have been unevenly distributed through the soil.

Attention has already been directed to the fact that the total deviations in the year immediately following the selection show an excess in the direction of the selection. This can be brought out better by putting the figures in the form of percentages. From previous discussion it is clear that we need to deal only with one of the selections, either the plus or the minus. Table 6 shows for the plus selections the percentage of the total deviations falling in the plus rows and in the minus rows.

TABLE 6.

Percentage of Total Deviations for the Plus Selections which Fall in the Plus and the Minus Rows.

Selection made in	Rows grown in	+Selection.	
		+	—
1911	1912	*57.87*	*42.13*
"	1913	50.93	49.07
"	1914	47.24	52.76
1912	1913	*54.30*	*45.70*
"	1914	47.65	52.35
1913	"	*52.51*	*47.49*

This table shows that the only instances in which the deviation can be significantly beyond the expected ratio of 50 per cent. are the rows in the years immediately following the selection (*italics*). Unfortunately if we attempt to determine the probable error of these ratios we get into trouble from the manner in which the sampling was done. Whatever may be the significance of the individual ratios, the fact that the excess is in the same direction and fairly large in each of the three years makes it probable that, on the whole, some significance may be attached to them.

Before discussing this point further we will examine the relation of the average size of the deviation in the plus and minus rows. These averages are given in tables 3 to 5. Their relation to each other will be made simpler by figure 2.

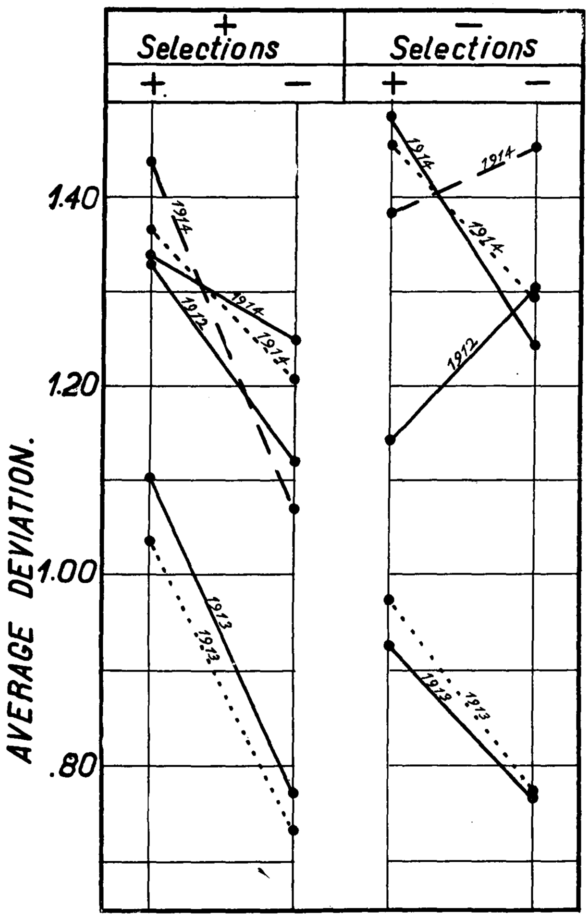

Fig. 2. Showing the average deviation per plant row, in relation to the character of the selection. The years given in the figure are those in which the designated rows were grown.

Selection in 1911 ————————

Selection in 1912 . . . .

Selection in 1913 ——— ——— ———

From this figure it is seen:—

1. That in every case the plus selections have shown a larger average deviation in the plus direction.

2. The minus selections on the other hand do not show such a regularity. In only two out of the six cases is there a larger average deviation in the direction of the selection.

3. It is of interest to note that the average deviation per plant row is much smaller in 1913 than in the other two years. It has been pointed out in a previous paragraph that the 1913 yields were much lower than in the other years. It has also been noted that there is an excess of rows showing minus deviations in this year. This latter fact is evidently associated with the fact that in this year the minus selections show a very much larger average deviation in the direction opposite to the selection.

In the 1911 selection and 1912 rows and the 1913 selection and 1914 rows the average deviation in both the plus and minus selections is in the direction of the selection. It will be further noted that these are rows grown the next year after the selection. The question arises as to whether in these years the deviations are greater than might be expected in random sampling. This question can perhaps be tested easiest by determining the goodness of fit of the expected and observed average deviations.

Slutsky[17] has recently extended Pearson's tests for the goodness of fit to include other types of curves than frequency distributions. It is possible to apply this method to the present data and determine from Elderton's tables the probability that our observed deviations could have arisen from random sampling. The data for the 1911 selection and 1912 rows have been chosen for this purpose since these rows show the most consistent deviations in the direction of the selection. The theoretical points are determined by considering that if there were no effect of selection the average deviation of the rows from plus selections would be equal in the plus and the minus directions. The same would be true of the minus selections. The test is then made to

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[17] Slutsky, E. On the Criterion of Goodness of Fit of the Regression lines and on the Best Method of Fitting Them to the Data. Jour. Roy. Stat. Soc., Vol. LXXVII, Pt. 1, pp. 78-84. See also, Pearl, R. Amer. Nat. Vol. 48, pp. 505-507, August, 1914.

determine whether these four points deviate farther from the theoretical values than could be expected. By this test we find that

$$P = .6561$$

Or, in other words, if there is no effect of selection we should expect to get a fit as bad or worse than that observed in 65 out of every 100 trials. This is a reasonably good fit and we may conclude that these deviations do not behave differently than might be expected if there was no effect of the selection. There is thus no positive evidence that the selection has produced any effect even in the first year after the selection.

SUMMARY.

Summarizing the results of this section it may be said that from the data so far examined there is some evidence of an effect of a selection upon the rows grown the next year. In no single case is the effect great enough to be significant in itself. However, the fact that there is a reasonably large difference in the same direction after each of the three selections indicates that there may be some immediate effect of the selection.

It is quite possible that the apparent effect of selection upon the rows grown the following year is to be explained as physiological rather than genetic. It is possible that the larger and consequently more vigorous plants produce grain which has more nourishment or which for some other reason gives the new plant a better start. This brings us to an old queston which it is extremely difficult to answer. It will be considered in a later paragraph.

The Effect of Successive Selections in the Same Direction.

If the slight effect of selection upon the following generation, as noted above, is due to changes in the germinal substance, then a much more marked effect ought to be produced by two or three successive selections in the same direction. A portion of the 1913 rows have been subjected to two such selections and some of the 1914 rows to three such selections. The results are shown in table 7.

TABLE 7.

Showing the Effect of Two or Three Successive Selections in the Same Direction.

	1913 Rows.				1914 Rows.			
	++ Selection.		-- Selection.		+++ Selection.		--- Selection.	
	+	—	+	—	+	—	+	—
Number of rows	28	39	24	41	17	23	17	21
Total deviations	26.93	28.75	16.21	30.45	20.01	30.07	19.60	36.66
Average deviation per row	.962	.737	.675	.743	1.177	1.307	1.153	1.746

From this table it is noted:

1. That with two successive plus selections (1913 rows) there is no effect of the selection. There is a slight excess of the total minus deviations, i. e. in the direction opposite to the selection.

2. With two successive minus selections (1913 rows) there is a substantial excess of the total minus deviations. The total minus deviations are almost twice the total plus deviations.

3. With three successive selections in the same direction (1914 rows) there is an excess of the minus deviations in each case. Even where the selection has been plus in each year the total minus deviation is one-third greater than the plus deviations. Here there is a substantial excess in the opposite direction to the selection.

4. With three successive minus selections there is a marked excess in the direction of the selection.

Judging from these figures it would appear that successive plus selections have resulted in rows which on the average were below the means of their lines. On the other hand successive minus selections have shown in each case very marked excess in the direction of the selection.

The results so far obtained are to a large extent contradictory. It has been seen that, considering the effect of each selection on the years following it, there is some evidence of a positive effect on the year immediately following. If this effect were really due to the selection, then successive selections in the same direction ought to produce a still more pronounced effect. From table 7 it is seen that this prediction is realized in the case of the minus selections but with the plus selections the opposite result is obtained.

In view of the possible significance of these figures and those exhibited in tables 3 to 6 it is worth while to attempt an analysis of these data by still other methods.

Indices of Selection.

Attention has been called to the fact that in the method used in the preceding pages two factors have been left out of account. These are (1) the possible difference in the variability of different pure lines, and (2) the size of the deviation of the selected plants. That is, all plus deviations of the selected plants have been given equal weight although some plants were 20 grams above the mean and others only a fraction of a gram. If there is any real influence of the selection, a plant 20 grams above its mean should have more effect on the next generation than a plant only one-half gram above its mean. In view of the fact that the results obtained by the preceding method are somewhat doubtful in meaning it will be well to take these factors into consideration.

The difference in the variability of the different pure lines could best be expressed by their standard deviations or coefficients of variation. It would then be possible to divide the deviation of each selected plant or of each row by the standard deviation of the corresponding pure line. This would express the variability of the plant (or row) in terms of the variability of the pure line. However, in the majority of the pure lines used in this work the number of rows is too small to obtain a reliable standard deviation.

Very probably the chief factor in increasing or decreasing the standard deviation of a given line is the size of the mean. The greater the size of the mean the greater the chance for absolute variation. Consequently if each deviation is expressed as a percentage of its mean it is probable that the chief element in the difference in variability will have been taken into account.

We have, therefore, gone through the tables (cf. table 2) for each pure line and expressed the deviation of each plant and each row as a per cent. of the mean of that pure line for the given year.

In order to take account of the second factor, viz. the size of the deviation of the selected plant, the following points may be considered. If there is an effect of the selection the rows from the plus selections will tend to deviate in the plus direction, and *vice versa.* Owing to the regression the deviation of the daughter rows will not usually be so great as that of the mother plant. The amount of this regression and likewise the amount and direction of the deviation of each row in relation to its mother plant may be expressed as an index. If we let Dm be the deviation of the mother plant from its mean and Dd the deviation of the corresponding daughter row from its mean, then an index, I, may be calculated in which

$$I = \frac{Dm - Dd}{Dm}$$

If in this index the daughter row lies at the mean of the pure line, then Dd is zero and $I = 1.0$. In this case there is no effect of the selection. If the deviation of the daughter row Dd is in the same direction as the deviation of the mother plant, then $I < 1.0$ and there is apparently an effect of the selection. If, on the other hand, the daughter row deviates in the opposite direction to that of its mother plant, then $I > 1.0$.

This "Index of Selection"[18] in reality expresses the amount of regression of the offspring on the parent in the individual case.[19] It also brings together considerable other information into a single constant. Thus if the index is less than 1 we know at once that the row in question deviated in the direction of the selection. It likewise tells us the amount of deviation relative to the selection. If the index is 0.5 the row deviated half as far as the selected plant. If the index is 1.33 we know that the row deviated in the opposite direction to that of the

[18]To be distinguished from a "Selection Index." Cf. Pearl R. and Surface, F. M.—Selection Index Numbers and Their Use in Breeding. Amer. Nat., Vol. XLIII, pp. 385-400, 1909. Also Pearl, R.—Further Notes Regarding Selection Index Numbers, Amer. Nat., Vol. XLVI, pp. 302-307, 1912.

[19]It should be remembered, however, that these indices are not the same as Pearson's coefficients of regression calculated from the correlation coefficient and the standard deviations.

selected plant and that its deviation in that direction was equal to one-third the deviation of the mother plant.

Attention should also be called to the fact that if the deviation of the daughter row is in the same direction and greater than the deviation of the selected plant the index will be negative. Further if the deviation of the daughter row is in the opposite direction and greater than the deviation of the mother plant the index will have a value greater than 2.

These indices may be treated as other statistical constants. Thus, if there is no effect of selection within the pure line these indices, *on the average,* will be equal to 1.0 within the limits of chance deviations. If there is an effect of the selection the average index will be significantly less than 1.0. On the other hand, if the average index is significantly greater than 1.0 it will indicate that there is a tendency for the deviation to swing in the direction opposite to the selection.

In calculating these indices the deviations of the plants and the rows expressed as percentages of their means have been used instead of the absolute deviations. In this way these indices take account of both the factors discussed at the beginning of this section.

Indices have been calculated to show the effect of each of the three selections upon the rows grown in each of the succeeding years. The average index for both the plus and minus selections and for all the rows grown in each year is given in Table 8. Probable errors for the mean index have been calculated from the distributions of all the indices for each year.

TABLE 8.

Showing the Mean Index of Selection for the Plus and Minus Selections and for All the Rows, for Each Year.

Selection Made in	Rows grown in	Mean Index.		
		+ selections.	— selections.	All selections.
1911	1912	1.1575	1.1556	1.1566 ± .1442
1911	1913	1.3051	0.8910	1.0932 ± .1522
1911	1914	1.0053	0.8532	0.9250 ± .0491
1912	1913	0.9509	0.9615	0.9568 ± .0241
1912	1914	1.0151	1.0100	1.0126 ± .0139
1913	1914	1.0285	1.0102	1.0197 ± .0221

From this table it is seen:

1. That in the majority of cases the mean index is not far from the theoretical value 1. From the indices for all the selections in each year (last column) it is seen that in the majority of cases the deviation from 1 is not at all or very little greater than the probable error. In two cases, viz. the 1911 selection and 1914 rows, and the 1912 selection and 1913 rows the difference is very nearly twice the probable error. In these cases the mean index is less than 1 indicating a possible effect of the selection.

2. There is considerable difference in the mean index of the different years. Thus the 1911 selection and 1912 rows show a mean index considerably above 1. However, the probable error of the index for all the selections is practically as large as the deviation of the index above 1. On the other hand the 1912 selections and 1913 rows show a mean index consistently less than 1.0. The difference between 1.0 and the mean index of all the selections is .0432, a little less than twice the probable error. In none of these cases is the deviation from 1.0 statistically significant.

3. On the whole the mean index of the plus selection is greater than that of the minus selection. In only one case (1912 selection and 1913 rows) is this relation reversed. In three of the other years the difference is only nominal. However, in two cases (1911 selection and rows of 1913 and of 1914) the excess of the mean index of the plus over that of the minus selections is quite marked. If we average the six mean indices of the plus selections it is found to be 1.0770, while the corresponding average for the minus selections is only 0.9803. It is very doubtful whether this difference has any significance.

4. There is no evidence from these indices that the selection is more effective upon rows grown the year after the selection than upon rows grown in later years.

Many of the irregularities in these mean indices are attributable to the effect of one or two selections. For example, in Line No. 262 a plant was selected in 1911 whose yield was only 0.05 of a gram above the mean. It so happened that several of the rows grown from this plant deviated from their mean much farther than 0.05. Consequently they gave indices much greater than 1; in one case an index of —23.5 and in another +48.8. These extreme variations tend to balance each other and no doubt would do so if sufficient rows were grown. But with a small number of rows such a selection may materially change the value of the mean index. There is *a priori* no reason why such small selections should be omitted. For on the selection theory a small variation *should* result in a much smaller deviation in the daughter row. However, there are very few of these small selections in the present data.

In order to show the effect of this one small deviation, which is by far the smallest one in these data, we may give the mean index for the 1911 selection upon the 1912 and 1913 rows when Line 262 is omitted entirely.[20]

TABLE 9.

Mean Index with Line 262 Omitted.

Rows Grown in	Mean Index.		
	+selections.	—selections.	All selections.
1912	0.9952	1.1723	1.0842
1913	1.1249	0.8910	1.0043

Comparing these figures with those in the first two rows of Table 8 it is seen that omitting the effect of this very small selection results on the average in bringing the mean index nearer to 1.

On the whole these indices do not give us any evidence that the selections have had any effect upon the succeeding generations. The values tend to fluctuate about 1.0 as demanded by Johannsen's theory. It should be pointed out that if regression took place within these pure lines according to the Galton-Pearson theory of ancestral inheritance the value of these indices should approach the value 0.333. There is not the slightest indication that they do this.

[20]There were no rows grown from this small selection in 1914.

Indices of Successive Selections in the Same Direction.

As a matter of completeness it will be well to examine the indices for those rows which have been subjected to several successive selections in the same or different directions.

Table 10 shows the mean indices for the four classes of selection possible in the 1913 rows. Table 11 shows the mean indices for the possible kinds of selections to which the 1914 rows have been subjected.

Table 10.

Mean Indices of Selection for Each of the Four Kinds of Selection for the 1913 Rows.

Character of the selection.	Number of rows.	Mean Index.		Mean Index Omitting Line No. 262.	
		1911 selection.	1912 selection.	Number of rows.	1911 selection.
++	67	0.7350	0.9252	65	1.1044
——	65	0.8097	0.8615	64	0.8241
+—	59	1.9525	1.0716	57	1.1481
—+	67	0.9698	0.9766	66	0.9698

Table 11.

Mean Indices of Selection for Each of the Possible Kinds of Selection for the 1914 Rows.

Character of Selection.	Number of rows.	Mean Index.		
		1911 selection.	1912 selection.	1913 selection.
+++	40	0.9734	1.0453	1.0821
++—	26	1.0833	1.0128	0.9546
—++	16	1.1394	1.0320	1.0051
+—+	6	0.5460	1.0731	0.9776
+——	12	1.0912	1.0574	1.3085
—+—	10	1.2460	0.7777	1.1770
——+	30	0.7536	1.0576	0.9797
———	38	0.7335	0.9726	0.9063

From Table 10 it is seen that the apparent marked effect of the two plus selections in 1911 entirely disappears, if we omit Line No. 262 in which there is one selection only very slightly above the mean. In a similar manner the very large mean index for the + selection in 1911 is reduced to a figure comparable with other indices. However, with two minus selections there is in each case a very marked decrease in the mean index. This index is of the same order of magnitude with each of the two selections. Further it is not essentially changed by omitting the one disturbing line (No. 262) from the 1911 selections.

From table 11 it is seen that there is very little regularity in the indices of the three selections. Thus with three plus selections the mean index shows a tendency to lie slightly above 1, although probably not significantly. At least it may be said that there is no evidence that three successive plus selections have modified these pure lines in the direction of the selection.

With three minus selections the case is somewhat different. With each of the three selections the mean index is considerably less than 1, indicating that possibly the minus selections have produced a real effect upon the pure lines. On going through the individual indices it appears that the result is not due to a few very small indices but that there is a real tendency for the indices in these classes to be less than 1. This result it will be remembered falls into line with the conclusions drawn from Tables 7, 8 and 10.

Selection for Characters other than Yield.

In the preceding pages the only data dealt with have been those for the yield of grain per plant. In order to see whether the other characters upon which we have data behave in a similar manner the records of some of these have been at least partially analyzed. The characters to which most attention has been paid are the height of plant and the number of culms. These show but very little that is essentially different from the data for yield of grain. On this account we will discuss the data for height very briefly and omit the remaining characters.

Tables 12, 13 and 14 show the same data for height of plant that Tables 3, 4 and 5 show for weight of grain.

TABLE 12.

Effect of the 1911 Selections for Height of Plant upon the Rows in Each of the Three Succeeding Years.

Rows grown in		Selected Plants.		Daughter Row.			
				+Selections.		—Selections.	
		+	—	+	—	+	—
1912	Number of rows	86	70	44	42	35	35
	Total deviations	393.35	420.53	180.65	166.00	121.77	136.39
	Average deviation	4.574	6.008	4.105	3.952	3.478	3.897
1913	Number of rows	130	126	61	69	71	55
	Total deviations	566.58	697.39	277.19	267.83	249.56	258.50
	Average deviation	4.356	5.535	4.544	3.882	3.515	4.700
1914	Number of rows	76	102	34	42	52	50
	Total deviations	335.07	726.39	117.45	125.67	194.54	186.31
	Average deviation	4.409	7.121	3.454	2.991	3.741	3.726

TABLE 13.

Effect of the 1912 Selection for Height of Plant upon the Rows in Each of the Two Succeeding Years.

Rows grown in		Selected Plants.		Daughter Rows.			
				+Selection.		—Selection.	
		+	—	+	—	+	—
1913	Number of rows	101	155	55	46	77	78
	Total deviations	540.48	1697.42	179.56	176.09	347.19	350.24
	Average deviation	5.351	10.948	3.265	3.828	4.509	4.490
1914	Number of rows	78	100	40	38	46	54
	Total deviation	401.45	1123.88	139.58	99.27	172.41	212.71
	Average deviation	5.147	11.239	3.490	2.612	3.748	3.939

TABLE 14.

Effect of 1913 Selection for Height of Plant upon the Rows Grown the Next Year.

Rows grown in		Selected Plants.		Daughter Rows.			
				+Selection.		—Selection.	
		+	—	+	—	+	—
1914	Number of rows	101	77	47	54	39	38
	Total deviations	899.73	933.82	169.60	171.11	142.39	140.87
	Average deviation	8.908	12.128	3.609	3.169	3.651	3.707

Inspection of these tables shows:

1. That in each year the number of daughter rows is very equally divided between the plus and minus columns. In no case is the difference greater than might be expected in random sampling.

2. The total deviations of the daughter rows are in most cases also very equally divided between the plus and minus directions. In four out of the six cases the excess of the total deviation is in the direction of the selection. In only one instance is this deviation large enough to be significant. This is in Table 13, the rows grown in 1914. For the plus selection in this year the theoretical total deviation is 119.43 centimeters. The difference between the observed and expected ratios is 20.15 centimeters. As noted before it is difficult to determine the standard error of these total deviations. However, it is probable that this difference is not beyond the range of the fluctuation of random sampling. In all of the other years the difference is certainly insignificant. For this and other reasons noted below, it seems probable that this one large deviation is not significant in connection with the selection.

3. Inspection also shows that the average deviation per plant row is very equally distributed between the plus and minus columns. The largest difference between the observed and expected average deviation is only a little over 0.4 cm. However, in 9 out of 12, or in 75 per cent. of the possible cases the excess is in the direction of the selection. This difference is not greater than might arise in random sampling.

4. There is no evidence that the selection for height of plant has produced a greater effect the first year after the selection than in later years.

Since the above tables do not give any positive evidence of selection, it has not been thought necessary to calculate all of the indices of selection for this character. The indices for two years have been calculated and they show essentially the same thing as the indices for weight of grain. The indices for height tend to vary a little more widely from the average value of 1 than those for grain weight. This is due to the fact that some of the selections for height were much nearer the mean than in the former case. It is not thought necessary to table these indices.

Discussion.

The statistical analysis of these data has given but very little evidence of the positive effect of selection within these pure lines. The one or two instances in which there is some doubt, may be discussed briefly. The first instance is that shown in Table 7 in which the total deviations of the daughter rows show a positive excess in the year following the selection. There is some question as to whether these excesses in the direction of the selection are not to be regarded as coincidences of random sampling. This is rendered more probable because the later analysis by means of the indices show very little evidence for such an effect.

However, if these excesses are to be regarded as significant it is very probable that they are due to physiological rather than genetic causes. It is quite conceivable that the grain from the more vigorous heavy yielding plants differs from that of the smaller plants in either the amount or quality of its food material. It was thought that possibly some evidence on this point could be obtained by determining the correlation between the yield and the weight per 100 grains of individual plants. This correlation was determined for several pure lines but in each case it was significantly zero, even showing a slight negative value in some instances. Thus it appears that the size of the grain is not the determining factor in these data at least. Whether the grain from the large and small plants vary in the character of their nutrient material is a question that we have not studied.

It was pointed out in connection with Tables 7, 10 and 11 that with successive minus selections there was a positive effect of the selection. This was shown both by a study of the deviations from the mean and of the indices. On the other hand, successive plus selections appeared to show a negative effect of the selections. Whether any significance is to be attached to these slight differences or not cannot be decided by the present data.

On the whole these results certainly show that selection within these pure lines of oats has been without any marked effect upon the progeny so far as the characters studied are concerned. The results based upon the study of the indices agrees as closely as could be expected with Johannsen's theory.

It is proposed to continue the selections within certain of these pure lines upon a somewhat different plan. It is hoped that by these methods it will be possible to analyze the data by an individual rather than a statistical method. Such an analysis was attempted with the present figures, but it was found that they are inadequate for that purpose. It is believed that possibly some new evidence can be brought to bear upon the selection question in that manner.

Summary.

The chief points brought out in this paper may be summarized as follows:

1. The present study attempts to analyze the results of three successive years of selection within pure lines of oats. Twenty-eight pure lines representing 13 varieties have been used in this work. In the four years 621 garden rows have been grown involving over 12,500 plants. The characters studied were weight of grain, weight of plant and of straw, height of plant and the number of culms. Only two characters, yield of grain and height of plant, are analyzed in detail in this paper. The remaining characters show essentially the same things.

2. It is pointed out that the oat flower is practically always self-fertilized. It is shown that if this is true every oat plant must be regarded as homozygous for all of its characters. Consequently the oat plant fulfills all the requirements in the original definition of a pure line.

3. The characters studied are subject to rather wide fluctuations due to environment. For this reason it is not possible to compare the absolute values of these characters from year to year. Instead the deviations of the plants and rows from the mean of their pure line in the given year have been used.

4. As a first approach to the problem in hand we have determined the number of rows, grown from plus selections, which deviated in the plus direction and likewise the number deviating in the minus direction. The same thing has been done for rows grown from minus selected plants. Thus for each selection there are four classes of rows. (Cf. Tables 3, 4 and 5). Also the sum of the deviations of the rows in each class has been determined and likewise the average deviation in each class.

5. From these data for the yield of grain, it is pointed out that usually in the year next following a given selection there is an excess deviation in the direction of the selection. This appar-

ent effect of a given selection is very much less noticeable or not at all in the later years. It is probable that the effect in the first year is due to physiological rather than genetic causes.

6. Considering the effect of two and of three successive selections in the plus direction it is seen that there is an excess deviation in the direction opposite to the selection. However, with two and three selections in the minus direction there is an excess in the direction of the selection (Table 7). These results balance each other so that it appears safe to conclude that neither were due to the effect of the selection.

7. The methods of analysis described above leaves out of account two factors, viz. the difference in the variability of the different pure lines and second the size of the deviation of the selected plant. The first of these factors can be partially taken into account by expressing each deviation as a percent. of its mean. The second factor can be accounted for by expressing the deviation of each plant as an index.

$$I = \frac{Dm - Dd}{Dm}$$

where *Dm* is the deviation of the mother plant from its mean and *Dd* is the deviation of the daughter row from its mean. If there is no effect of the selection as Johannsen claims then this index should on the average equal 1. If regression takes place within these pure lines as claimed by the Galton-Pearson theory of ancestral heredity, the index would on the average approach 0.33. In general if the index is significantly less than 1 it indicates some effect of the selection.

8. For the yield of grain, these indices have been calculated for the effect of each selection upon the rows grown in each of the following years. The average index for each class of selection and for all the selections are given in Table 8. As shown in their probable errors these mean indices are not significantly different from 1. This indicates that there is no effect of the selections within these pure lines.

9. The mean indices showing the effect of two or three successive selections in the same or in different directions are shown in Table 10 and 11. These indices are also significantly equal to 1 with the possible exception of the successive minus selections. These later indices are consistently less than 1. Whether they really indicate an effect of the selections or not, cannot be determined from the present data. The values are not very far below 1 and in view of the other evidence we are inclined to regard them as random fluctuations.

10. It is pointed out that where selections are made which are only slightly above or below the mean of their pure line, spurious values of this Index are sometimes obtained. This is especially true if a relatively small number of rows are grown from such a selection. The reason for this is that the means of some rows may deviate much farther from the mean of the line than did the mother plant. This will produce indices very large either positive or negative. *A priori* there is no reason for excluding such small selections. They ought, on the selection theory, to result in rows which would deviate less from the mean of the line than rows grown from large selections. Only one such "small" selection is included in the present data. The effect of omitting the line (No. 262) to which it belongs is shown in tables 9 and 10.

11. The analysis of the selections for height of plant shows essentially the same results as found for yield of grain. Analysis by the method of deviations shows that in only one instance is the excess in the direction of the selection large enough to have any possible significance. For reasons discussed in the text it is probable that this one large deviation is not significant in connection with the selection.

12. Indices of selection for height of plant have been calculated for several of the selections. Since they show nothing essentially different from those for yield they have not been included in the present paper.

13. On the whole the results obtained in this study give no evidence that selection for three years has modified any of the characters studied. The one or two apparent exceptions discussed in the paper might very easily arise in chance distributions where so small a number of years are considered. The weight of the evidence against an effect of selection far outweighs the evidence for such an effect. *It must be concluded that in the present material and for the characters studied, selection for three years has produced no effect which can be detected by the methods used.*

14. It is proposed to continue a portion of these selections and later to attempt an individual analysis rather than the statistical one presented in this paper.

BULLETIN 236.

FIELD EXPERIMENTS.

Reported by Chas D. Woods.

The work of investigation at the two experimental farms (Aroostook Farm, Presque Isle, and Highmoor Farm, Monmouth) is planned by the Director, the Biologists, the Plant Pathologist and the Entomologist. The results of the more scientific phases of the studies are reported from time to time in the bulletins but it always happens that there are results obtained that lie somewhat outside of the lines of work of any of the Station specialists. Some of the more popular and practical results are here reported. The carrying out of these experiments and the taking of the requisite notes devolved upon different members of the Staff. In general the field work was carried out under the direction of the farm superintendents.

Drawing Conclusions from Field Experiments.

Field experiments at the best are somewhat uncertain because there are so many factors of soil, temperature, rainfall, and the like, that affect the results which are beyond the control of the experimenter. For this reason it is always planned at this Station to carry the same experiment under as nearly as possible the same conditions through a series of years before attempting to draw any very definite conclusions. The results here reported should be considered more in the light of reports of progress than of completed studies. It may happen that the teaching that a single year's results seem to warrant may be reversed by the repetition of the experiment in other years under different climatic or other conditions. This is illustrated in the paper on the Effect of Spraying Iron Sulphate on Potato Tops given on page 51.

Commercial Varieties of Oats at Highmoor Farm in 1914.

The Station has been conducting a test of commercial varieties of oats at Highmoor Farm since 1910. The detailed results of these tests for the four years 1910 to 1913 inclusive were published as Bulletin No. 229. The results of the 1914 test show many interesting points, and are here summarized.

The method used by the Station in recent variety tests has been to plant four plots of each variety. Each plot contains 1-40 of an acre, making in all 1-10 of an acre devoted to each variety. The four plots of a variety are placed in different parts of the field so that the yield of any one variety is less likely to be affected by the quality of the soil. The average of the four plots is taken as the yield of the given variety for the year.

The twenty-one varieties grown in 1913 were again tested in 1914. In addition one new variety was added, viz., the O. A. C. No. 72. This oat was bred at the Ontario Agricultural College and has proven to be a very excellent variety in Canada.

The past season was an exceptionally good one for growing oats at Highmoor Farm. The yields have been far in excess of anything previously obtained. One of these commercial varieties yielded well over 100 bushels per acre. This was the Minnesota No. 26 with a yield of 105.5 bushels per acre. One plot of this variety yielded at the rate of 132.5 bushels per acre. Two other plots reached 100 bushels while the fourth plot gave over 89 bushels.

Three other varieties yielded only a little below 100 bushels per acre. These were the Gold Rain (98.8 bush.), the Early Pearl (98.1 bush.) and the Silver Mine (96.3 bush.).

Of these four highest yielding varieties the Early Pearl and the Minnesota No. 26 ranked second and third in yield in 1913. These two varieties have now been tested for three years. Average yields for the three years are for the Early Pearl, 77.3 bushels; and for the Minnesota No. 26, 75.3 bushels. These two varieties are exceptionally promising for central Maine.

The Gold Rain variety which ranked second in yield this year is also an excellent oat. For the three years in which it has been tested it has averaged 72.6 bushels per acre. This is a yellow oat which was originally bred by the Experiment Station at Svalof, Sweden.

Eleven of the varieties have now been tested for five years. On the basis of the four year tests given in Bulletin 229 the Irish Victor, Imported Scotch, Lincoln and Prosperity were mentioned as the best of these varieties. These four varieties yielded well in 1914 but not so well as some of the newer varieties mentioned above. The 1914 yield of the Irish Victor was 88.6 bushels, the Imported Scotch 86.8 bushels, the Lincoln 87.6 bushels and the Prosperity 88.8 bushels.

The extra early oats like the Kherson, Daubeney and Rebred 60-Day again did not yield as well as the later varieties. It is possible that these early varieties will be better adapted to the northern part of the state than to the region around Highmoor Farm.

On the whole all of the yields were exceptionally high. The average yield of the 22 commercial varieties was 87.5 bushels per acre. The highest average yield obtained in any previous year was 64.2 bushels in 1910. The exceptional yields this year were in the main due to the presence of abundant moisture during the growth and formation of the grain. The grain matured exceptionally well and is of an excellent color. The weight per measured bushel runs unusually high. These oats are exceptionally good for seed and it is hoped that they will be tried extensively by the farmers in the State in 1915.

In addition to the testing of these commercial varieties a number of new varieties have been originated in the breeding work of the Station. A number of these have now been tested in large plots for two years and have given very satisfactory yields. Several of these new varieties are considerably better than any of the commercial varieties so far tested.

The yields per acre of all of the commercial varieties of oats grown at Highmoor Farm in 1914 are shown in the following table:

Yield of Commercial Varieties of Oats Grown at Highmoor Farm in 1914.

Variety	Acre Yield Bush.	Variety	Acre Yield Bush.
Abundance	76	Minnesota No. 26	105
American Clydesdale	77	O. A. C. No. 72	90
Banner	90	President	90
Daubeney	82	Prosperity	89
Early Pearl	98	Rebred 60-Day	81

Garton No. 5	92	Senator	85
Gold Rain	99	Siberian	80
Imported Scotch	87	Silver Mine	96
Irish Victor	89	Swedish Select	83
Lincoln	88	Victor (black)	79
Kherson	78	White Plume	91

Tests of New Varieties of Oats Originated at Highmoor Farm.

In addition to the testing of commercial varieties of oats the Station has been engaged for several years in breeding new varieties of oats that it is hoped will be better adapted to the conditions in this State than any of the existing varieties. The first part of this work was begun in 1910 and has now reached a stage where the results may be given to the public.

In 1910 about 350 individual plants were selected for the variety test plots of that year. In 1911 the seed from each of these plants was sown in a separate garden row. Thus the plants in each row were the offspring of a single plant of the year before. Careful notes were taken on each row, and those which showed the most desirable characters were harvested and threshed, each row by itself. The next year the seed of these most promising rows was planted in small plots of 1-2000 acre. This was necessary on account of the small amount of seed. Notes were again made and only the best plots selected. Thus out of 350 plants originally selected the offspring of 33 were regarded as good enough to continue into 1-40 acre plots in 1913.

In 1914, 31 of these "pure lines" were tested for the second time in duplicate plots. These "pure lines" as they are called are essentially new varieties. Each one of them has been developed from a single plant. Since the oat flower is always self-pollinated each plant in one of these pure lines has the same hereditary constitution as every other plant in that line. For this reason plots of these pure lines are much more even in ripening, in yield, in strength of the straw, and other characters, than ordinary commercial varieties. Further, many of these new varieties are proving superior in yield to any of the commercial varieties so far tested. Out of the 31 pure lines tested for two years 15 have been judged good enough to be offered to the public. These pure lines will be tested further for several years and possibly some more of them will be discarded as showing no substantial improvement over commercial varieties already in existence.

We believe that these pure lines represent better seed than can be obtained in commercial varieties. They are strictly pure bred and come true to type without showing any mixture. They further ripen very evenly which is a very desirable character. With varieties which do not ripen evenly a considerable amount of grain is lost from the shattering of over-ripe plants.

These new varieties have not been given names but bear the number by which they are known in our records, prefixed by the word "Maine." The following table shows the yield of these pure lines for the two years and for 1914. The year 1914 was an exceptionally good one for oats and the yields are higher than can be expected in a series of years. A very limited amount of seed is available from some of these lines.

Yields in Bushels per Acre of the Pure Lines of Oats Bred at Highmoor Farm.

Pure Line.	2-year average.	1914 yield.
	Bushels.	Bushels.
Maine No. 340	91.4	108.7
Maine No. 337	89.4	120.0
Maine No. 336	88.5	101.7
Maine No. 230	86.8	104.2
Maine No. 351	85.1	100.2
Maine No. 286	83.6	96.7
Maine No. 281	83.2	93.3
Maine No. 247	83.2	103.7
Maine No. 355	81.9	92.7
Maine No. 357	81.5	81.5
Maine No. 307	81.4	95.9
Maine No. 346	81.2	90.6
Maine No. 264	80.4	95.7
Maine No. 128	79.8	89.5
Maine No. 334	79.5	98.9
Average	83.7 Bushels.	98.2 Bushels.

Rate of Seeding Oats in Aroostook County.

It is the prevailing custom in Aroostook County to seed very heavily with oats. Perhaps the majority of the farmers sow from four to six bushels to the acre. It has been the experience in other parts of the country, and even in other parts of the State, that this is too much seed for the best results. From two to three bushels per acre has given the best results in the southern part of the State. However, knowing that Aroostook conditions are quite different from those in the other parts of the State the Station has not thought it best to make any recommendation for the former region.

The acquisition of Aroostook Farm opened to the Station the opportunity to start experiments in this direction. Preliminary experiments were carried out this year (1914). It must be understood, however, that these experiments must be repeated several years before trustworthy results can be secured. That is, the results obtained this year may not hold good another year when the seasonal conditions are different. What we want to know is—How much oats should be sown per acre to obtain the best yield in a series of years? Consequently too much reliance must not be put in the results of any single year.

Six different rates of seeding were used this year, ranging from two bushels to five. Six plots of the same size were laid out in as uniform a piece of ground as could be found. It is to be remembered that this is the first year the Station has had the farm and little is known of the former management of any of the land. This piece was in potatoes in 1913. Of the treatment and the yield in that and preceding years there is no record. The plots were all of the same size but were less than an acre each. The seeding was done with a large disk drill. The seed used was the Prosperity variety and was grown at Highmoor Farm in 1913. It was planned to run these plots in duplicate but owing to the lateness of the season before the seeding could be done this had to be abandoned.

The following table gives the results for the year 1914.

Rate of Seeding in Pecks.	Pounds of straw per plot.	Bushels of grain per plot.
8	2464	48*
10	2403	50*
12	2916	65
14	2768	58
16	2758	70
20	2600	68

*These two plots were slightly injured by colts which broke through a neighboring fence.

These results undoubtedly indicate that the higher rates of seeding gave better results this year. The first two plots were slightly injured a short time before harvest. On this account the yields were doubtless somewhat higher than found. It is further seen that three bushels per acre have given very nearly as good a yield as five bushels. Why the yield of grain from the plot with 14 pecks of seed should be so much lower than those on either side of it is not clear. Apparently it was not due to the rate of seeding. The yield of straw was as high as on most of the other plots.

It is planned to continue these experiments for several years. In this way it is hoped to be able to answer the question as to the proper amount of seed for Aroostook conditions.

Sulphate of Ammonia Compared with Nitrate of Soda as a Source of Nitrogen in Potato Fertilizers at Aroostook Farm in 1914.

A few years ago there was quite a general failure of the crop of potatoes in Aroostook County where a certain brand of fertilizer was used. This fertilizer was analyzed by the Station chemists and found to be high grade. While it was not quite up to its guaranty in some particulars it did carry enough nitrogen, potash and phosphoric acid to more than grow a good crop of potatoes. This fertilizer carried none of its nitrogen in the form of nitrate of soda, but it was all in the form of sulphate of ammonia and high grade organic materials. This led to the stronger reaffirming of the position which the Station had taken relative to the use of nitrate nitrogen on the potato crop. In earlier publications it has been pointed out that the potato makes its demands for nitrogen early in the season and that in the cold, late springs so common in Aroostook County, the crop demands that part of the nitrogen should be immediately available. For this reason the Station has strongly urged that about one-third of the nitrogen in a potato fertilizer be nitrate nitrogen.

In the process of making gas and coke from coal there is developed a large amount of sulphate of ammonia, which in many coke and gas plants is still going to waste. In some plants this now is being conserved and many thousand tons of sulphate of ammonia are thus obtained each year. With the increasing use of high grade organic nitrogen for food of animals, the price of tankage has been going higher and higher year by year. It is, of course, desirable, if it can be done, that as much as possible of this sulphate of ammonia which is a comparatively cheap source of nitrogen be used in Maine fertilizers. Because of this, arrangements were made to begin in 1914 a series of experiments to run over a period of several years. The "base" which was used in these goods was made by the wet process, whereby nitrogen from rather low grade goods is made as available as from high grade goods. The available phosphoric acid was furnished in the form of acid phosphate and the potash in the form of sulphate of potassium. The fertilizer was free from chlorides so as to preclude the possibility of the formation of poisonous ammonium chloride. The base carried approximately one-third of the nitrogen that went into the formula. The remainder of the nitrogen was furnished in the form of nitrate of soda and sulphate of ammonia, as indicated in the following plan:

Plot 1. Basal mixture and 2-3 of the nitrogen in form of nitrate of soda.

Plot 2. Basal mixture and 2-3 of the nitrogen in form of sulphate of ammonia.

Plot 3. Basal mixture and 1-3 of the nitrogen in form of nitrate of soda and 1-3 in form of sulphate of ammonia.

Plot 4. Basal mixture, and 1-3 of the nitrogen in form of high grade organic and 1-3 in form of nitrate of soda.

Plot 5. Basal mixture and 1-3 of the nitrogen in form of high grade organic and 1-3 in the form of sulphate of ammonia.

There was about an acre in each plot. The Lowell Strain Green Mountain potato was used for seed. The fertilizer was applied at the rate of 1500 pounds per acre, and supplied about 60 pounds of nitrogen, 120 pounds of available phosphoric acid and 105 pounds of water soluble potash per acre. Other than the fertilizer used the plots were planted, cultivated, sprayed and cared for in all particulars alike.

May and June were rather cool months and hence would be favorable to the nitrate of soda. The mean temperature for May was 53.2 degrees, for June 56.0 degrees, July 63.5 degrees, August 60.1 degrees and September 55.8 degrees. There were several cold nights with frosts in June. May 4 the thermometer went to 25 degrees, May 5 to 32 degrees, June 9 to 30 degrees and June 28 to 31 degrees, and on this latter date there was quite a heavy frost so that it injured potatoes, not in these experiments but on some other plots at Aroostook Farm. The lowest temperature in July was 40. The lowest temperature in

August was on the 28th when it was 35 degrees. It was, however, colder than this at some of the lower parts of Aroostook Farm, where there was a slight frost on this night of August 28.

It is to be remembered that experiments of this kind cannot be expected to give results in a single year that will be conclusive. The weighed yields on the plots were as follows: Plot 1, 127 barrels; Plot 2, 121 barrels; Plot 3, 123 barrels; Plot 4, 126 barrels; Plot 5, 118 barrels, per acre. The plots containing sulphate of ammonia averaged 119 barrels and the plots containing nitrate of soda averaged 126 barrels per acre, while the plot which contained both sulphate of ammonia and nitrate of soda was half way between or 123 barrels per acre. In this single year's trial the results were in favor of nitrate of soda.

It is planned to repeat this experiment in 1915.

Method of Application of Fertilizer upon Potatoes at Aroostook Farm.

It has always been more or less customary in growing potatoes in Maine to apply the fertilizer in the drill or hill at the time of planting. This was largely the practice when farm manures were used in connection with potato growing and has been followed with commercial fertilizers. Although now when farm manures are used in connection with potatoes they are more likely to be applied broadcast and a smaller amount of fertilizer applied in the drill. There was little question in the minds of practical growers that when 500 to 1000 pounds of fertilizer were applied per acre that it was to the best advantage to apply it in the drill. With the increase up to 1500 to 2000 pounds per acre the question has arisen whether it may not be advisable to apply the fertilizer at different times. This led the Station to undertake trials at Aroostook Farm.

In 1914 an experiment was started to extend over a period of years for the purpose of testing the method of applying fertilizer. Something over acre plots were used. In the first and fourth of the six plots 1000 pounds per acre of the fertilizer were applied broadcast before planting and 500 pounds were applied with the planter. On plots 2 and 5 the whole 1500 pounds per acre of fertilizer were applied at the time of planting. On plots 3 and 6, 1000 pounds per acre were applied with the planter at the time of planting and 500 pounds at the first cultivation.

The fertilizer used was high grade, carrying 4 per cent nitrogen, 8 per cent of available phosphoric acid and 7 per cent of water soluble potash. One-third of the nitrogen was in the form of nitrate of soda, and the remainder was high grade organic nitrogen. The yields are based upon weighings and not upon measure. The potatoes were clean, without adhering soil.

In potato experiments at Highmoor Farm the Station had found that when there was only a small amount of rainfall following the second application of fertilizer that apparently this added fertilizer was not well utilized. This present season, however, at Aroostook Farm there was ample water to dissolve and render this plant food in all of the fertilizer available. It has been estimated that it takes about six inches of water to successfully grow a crop of potatoes. In the spring of 1914 the ground was well filled with water. In May at Aroostook Farm there was 2.74 inches of rainfall, and in June 4.8 inches, in July 2.23 inches and in August 2.35 inches, or a little more than 12 inches during these four months.

On plots 1 and 4 on which 1000 pounds of the fertilizer were applied broadcast and 500 pounds with the planter at the time of planting, the yield was 121 and 127 barrels, making an average of 124 barrels per acre. On plots 2 and 5, where 1500 pounds of fertilizer were applied all in the drill at the time of planting, the yields were 134 and 127 barrels, or an average of 130 barrels for the two plots. The yields on plots 3 and 6, where the fertilizer was applied 1000 pounds in the drill and 500 pounds with the first cultivation, were the same as in plots 1 and 4, being 127 and 121 barrels with an average of 124 barrels per acre.

In field experiments of this kind even if there had been marked differences it would not do to draw conclusions from a single year's trial because there are so many things that come in to modify the results of a field experiment even when the plots are as large as these were.

So far as a single year's test goes there is little to choose between the three methods, although 6 barrels more per acre were obtained where all of the fertilizer was applied in the drill than in the two other methods. It is interesting to note, however, that one of the plots in each method of treatment yielded at the rate of 127 barrels to the acre. If those plots alone were selected there would have been no difference in yields in the experiment.

It is planned to repeat this experiment in 1915, at which time there will be added another plot in which all of the fertilizer will be applied broadcast before planting and none applied with the planter.

THE EFFECT OF SPRAYING IRON SULPHATE ON POTATO TOPS.

For a number of years the Station experimented with copper sulphate and iron sulphate as a means of eradicating wild mustard from oats. As it was found that wild mustard could be successfully controlled in this way, numerous inquiries were received relative to the possibility of exterminating wild mustard in potatoes. While it was expected that the application of the iron sulphate would materially injure the potato vines there was no experimental evidence as to what the effect would be on the resulting crop.

In 1913 an experiment of this kind was conducted at Highmoor Farm in which, strange to say, there seemed to be an increased yield where the iron sulphate was used. The results were published in Bulletin 224. It was stated as a conclusion: "The experience indicates that with a field of potatoes badly infested with mustard spraying with sulphate of iron solution may be resorted to with a reasonable expectation that the yield of tubers will not be diminished. At present such a treatment can only be recommended as a rather extreme measure."

This experiment, on which the above was based, was conducted in the central western part of the State on Highmoor Farm, and in a year in which there was a particularly long growing season. A similar experiment was made on Aroostook Farm the present season with Green Mountain potatoes. There were five plots, three of which were untreated, one of which was sprayed once with sulphate of iron, and another which was sprayed twice with sulphate of iron. The tops that were sprayed once quite quickly rallied, and those that were sprayed twice were much more checked. The yield per acre on the unsprayed plot was at the rate of 138 barrels per acre. The plot sprayed once yielded at the rate of 111 barrels per acre, and that which was sprayed twice at the rate of 100 barrels per acre.

The results obtained in 1914 were what would naturally be expected and were quite different from those obtained at Highmoor Farm in 1913. This would seem to indicate, as one would expect to be the case, that sulphate of iron applied to potato vines is sufficiently injurious to the vines to render it an impracticable method of fighting wild mustard.

Fertilizer Experiments on Apple Trees at Highmoor Farm.

As it is pretty generally known, when the State purchased Highmoor Farm it had something over 3500 apple trees upon it. These trees were about twenty-five years old, but for the most part had been completely neglected, as regards pruning, fertilization, culture and spraying. The first season that the Station had the farm the orchards were plowed, cultivated and sprayed. Pruning was begun and has been continued until at the present time the orchards are in pretty fair shape. It was, of course, not desirable or practical to thin the trees out at the start to where they should be at the end, but the pruning while rather severe each year has been gradually decreased in amount.

The orchards were annually fertilized at the rate of 1000 pounds per acre of a commercial fertilizer carrying 4 per cent of nitrogen, 8 per cent of available phosphoric acid and 7 per cent potash. At the end of the third year the orchards had so far responded that they gave a good crop and since that time fertilizer experiments have been carried on in various portions of the orchards, as follows:

The use of highly nitrogenous fertilizers have been advocated as a means of forcing trees into bearing and in some parts of the State has been tried with results that seemed to be gratifying. This method was first suggested by Doctor Fisher of Massachusetts and was tried by the Station several years ago in coöperative work with Mr. Pope in his orchard at Manchester without very decisive results. At Highmoor Farm a row of 32 Baldwin trees was divided into three sections. The trees were treated alike so far as the application of standard fertilizer was concerned, but ten of the trees at each end of the row received in addition nitrate of soda at the rate of 100 pounds per acre. Also the Baldwin orchard was divided into two parts so that part of it received the usual treatment and in addition received 100 pounds of nitrate of soda per acre per year. No differences that could be attributed to the additional nitrate of soda have been observed.

In experiments carried out at the New York State Experiment Station it has been found that with their deep clay soils, well suited to apple tree growth and apple bearing, that there is no effect from the use of fertilizers either upon the growth of young trees, the wood growth on matured trees, or in the amount, coloring, or size of the fruit. To see if anything like this would hold with Maine conditions, particularly with the rather shallow soil and with the stubborn subsoil upon Highmoor Farm, an experiment was begun in 1912. It is to be remembered that the orchard had been cultivated and fertilized for the three preceding years and brought into good condition. About 400 trees were divided into three plots containing 12 rows extending clear across the large No. 1, Ben Davis orchard. Plot A, (rows 1 to 4) has received no fertilizer since 1912. Plot B, (rows 5 to 8) has received annually since 1912, 500 pounds of a fertilizer carrying 4 per cent of nitrogen, 8 per cent of available phosphoric acid, and 7 per cent of potash. Plot C, (rows 9 to 12) has received annually since 1912, 1000 pounds per acre of a commercial fertilizer carrying 4 per cent of nitrogen, 8 per cent of available phosphoric acid and 7 per cent of potash.

Careful records of growth shown by measure, and of yields of fruits as shown by weight, are made of all of the trees in the orchards at Highmoor Farm. Thus far no results that could be attributed to the fertilizer have appeared. No person examining the twelve rows of apple trees, part of which have been fully fertilized, part partially fertilized and part not fertilized at all for the past three years, could detect differences whereby he would be able to pick out the treated from the untreated rows.

It is to be remembered that in all of these experiments nothing has been grown upon the land except apple trees and apples. An orchard cover crop is sown in the fall, is plowed under early in the spring, and the land is kept cultivated until well into August when the cover crop is again sown. The plant food stored up in the wood growth and that which has been removed in the apple crop has been taken from the soil, but beyond that the soil has not been made to pay tribute to any other crop.

This experiment is to be continued for many years, or until the unfertilized rows show evidence of need of plant food.

Turnips as a Stock Food.

YIELDS AND FOOD VALUE.

It is probably true that the corn plant generally yields a larger amount of digestible dry matter at less cost than any other plant that usually enters into a rotation. There are, however, parts of the State in which corn does not do well. Even in the corn growing section of the State there are occasional farmers who desire to grow succulent food and do not wish to go to the expense of putting up a silo. These people have always looked towards roots for a green winter food. This is particularly true of the eastern part of Washington County where many farmers are interested, in a small way, in dairying. One of their most serious problems is how to provide some form of succulent food for winter use. On many of the farms corn cannot be grown, partly because of the climatic and partly because of soil conditions. Nor have mangolds been grown in that locality with marked success. Both turnips and rutabagas, however, seem particularly adapted to that section of the State. Large crops can be grown. They thrive on clay soils. They can be planted late after the low lands have become fit to work. They furnish a hoed crop for the rotation upon land on which no other hoed crop can be grown. And they fill a very important place in the ration of the dairy animal.

A coöperative field experiment planned by the College of Agriculture and carried out by Mr. Clarence A. Day on the farm of Mr. F. P. Washburn of Perry, is here reported.

This experiment is in a series in which the following problems are being studied; the place of turnips in the rotation; as to whether the crop does better on sod or on potato ground; methods of fertilization; tests of varieties; and an attempt, if possible, to get at the cause of the serious trouble to turnips in Washington County known as black-heart.

The field selected for this experiment was a clay loam, free from rock, and typical of the better grade clay soils in the towns near the St. Croix River. For the purpose of the test the field was divided into tenth acre plots, 2 rods by 8 rods in size. The fertilizer used, the yields in pounds per plot and in bushels and tons per acre, and the quality of the turnips are given in the table which follows:

Table showing varieties grown, fertilizers used and yield and quality of rutabagas grown in coöperative test at the farm of F. P. Washburn, Perry, in 1914.

Plot.	Variety.	Fertilizers.	Yield. Pounds per plot.	Yield. Per Acre. Bushels.	Yield. Per Acre. Tons.	Quality. Good.	Quality. Black hearted. Badly.	Quality. Black hearted. Slightly.
						%	%	%
1	Carter's Imperial.....	600 pounds fish chum.......	4775	795	23.8	-	100	-
2	Carter's Imperial.....	400 pounds chum........... 100 pounds acid rock..... 30 pounds muriate.........	5635	940	28.2	45	55	-
3	Carter's Imperial.....	8 pounds nitrate.......... 80 pounds acid rock....... 45 pounds tankage......... 30 pounds muriate..........	4750	795	23.8	35	65	-
4	Carter's Imperial.....	15 pounds nitrate.. .... 25 pounds acid rock......... 68 pounds tankage.......... 21 pounds muriate..........	4485	748	22.4	44	48	8
5	Carter's Imperial.....	3 loads barn dressing in drill	4805	800	24.0	66	26	8
6	Carter's Imperial.....	2 loads dressing harrowed in 4 pounds nitrate........... 65 pounds acid rock........ 20 pounds tankage.......... 21 pounds muriate..........	4890	815	24.5	70	16	14
7	Carter's Imperial.....	2 loads dressing ploughed in 150 pounds acid rock in drill	4025	670	20.1	72	18	10
8	Carter's Imperial.....	2 loads dressing plowed in.. 5 pounds nitrate........... 65 pounds acid rock........ 20 pounds tankage.......... 20 pounds muriate..........	4775	795	23.8	66	24	10
9	Skiwings Purple Top..	Same as plots 8 and 10......	4100	682	20.5	88	0	12
10	Golden Neckless...... White Egg...........	Same as plots 8 and 9.......	1900 2835	632 945	19.0 28.3	100 -	- 100	- -
	Total for the acre..	....	46975	782	23.5			

The average yield per acre for all of the plots and varieties was 782 bushels. The estimated cost of labor, fertilizer, rent of land and seed, was $59.05. At this rate the turnips cost 7.6 cents per bushel, or about $2.50 per ton.

At Highmoor Farm the Imperial Swede rutabagas were grown in 1914 to be used as winter food for sheep. The land was the rather heavy loam characteristic of the farm. It was fertilized with 5 cords of stable manure and 500 pounds of a 4-8-7 fertilizer per acre. The yield was less than that on the

Washington County Farm, being 630 bushels per acre, or 18.9 tons. It required 130 man hours and 45 horse hours per acre to grow and harvest these turnips.

Rutabaga turnips carry about 11 per cent of dry matter. Corn silage from thoroughly matured field corn will have nearly 19 per cent of dry matter, and silage from immature corn carries about 14 per cent dry matter. There have not been many digestion experiments made with rutabagas, but those that have been made show that rutabagas are considerably more digestible than silage made from the entire corn plant. Corn silage has about 70 per cent of its organic matter digestible and rutabagas have 91 per cent. About 55 per cent of the protein of corn silage is digestible while 80 per cent of the protein or rutabagas is digestible. Less than 75 per cent of the nitrogen-free extract (the soluble carbohydrates) of corn silage is digested while 95 per cent of the nitrogen-free extract of turnips is digested.

In the experiments carried on by the Maine Experiment Station it has been found as a result of seven trials that with Maine matured field corn there was an average yield of 11 tons per acre. This carried 4225 pounds of total dry matter of which 3075 pounds were digestible. With the much larger immature Southern corn grown in comparison, as a result of seven trials, the yields were 17 tons of silage per acre. This carried 5000 pounds of dry matter and 3250 pounds of digestible dry matter. Approximately 19 tons per acre of rutabagas grown at Highmoor Farm in 1914 carried about 4200 pounds of dry matter of which more than 3800 pounds were digestible, or considerably in excess of the digestible dry matter produced per acre in an average crop of silage corn. The 23½ tons of rutabagas grown at Mr. Washburn's farm in Perry carried two tons and a half of digestible dry matter or about a ton more per acre than was carried in the mature Maine field corn as found as the result of seven trials by this Station.

As stated at the beginning a ton of digestible dry matter can probably be grown cheaper per ton as corn than in the form of roots. The corn crop can be handled more completely by machinery and has many other advantages. But to the man who has late land, or to one who needs succulent food and has not a silo, or to one in a locality where corn does not thrive well, rutabagas furnish a large amount of succulent matter that can be cheaply grown and without an undue amount of hand labor.

"BLACK HEARTED" TURNIPS.

A very serious drawback to turnip culture in the southeastern part of Washington County is that under certain conditions they are "black hearted." This renders the turnip unfit for market, although apparently it does not affect its value as a stock food. So serious is the situation that some commission men in Boston and New York decline to handle "St. Andrews" turnips at all.

The County Demonstrator for the College of Agriculture in Washington County learned of these facts in 1913, and had specimens sent to the Maine Agricultural Experiment Station by Mr. Washburn of Perry. Mr. Washburn said that these particular turnips were grown upon a fertilizer composed of a ton of smoked herring skins, 400 pounds of bone black, and 300 pounds of muriate of potash per acre. Also that the weather conditions were too dry for the best results during June, July and August. He noted that the disease apparently attacked the turnips as soon as they began to form and was very noticeable when they became as large as eggs. He said that it did not increase in storage. Farmers in that vicinity had always grown the Purple Top rutabaga, they had not noticed that weather conditions at time of planting had any effect on the trouble, although many farmers thought it was worse in a dry season. If the turnips stop growing for a time the trouble almost invariably appears. Mr. Washburn thought there was a relation between the kind of fertilizer used and the turnip trouble. With barn manure and fish composted they would get good turnips. He had used fish pomace alone and raised a light crop of turnips but of excellent quality. The addition of bone black and sulphate or muriate of potash increased the amount of black heart. He sometimes had as high as 275 barrels per acre without a bushel of good ones in the lot.

The turnips sent to the Station were of perfect form outside, the skins were bright and smooth. When cut the flesh had large patches of a dull brown color. The discoloration extended out nearly to the skin. The flesh of many of the turnips was stringy. Careful examination by the plant pathologists showed that this black heart is not a disease in the sense that it is either produced by fungi or bacteria. It is apparently a physical condition arising from some factor or factors in the growth of the plants, which laboratory studies failed to disclose.

One of the objects of the demonstration experiment above described was to obtain light upon the nature and cause of black heart. The crops from these plots were all tested for black heart by cutting 100 turnips taken at random from each plot. The results of this examination are given in the three last columns of the table on page 55.

While very little was learned by the season's experience as to the cause of black heart, several theories which have been advanced have been explained. The fact that on some of the plots the turnips were all black hearted while on others they were nearly all perfect, proves that the trouble is not due to seasonal conditions, nor is it due to the seed used. It also bears out the statement of the plant pathologist that this is not a definite disease, for if it were all of the turnips in one row would hardly be perfect while those in the next row would be all black hearted. In the case of two rows growing side by side of different varieties one was all black hearted and the other entirely free from black heart.

The previous observations made by Mr. Washburn that he is "certain it is not the fish that gives the black hearted product" did not hold in 1914, for the plot manured with fish chum alone had all of the turnips black-hearted. It is not due to the chum alone, for the plot without chum (fertilized with tankage, mirate of soda, acid rock and muriate) had 65 per cent of the turnips black hearted. When grown on barn dressing alone 26 per cent were black hearted; when grown on barn dressing with the addition of chemicals 16 to 24 per cent were black hearted, on the three different plots.

Four plots, fertilized alike with stable manure plowed in and an application of nitrate of soda, acid phosphate, tankage and muriate, were planted with different varieties. Three varieties of rutabagas—Carter's Imperial, Skiwing's Purple Top and Golden Neckless—and a true turnip—White Egg—were grown. The Golden Neckless had a smaller yield than the other varieties but was entirely free from black heart. The crop from the Carter's Imperial had 18 per cent black hearted turnips, that from the Skiwing's Purple Top had 24 per cent black-hearted. The White Egg was 100 per cent black hearted.

There is little warrant in drawing very definite conclusions from this trial. It seems fairly clear that there is a difference in strains as to susceptibility to the trouble, for one variety grown was entirely free from black hearted roots. As the trouble has, so far as we can learn, never been reported elsewhere it evidently is not due primarily at any rate to seed and is perhaps somewhat climatic. The addition of stable manure materially reduced the percentage of black heart an all four plots. Stable manure carries many active ferments, bacteria, and fungi. These may be a factor in control. These trials suggest that a crop free from or with low per cent of black hearted roots is more likely to be obtained when farm manure is used. It is hoped to conduct further coöperative studies in 1915.

Are Sheep Profitable in Maine?

AN EXPERIMENT UNDERTAKEN AT HIGHMOOR FARM.

At the spring meeting of the Station Council the following facts were presented by the Director:

As is well known, the sheep industry in Maine, as well as the country over, has greatly diminished. Apparently the sheep industry in Maine reached its maximum in 1880, at which time there were in round numbers 565,000 sheep in the State. In 1890 this number had become reduced to 370,000 and in 1900 to 248,000, in 1910 to 125,000. Between 1910 and 1912 there has been a slight increase as the number of sheep reported by the State assessors, exclusive of lambs, for that year was about 134,000.

Attention was called to the facts:—that at Highmoor Farm there are about 100 acres in pasture at present unutilized; that there is barn room which with very small expense could be made to carry 150 sheep; and that there has never been permanent agriculture without animal husbandry anywhere in the world. The facts brought out in Bulletin 224 relative to the lack of profit in the sale of hay, because of the large amount of fertilizing material removed from the land in a hay crop, were referred to and it was also pointed out that Highmoor Farm now annually sells considerable hay.

Because of these facts the Council authorized the purchase of ordinary grade sheep sufficient to make the foundation for stocking Highmoor Farm, not for the purpose of a definite scientific experiment but to study the question as to whether sheep can or cannot be profitably raised in Maine. For this reason the sheep carried upon the farm are not of fancy type. They are not pure bred and, therefore, none of the animals can be sold at a fancy price. They are just plain sheep such as any ordinary farmer can carry. While care is exercised in handling the sheep no high priced labor is used. No special "shepherd" is employed.

As this experiment is not of sufficient scientific character to warrant its being carried out by any funds which are available to the Experiment Station for work of investigation it is necessary to keep distinct, separate accounts for every item of expense and of receipts. Consequently from the treasurer's books it will be possible at any moment to know whether the sheep are or are not paying.

The experiment was begun by placing upon the farm early in the summer of 1914 a flock of 75 grade Hampshire sheep with their lambs. The sheep were bred in the fall of 1914 to pure Hampshire sires. The whole matter is more of a demonstration experiment than of investigation, and is and will be handled chiefly with the purpose of ascertaining whether or not hay and pasturage can be profitably marketed through sheep. The further question as to how far sheep may be relied upon to maintain fertility upon Maine farms will be considered.

Only ordinary animals with ordinary care under ordinary conditions are being used. If this venture proves to be a profitable one it will be such that any man in the State can imitate if he wishes to do so. If, barring accidents, this venture does not prove to be a financial success it is doubtful if the Maine farmer would be justified in carrying ordinary sheep for ordinary market purposes upon his farm.

The two chief initial items of expense are for the sheep themselves and for the fencing of the pastures. Because of the irregular shape of the pastures at Highmoor Farm in order to enclose and properly divide the 100 acres, it was necessary to build nearly two miles of fence. As there are few sheep kept in the vicinity of Highmoor Farm, and as the laws of the

State permit dogs to run loose, it was thought necessary to make this fence as nearly dog proof as practicable. It is rather fine woven, extra heavy wire fence 58 inches high with a barbed wire on the inside top. Partly because of the difficulty of obtaining sufficient numbers of cedar posts at a reasonable price and partly because of the increased expense of setting wooden posts, steel posts were used. The corner posts were set by boring a hole with a soil auger and driving to the required depth. The cost of the material for the fence was greater than it would have been if wooden posts were used, but the cost for labor in building was less. Steel posts are also more readily driven in the spring if thrown up by frost.

While the first cost of this fence is quite large it is very durable. The fence should last with only slight care to drive down the line posts each spring longer than a stone wall will last. The fence is probably man proof as well as dog proof. If it does not prove the former a second barbed wire will be strung which will effectually stop anyone, even the most athletic, climbing over the fence without practically destroying his clothing and receiving serious injury from barbs. The barbed wire is on the inside of the fence and makes a lawful as well as effective highway fencee.

During the winter the sheep are being fed as follows: At 6 A. M. hay; at 10 A. M. roots (rutabagas) and apple (culls); at 2 P. M. straw with grain prepared as described below, and at 5 P. M. clover hay. They are given only what they will clean up. They are in pretty close feeding quarters which stimulates competition and makes for cleaner and better eating of the feed.

In the rotation that has been carried upon the farm there are quite large amounts of oat straw to be disposed of. There is only a small market, and at poor price, for oat straw. It is used not only in bedding the sheep but is made into a part of the daily ration. The straw is cut into short lengths by passing it through a small ensilage cutter (power driven). To each 12 bushels of the cut and dampened straw there is added a bushel and a half of grain mixture composed of equal parts corn meal, white middlings and linseed meal. The sheep clean up all but the coarsest of the mixture.

Preparing Land With Dynamite.

A great deal has been said about and considerable work has been done with dynamite as a means of loosening soil for crops. A trial was begun at Highmoor Farm in 1912. An acre and a half of land, the soil of which is fairly uniform that was in pasture and apparently had not been in crop for twenty-five or more years, was made free from stone, divided into three uniform plots of a half acre each, and treated as follows in September, 1912: One-half acre (A) was plowed and then sub-soil plowed. Another half acre, the middle one (B), was prepared by boring holes 30 to 36 inches deep a rod apart and discharging one-half pound stick of 20 per cent dynamite in each hole. The third plot (C) was plowed in the usual way. The plan is to leave the whole field to be treated alike each year to see if any difference could be noted in the resulting crops in the three methods of preparation.

The soil is the usual rather moderately heavy loam of Highmoor Farm which is underlain with a very difficultly penetrable sub-soil. In the spring of 1913 the whole field was plowed and the proper seed bed made for the planting of potatoes. The rate of seeding, use of fertilizers, time of planting, frequency of cultivation, and spraying to prevent blight, were all alike on all three of the plots. Careful records were made during growth and at the time of harvest. There were no appreciable differences in the crop on the three different plots. In 1914 the field was in corn. While there was not a uniform stand there were no differences that could be attributed to the method of preparation.

The field will be sown with oats and seeded to grass in 1915, but it is not likely that any differences whatever will appear. Notes will be made during the growing season and the yields will be measured at harvest.

Also in 1913 it was necessary to reset about 150 trees in the Baldwin orchard. Part of these trees were set in the usual way, by digging holes in the spring with a spade, thoroughly mixing the soil and setting out as commonly practiced by orchardists. Scattered over the orchard at varying points that seemed to be uniform and comparable with the others, the soil was loosened by the explosion of sticks of dynamite in the fall of 1912. The trees here were also set in the spring of 1913. There have only been two seasons of growth since these trees have been set, but there are no appreciable differences that can be attributed to the method of preparation of soil. The discharge of a half stick of dynamite at a depth of 30 inches loosened the soil horizontally for a distance of about 20 feet. No very great depth of disturbance could be traced below the level at which the sticks were placed.

Further trial was given in this particular soil to see if it was possible to take care of surplus water that in spring time accumulated in some parts of the Ben Davis orchard No. 1. For this purpose holes were bored in the fall of 1912 to the depth of about eight feet, and three sticks of dynamite discharged. In the spring of 1913 and 1914 there was no appreciable difference in the way in which these places that were treated with dynamite drained than in similar wet places which were not treated with dynamite.

In all of these cases the work was done by an expert in the use of dynamite sent out by one of the powder companies.

So far as the soil and soil conditions on Highmoor Farm are concerned it is doubtful if there is any advantage whatever in the use of dynamite in the preparation of soil.

Rotation Experiment.

POTATOES FOLLOWED BY POTATOES VERSUS CORN, FOLLOWED BY OATS AND GRASS.

There is a more or less widespread opinion that sweet corn is an exhaustive crop and not a good one to precede seeding down. In 1911, at the suggestion of the late Hon. Rutillus Alden, an experiment was begun upon Highmoor Farm to test the exhaustive effects of corn and potatoes in relation to land treated with chemical fertilizers and with organic manure. Four acres were selected in 1911 for the experiment. The whole field was planted to potatoes on chemical fertilizer that year, using 1,600 pounds per acre of a 4-8-7 goods. Green Mountain potatoes were used and the yield was practically uniform over the piece. The different treatments began in 1912. It will be noted that on plots A and B that only commercial fertilizer was used. On plots C and D 8 cords of well rotted farm manure, as well as 600 pounds 4-8-7 commercial fertilizer, were applied to each in 1912. On plots A and D potatoes were grown again in 1912, being a second crop in succession.

The experiment is somewhat unsatisfactory, partly because that in 1912 the yield of potatoes was small, due to the combined attack of Rhizoctonia and early blight. Also sweet corn has never been grown to advantage at Highmoor Farm. As noted, the crop in that year was small. 1912 had a dry summer which doubtless contributed to the reduced yield.

The results are given in the following tabulation. It will be noted that there is no special effect to be attributed to the sweet corn on the after crops, although the yield of sweet corn was materially less on commercial fertilizer than on the farm manure plus commercial fertilizer. The yield of hay in 1914 was greater on the plots that had farm manure in 1912.

Rotation Experiment. Treatment and Yields.
In 1911 Potatoes Grown on all Plots, Good Yields, 1,600 lbs. 4-8-7 Fertilizer Applied to Each Plot.

Year.	Fertilizer Used.	Yields.
	Plot A.	
1912	1700 lbs. 4-8-7 commercial fertilizer	89 bushels potatoes.
1913	500 lbs. 4-8-7 commercial fertilizer	54 bushels oats. 2225 lbs. straw.
1914	350 lbs. top dressing*	4725 lbs. hay.
	Plot B.	
1912	1700 lbs. 4-8-7 commercial fertilizer	2808 lbs. sweet corn ears. 3620 lbs. stalks.
1913	500 lbs. 4-8-7 commercial fertilizer	58 bushels oats. 2230 lbs. straw.
1914	350 lbs. top dressing*	4750 lbs. hay.
	Plot C.	
1912	8 cords farm manure 600 lbs. 4-8-7 commercial fertilizer	3482 lbs. sweet corn ears. 3385 lbs. stalks.
1913	500 lbs. 4-8-7 commercial fertilizer	59 bushels oats. 2475 lbs. straw.
1914	350 lbs. top dressing*	5000 lbs. hay.
	Plot D.	
1912	8 cords farm manure 600 lbs. 4-8-7 commercial fertilizer	87 bushels potatoes.
1913	500 lbs. 4-8-7 commercial fertilizer	54 bushels oats. 2120 lbs. straw.
1914	350 lbs. top dressing*	5065 lbs. hay.

*100 lbs. nitrate of soda, 150 lbs. acid phosphate and 100 lbs, muriate of potash.

BULLETIN 237.

SEX STUDIES. VII. ON THE ASSUMPTION OF MALE SECONDARY CHARACTERS BY A COW WITH CYSTIC DEGENERATION OF THE OVARIES.[1]

RAYMOND PEARL AND FRANK M. SURFACE.

Evidence regarding the relation between somatic secondary sexual characters and the primary sex organs, the gonads, is derived in the main from one or another of three sources, viz.:

1. Castration experiments.
2. Transplantation, or organ extract injection experiments.

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[1]Papers from the Biological Laboratory of the Maine Agricultural Experiment Station, No. 82.

This paper forms the seventh in a series of studies on various phases of the problems of sex determination and secondary sexual characters which have been published by the senior author and his associates during the past seven years. In accordance with a general policy of the laboratory it is proposed that, in the future, papers dealing with these problems shall appear under the general title "Sex Studies." The papers which have already appeared in this series, and which are now assigned numbers in the order of their appearance, in accordance with the above mentioned policy, are:

Sex Studies I. On the Relation of Race Crossing to the Sex Ratio. By Maud Dewitt Pearl and R. Pearl. Biol. Bul., Vol. XV, pp. 194-205, 1908.

II. A Case of Hypospadias in a Ram. By R. Pearl. American Vet. Rev., Vol. XL, No. 6, pp. 794-796, 1912.

III. The Interstitial Cells and Supposed Internal Secretion of the Chicken Testis. By A. M. Boring, Biol. Bul., Vol. XXIII, pp. 141-153, 1912.

IV. Fat Deposition in the Testis of the Domestic Fowl. By R. Pearl and A. M. Boring, Science, N. S., Vol. XXXVI, pp. 833-835, 1912.

V. Data on Sex Determination in Cattle. By R. Pearl and H. M. Parshley. Biol. Bul., Vol. XXIV, pp. 205-225, 1913.

VI. The Relative Time of Fertilization of the Ovum and the Sex Ratio Amongst Jews. By R. Pearl and Redcliffe N. Salaman. Amer. Anthropol., Vol. XV (N. S.), pp. 668-674, 1914.

3. Pathological and teratological cases (including hermaphroditism) in which some lesion or developmental abnormality of the gonads is accompanied by a change in the secondary characters.

The present paper is offered as a contribution to the data on this problem under the last category.

Description of Case.

A pure-bred registered Ayrshire cow, Dorothy of Orono (23010), bred and owned throughout her life by the University of Maine, had the following history. Her sire was Roderick Dhu (8590) and her dam Dorothy Alaska (14912), a cow showing no sexual abnormality or derangement of any kind. Dorothy of Orono was dropped October 19, 1906.

She proved a regular breeder in the earlier years of her adult life, as is shown by the following table.

TABLE 1.

Breeding Record of Dorothy of Orono.

Date of Birth of Calf.	Sex of calf.	Notes on Offspring.
1909, Sept. 17........	♂	Cross-bred calf sold as skinner.
1910, Sept. 10........	♀	Pure-bred Ayrshire heifer Dot Alaska (29353). Still owned by University of Maine. Has never shown any sex abnormalities.
1912, Feb. 24.........	♂	Cross-bred calf, sold as skinner.

When 3 years and 327 days old Dorothy of Orono was started on an official milk test of one year, which she completed with a record of 11463 lbs. of milk, carrying 417.71 lbs. of butter fat. For this record she was entered as No. 426 in the Ayrshire Advanced Registry.

Her complete lactation record is shown in Table 2.

TABLE 2.

Lactation Record of Dorothy of Orono.

Lactation Periods.	Days in milk.	Pounds of milk.	Pounds of fat.	Remarks.
Sept. 21, 1909–Aug. 4, 1910	316	7,840.6	293.62	
Sept. 11, 1910–Nov. 25, 1911	440	12,426.4	450.75	Lactation in which Advanced Registry record was made.
Feb. 26, 1912–March 24, 1913	391	7,016.8	253.92	Cow was sick for sometime during this period.

At this point begins the interesting part of the history. After March 24, 1913, the cow never gave any milk. The udder rapidly shrunk to a very small size and the animal began to show the external characteristics of a bull. This change was very slight at first but soon became much more marked. *After a lapse of 8 months the general external facies and the behavior of the cow were like those of a bull to a remarkable degree.* The neck had become thickened in its posterior parts, and had developed a well marked crest, as is characteristic of a bull. If the cow had been so screened that only her fore-quarters and neck were visible any observer would have unquestionably pronounced her a male. The assumption of male characters in these regions was complete and perfect. In the hind-quarters the change from characteristic female conformation in the male direction, while less striking than in the anterior parts, was still clearly evident. The udder shrunk away to a very small size. The hips and rump took on the smooth, rounded, filled-out appearance which is characteristic of the bull but not of the cow.

Altogether the assumption of male secondary characters was so distinct as to arrest at once the attention of all who saw her in the barn, including casual visitors who knew nothing of the history of the animal. It is extremely difficult to describe the change exactly, chiefly because the secondary sexual characters in cattle are so indefinite. Anyone acquainted with cattle can tell at a glance the sex of a mature animal from its general bodily conformation, without looking at the sex organs, but it is difficult to itemize the differences. Perhaps the crest in the male, and the associated development of hair on the dorsum of the neck and head is the most striking male secondary character. This character was very completely developed by the cow Dorothy of Orono. Unfortunately, owing to a misunderstanding, we have no photographs of the animal, showing the condition before and after the change.

The change in behavior of the animal was as striking as that in conformation, though not so easy of interpretation. Before considering this, it should first be noted that after the cow dropped her third calf on February 24, 1912, she was put to the bull and received service on the following dates, all in 1912: May 30, June 23, July 15, August 13, October 15, October 30, and November 16. On each of these occasions she showed some evidence of oestrum, but on the later dates in the series the manifestations were slight, and an increasing disinclination to take the bull became evident. After November 16, 1912, she never came again in heat up to the time she was killed (February 19, 1914), nor would she receive the bull.

During this time she showed the sex behavior of a bull, attempting copulation with the cows. At first this behavior was discriminatory, only those cows which were in heat being mounted. In fact this cow Dorothy of Orono was during this time used by the herdsman to test other cows for the presence of oestrum. Later all discrimination was lost and she would mount any cow within reach.

At no time did she show characteristic symptoms of nymphomania, unless the mounting of other cows be so interpreted. Such behavior ("bulling") is, to be sure, one of the manifestations of oestrum in many normal cows, and is sometimes observed in nymphomania.[2] Hess (quoted in Williams, *loc. cit.*, p. 174) says on this point: "In some cases of nymphomania, the affected animals attempt to mount neighboring cows, bulls, oxen, and even persons and continue to ride the former for a long interval; on the other hand they permit bulls and also other cows to mount them constantly." The difference between the latter type of behavior and the case here described is evident. Hess however says, farther on, that cases of nymphomania associated with cystic ovaries do occur, in which the individuals refuse to receive the bull, or to be mounted by other cows.

[2]Cf. Williams, W. L. Veterinary Obstetrics, Ithaca, 1909.

The whole question of the correct interpretation of abnormalities of sex behavior in cattle is a difficult one. There is a lack of precise information collected by competent behaviorists either in regard to the normal or the abnormal behavior. It is not at all impossible that all of the behavior which has been called nymphomania in cattle is really not the equivalent of the behavior so designated in women, but is rather an assumption, in greater or less degree, of the male sex behavior.

In any case great caution must be used in drawing conclusions regarding the relation between secondary sexual characters and primary sex organs from behavior data. Such data probably have but little, if any, critical value in this connection, because of the facts: (1) That the vicarious assumption in greater or less degree of the copulatory behavior of the other sex is of wide-spread and fairly frequent occurrence among higher vertebrates, particularly the domestic animals. (2) That such *changes* of behavior are as likely to be associated with an increased physiological tonus or activity of the gonads as with a decreased tonus or activity. Much current discussion of the problem of secondary sexual characters is extremely uncritical, in that it overlooks or disregards completely these facts, which are well known to students of the comparative psychology of sex and to those who, from long experience, are intimately familiar with the behavior of higher animals.

In the present case we are inclined to the view that the cow's sex behavior really changed to that of a male, coincidently with the physical changes already described. We would not, however, lay much stress upon the point for the reasons above indicated.

Injection of Pituitary Body (Anterior Lobe) Substance.

Before this cow was killed for autopsy it was thought desirable to determine whether by treatment of the animal with the substance of some endocrinal gland it might be possible to bring about a change in its sex behavior or in the external sex characters (udder, etc.). After careful consideration of the matter it was decided to try in this connection the substance of the anterior lobe of the pituitary body. The reason for this choice was the known connection between the pituitary body and the genital system. On this point Swale Vincent[3] says (loc. cit. p. 403): "A relation between pituitary and ovary is shown by the fact...............that in castrated women and animals there is frequently enlargement of the pituitary. Further after destructive diseases of the reproductive glands the pituitary reacts by hypertrophying." Also (p. 402) the same author calls attention to the fact that: "The pituitary during pregnancy resembles an epithelial tumor. The increase in amount of secretion is seen by the fact that one can squeeze a milky juice out of the gland. The hypertrophy persists to a certain degree, even after pregnancy, so that the weight of the gland in a multipara may be three times as great as that of a normal gland." Aschner[4] summarizes the more important results of his very thorough study of the physiology of the pituitary gland, so far as concerns the female genital organs in the following words (*loc. cit.* pp. 88 and 89).

"Hier finden sich bei erwachsenen Hunden leichte Degenerationserscheinungen an den Ovarialfollikeln und Abnahme des Fettes der interstitiellen Drüse in den ersten Wochen nach der Hypophysenexstirpation. Am Uterus sind kaum wesentliche Veränderungen nachweisbar, auch nicht im Sinne der Kastrations-atrophie. Das Auftreten der Brunst wird bei erwachsenen Tieren zwar nicht ganz gehemmt, aber doch deutlich abgeschwächt. Eine Gravidität kommt dabei niemals zustande. Eine bestehende Gravidität wird durch Hypophysenexstirpation unterbrochen.

"Bei jugendlichen Weibchen sind die Genitalveränderungen wieder sehr auffallende.

"Nach Exstirpation der Hypophyse in den ersten 3 Lebensmonaten zeigt sich ungefähr innerhalb der ersten 6 Wochen eine starke Abnahme der interstitiellen Drüse, fast bis zum Schwund derselben. Die Entwicklung der Ureier zu Follikeln wird bei den operierten Tieren um vieles verzögert, auch bleiben die Follikeln stets auffallend spärlicher als bei normalen Tieren.

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[3]Vincent, S. Internal Secretion and the Ductless Glands. London, 1912. An extensive bibliography is given in this work and it is not thought necessary here to cite earlier authorities in detail, since they can be found in Vincent's book.

[4]Aschner, B. Ueber die Funktion der Hypophyse, Pflüger's Arch. Bd. 146, pp. 1-146, 1912.

Eine vollständige Gleichwertigkeit der Keimdrüsen mit denen der normalen Tiere wird nie, auch nach vielen Monaten nicht erreicht.

"Alle diese trophischen Störungen werden in gleicher Weise durch die Exstirpation der ganzen Hypophyse ebenso wie durch die Exstirpation des Vorderlappens allein hervorgerufen.

"Der Hinterlappen der Hypophyse ruft diese Erscheinungen bei seinem Ausfall nicht hervor."

Goetsch and Cushing[5] have lately shown that the feeding of the dessicated extract of the anterior lobe of the hypophysis to young rats of both sexes "has a markedly stimulating effect upon the growth and development of the reproductive glands." This was evidenced both by the histological condition of the sex glands and the early and frequent breeding of the treated animals. Posterior lobe extract has no such effect.

Adler[6] has shown that in *Rana temporaria* and *Pelobates* larvae, hypophysectomy inhibits the development of the sex glands.

It seemed highly desirable, in view of the above mentioned results, to determine what effect the continued injection of anterior lobe substance would have in the case of this cow Dorothy of Orono, whose sexual functions were deranged in the manner already indicated.

As material for these experiments we used the dessicated powdered substance of the anterior lobe of the pituitary glands of cows. This material we obtained from the Organotherapeutic Department of Armour & Company in Chicago. The protocols of the experiment follow:

> November 25. Injected 1-2 gram of dessicated pituitary body anterior lobe mixed with 18 cc. 0.9 per cent. NaCl solution into the jugular vein at 10.30 A. M. No ill effects observed. Temperatures (Fahrenheit and rectal in all cases)—12 M., 101.4; 3 P. M., 101.8; 5 P. M., 101.8; morning of November 26, 101.4. (This was the second

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[5]Goetsch, E. and Cushing, H. The pars anterior and its relation to the reproductive glands. Proc. Soc. Exp. Biol. and Med., Vol. XI, pp. 26-27, 1913.

[6]Adler, L. Metamorphosenstudien an Batrachierlarven. I. Extirpation endokriner Drüsen. Arch. f. Entwickl., Bd. 39, pp. 21-45, 1914.

injection but in the first the syringe did not work well and only a few cc. were given).

December 1. Injected 1-2 gram of same powder mixed with 10 cc. of 0.9 per cent. NaCl solution at 10.30 A. M. Temperatures:—11 A. M., 102.0; 1.30 P. M., 101.2; 3.40 P. M., 101.0; 5.30 P. M., 100.4; December 2, 8.30 A. M., 101.6.

December 5. Injected 1-2 gram of same powder in 15 cc. NaCl solution subcutaneously at 11.15 A. M. Cow seemed to show some rumbling or difficulty in breathing when we came to inject her. For this reason we used subcutaneous route. Temperature just before injection, 11.15 A. M., 102.1; 12 N., 102.5; 2 P. M., 102.1; 5 P. M., 102.1.

December 9. Injected same dose subcutaneously at 11.30 A. M.

December 10. Same dose subcutaneously at 11.15 A. M.

December 11. Same dose intravenously at 10.20 A. M.

December 15. Injected 3-4 gram powder in 18 cc. 0.9 per cent. NaCl solution subcutaneously at 10.30 A. M.

December 16. Injected 3-4 gram in 22 cc. 0.9 per cent. NaCl solution; about half injected intravenously and half subcutaneously.

At this point the injections were stopped since the results had been absolutely negative so far as concerned the sexual functions of the cow. Of course the period included was too short for any structural changes in secondary sexual characters to have appeared. On the other hand, it was a sufficiently long period for any effect on the abnormal sex-behavior, the udder, or the external genitals to have appeared. There was not the slightest change in any of these respects, either during or after the period of the injections.

Post-mortem Examination.

On February 18, 1914, the cow was slaughtered. She was in good flesh and all the viscera were normal with the exception of the genital organs. The ovaries both showed extensive cystic degeneration (cf. figs. 4A and 4B). The whole ovary in each case was a mass of cysts of varying sizes. The walls of the cysts were made up of fibrous connective tissue and were very tough and resistant to rupture. The uterus and tubes were very small, practically in infantile condition. The ovaries, slit open to show the cysts, together with the ovaries of a normal cow are shown in figs. 3 and 4. The cystic ovaries showed no corpora lutea recognizable as such. The case is clearly one of multiple cystic degeneration of the ovaries.

HISTOLOGICAL AND CYTOLOGICAL DATA.

At the time of autopsy the ovaries of this cow were split in halves longitudinally and immediately fixed in McClendon's[7] fluid. At the same time the ovaries from a normal cow of about the same age as the one here under discussion were removed and fixed in the same fluid for comparison. Subsequently this material was sectioned by Dr. Maynie R. Curtis and stained in various ways.

The outcome of the study of this material is interesting from several standpoints, but particularly so in relation to the problem of secondary sex characters and the gonads. For it appears, after very careful study of the material, that *histologically and cytologically these cystic ovaries differ from the normal cow ovary in but one essential respect, namely that they have not corpora lutea.* The absence of lutear substance arises from the fact that ovulation does not occur. The oöcytes start their development in a perfectly normal way in the cystic ovary (figs. 5, 9, and 10). But after the follicle has reached the size at which it normally breaks and discharges its ovum, it still keeps on growing in the cystic ovary. Either through some physiological abnormality in the follicular epithelium which affects its secretory powers, or through some change in the permeability of the follicular walls, it results that the liquor folliculi keeps increasing in amount and the follicle does not rupture. Since no ovum is discharged, no corpus luteum can be

[7]McClendon, J. F. Preparation of Material for Histology and Embryology, etc. Anat. Rec. Vol. VII, pp. 51-61, 1912.

formed. The study of this case leads to exactly the same conclusions regarding ovarian physiology as those of Meyer[8].

Specifically the findings are as follows. The surface or germinal epithelium of the ovary is entirely normal, and agrees with the description and figures of Schmaltz[9] (*loc. cit.*) This is shown in fig. 5. Under this is seen the fibrous connective tissue layer, poor in cells, as in the normal cow ovary (the Schleimhautkörper of Schmaltz). Beneath this is the zona follicularis, with as many, and entirely similar follicles, as the normal ovary. A young oöcyte in which there has been no proliferation of follicle cells, or formation of liquor folliculi is shown in fig. 10. Fig. 9 shows an older oöcyte, in which the liquor folliculi is forming. These are entirely normal.

Interstitial cells in equal number, and with precisely the same cytological characteristics as in the normal ovary, are found in this cystic ovary. Two of these cells in one field of a 1-12 immersion objective are shown in fig. 6. As there is no detailed description of the interstitial cells of the cow's ovary in the literature, and as the technique we have used differentiates these cells with extraordinary clearness it seems desirable to describe them with some particularity. This description is equally applicable to the interstitial cells of the cystic ovary and those of a normal ovary, since these cells are absolutely indistinguishable in the two cases.

The interstitial cells are larger than the surrounding connective tissue cells of the ovarian stroma. Their outline, which is always clean-cut and definite, varies with the degree of crowding to which they are subjected from neighboring cells. They are usually rounded in outline but may be considerably elongated in one direction, leading to something approaching a spindle shape. Their large size, as compared with the non-secreting stroma cells, is due almost entirely to the size of the cell body and not to the nucleus. The nuclei of the interstitial cells are of the same order of magnitude as those of the surrounding connective tissue cells. These interstitial cells are found in all

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[8]Meyer, R. Ueber die Bezeihung der Eizelle und das befruchteten Eies zum Follikelapparat, sowie des Corpus luteum zur Menstruation. Arch. f. Gynaek., Bd. 100, pp. 1-19, 1913.

[9]Schmaltz, R. Die Struktur der Geschlechtsorgane der Haussäugetiere mit anatomischen Bemerkungen. Berlin (Parey), 1911.

parts of the ovary, but more numerously in the neighborhood of follicles and blood vessels. A study of free-hand sections stained with Sudan III, as used by Schaeffer[10] in her comparative studies on the secretory interstitial tissue of the ovary, shows precisely the same general distribution of this tissue in the normal and the cystic ovary.

The most striking thing about the interstitial cells, when they are properly differentiated by the stain, is the mass of granules of secretion which they contain (cf. figs. 6, 7, and 8). Some of the cells are so loaded with these granules that nothing else can be seen. The nucleus is completely covered. From this condition every gradation may be found to the other extreme when the cell is entirely empty of secretion granules.

For the precise definition of these cells we have found nothing equal to Kresylechtviolett[11], following the formalin fixation of McClendon's fluid. The stain should be differentiated in alcohol, to a point where the nuclei have nearly lost all contrast, and have practically the same pale blue as the cytoplasm of the connective tissue cells. Then it will be found that the granules of secretion in the interstitial cells are stained sharply and intensely purple. The contrast, when the staining is properly done, between the ordinary connective tissue and other cells of the stroma, and the interstitial cells with their granules of secretion, is extreme.

Returning to the general consideration of the histology of the cystic ovaries in this case, it may be pointed out that, while, after the pathological condition intervened, evidently any follicles which got well started on the road to development went on and formed cysts, yet in the body of the ovary are to be found the characteristic remains of earlier follicles, just as in a normal ovary. One of these old atretic follicles is shown in fig. 5 at *x*.

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[10]Schaeffer, A. Vergleichend histologische Untersuchungen über die interstitielle Eierstocksdrüse. Arch. f. Gynaek., Bd. XCIV, pp. 491-541, 1911. 2 Pl.

[11]Morse, R. L. Kresylechtviolett. Jour. Appl. Micros., Vol. 4, pp. 1492-1494, 1901.

Discussion.

The case described in the preceding pages presents for consideration certain definite and clear-cut results bearing on the problem of secondary sex characters. These are:

1. This cow had been a perfectly normal female and had performed all the reproductive functions, both primary and secondary, of that sex.

2. It later assumed certain of the secondary characters of the male, both in respect of structure and behavior, with perfect definiteness, and, so far as the characters concerned go, completeness. This change was, for example, at least as complete and definite as any of those described by Steinach[12] following castration and transplantation of gonads.

3. The gonads of this animal, examined subsequent to the change in secondary characters, were exactly like those of a normal cow, save in the one respect that the follicles were not breaking and discharging ova, but were forming follicular cysts or becoming atretic, and because of this no corpora lutea were formed.

a. The interstitial secreting mechanism of these ovaries was absolutely normal, both in respect of number of cells, and the cytological characteristics of the individual cells.

b. The germinal mechanism was perfectly normal up to the point where ovulation should occur. Then it failed to separate the ova from the ovary.

c. The outstanding, and so far as we can determine the only significant, anatomical and physiological difference between the gonads of this abnormal cow and those of a normal one, consists in the fact that the former lacked any lutear tissue.

From the above facts it appears clear at once that in this case the change in the secondary sex characters cannot with any degree of plausibility be attributed to any activity (or failure of activity) of the interstitial cells. On the other hand, the suggestion is evident that the change is associated with

[12]Steinach, E. Willkürlich Umwandlung von Saügetiermännchen in Tiere mit ausgeprägt weiblichen Geschlechtscharakteren und weiblicher Psyche. Pflüger's Arch., Bd. 144, pp. 71-108, 1912.

the absence of lutear tissue. This cow probably ovulated for the last time about November 16, 1912 (see page 69 *supra*). At least she ceased at that time to show signs of oestrum, which in the cow are associated with ovulation. By the following summer, supposing ovulation to have stopped at the date suggested, lutear tissue in the ovary would either have entirely disappeared or been reduced to a very small amount. But it was at this time (summer of 1913) that the cow began visibly to take on the secondary characters of the male. On the whole, the evidence seems as complete as it is possible to make it from observational data (in the absence of experimental) that the absence of lutear substance in the ovaries was causally connected with the assumption of male secondary characters. It is greatly to be regretted that this cow was not injected with corpus luteum instead of pituitary body substance.

The view above outlined suggests that the corpus luteum is one of the chief active ovarian agents in mammals in maintaining the "femaleness" of the individual, in addition to its other functions of inhibiting ovulation, etc. There is a good deal of evidence that such is in fact the case.

One line of evidence of this sort is furnished by the clinical data following administration of corpus luteum material in one form or another in cases of arrested sexual development in the female. It is not the place here to review this literature in detail. One very clear-cut and definite case may be cited, however. This case, from the standpoint of the biologist, is particularly favorable and pertinent in the present connection, since it is free from any associated pathological disturbances which so frequently make the interpretation, from a theoretical standpoint, of clinical data very difficult or impossible.

The case referred to is one reported by Elliott[13]. The essential facts are as follows: I have italicized the parts of particular interest from the present standpoint.

"Patient. Mrs. M., white, aged 27, married *five* years, has never been pregnant, and is anxious to have a child.

"Examination. General condition good, muscular, not fat; *figure* like that of a boy of 18; narrow hips, undeveloped

[13]Elliott, H. R. A Case of Infantile Uterus and Appendages with Result of Treatment. Jour. Amer. Med. Assoc., Vol. LXII, pp. 1085-1086, 1914.

breasts. Heart and lungs normal. *Uterus* about size of English walnut, *ovaries,* not palpable. (Has been examined by gynecologist who told her she could never have a child). Pelvis normal. Has had *menstrual* show of a few drops three or four times during her life. Epistaxis very free at times. *Sexual* feeling very slight, if at all, and only very seldom. Several members of family have had menstrual disorders, but none of this type.

"Treatment and Result. April 6, 1912: Patient was put on extract of luteum tablets, one three times daily for a week, two three times daily for another week, then returning to the first dosage. Some uterine massage was given."

"On May 20, 1912, menses appeared for a day. Patient had sensation of approaching menses in June, but only a pink show. She had a mild epistaxis. General condition is good; she seems to be rounding out. Becoming discouraged, patient abandoned treatment.

"Extract of luteum treatment was advised and started again in September, 1912. Uterus seems larger and cervix longer than in June. Last part of October patient had slight menstrual show, first time since June.

"Nov. 3, 1912: Patient noticed more sexual feeling last month.

"Nov. 25, 1912: No menses since show in October. Patient very much stouter, breasts enlarged, uterus larger, cervix longer. *Pregnancy* suspected and cautions given.

"Jan. 24, 1913: *Uterus* much larger, size of large pear, cervix long and firm. *Breasts* much larger, hips larger; general appearance of woman's *figure* instead of boy's. Side view. prominent above pubes, as in three and a half to four months' pregnancy."

At 6 P. M. on July 2, 1913, the patient was delivered normally of a male child.

In this case we have at the outstart an infantile condition of the uterus and essentially an indifferent condition of the secondary sex characters. Following the lutear medication there was a marked change to the distinctively female condition.

The data presented in this paper support very clearly the conclusion which has been reached by Below[14], Frank[15] and others, that there is a sharp distinction between the secretions of corpus luteum and interstitial cells in respect of their effect upon the organism. That the interstitial cells had nothing to do with the secondary sex characters in this case seems entirely clear.

SUMMARY.

This paper describes the reproductive history of a cow, which presents the following points of interest:

1. The cow was initially a perfect female, bearing calves and making a very high milk record.

2. Later she failed to come in heat, and gradually, but in the end to a very marked degree, took on male secondary sex characteristics, both in behavior and structure.

3. The gonads of this animal, examined subsequent to the change in secondary characters, were exactly like those of a normal cow, save in the one respect that the follicles were not breaking and discharging ova, but were forming follicular cysts, or becoming atretic, and because of this no corpora lutea were formed. The interstitial secreting mechanism of these ovaries was absolutely normal, both in respect of number of cells, and the cytological characteristics of the individual cells.

4. The evidence from this case strongly suggests that one function of the corpus luteum, through its internal secretion, is to maintain in full development the female secondary sex characters.

5. Repeated injections of a suspension of the dessicated substance of the anterior lobe of the pituitary body failed to bring about any change in the sex behavior of this cow after it had assumed a male character.

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[14]Below, N. A. Glandula lutea und Ovarium in ihrem Verhalten zu den normalen physiologischen und pathologischen Vorgängen im weiblichen Organismus. Monatschr. f. Geburtsh. u. Gynaek., Bd. XXXVI, pp. 679-696, 1912.

[15]Frank, R. T. The Functions of the Ovary, Surg., Gynaec., and Obst., Vol. XIII, pp. 3-53, 1911.

DESCRIPTION OF FIGURES.

Figs. 3A and 3B. Photographs of normal ovaries of a healthy cow about 6 years old. Note in fig. 3A the large freshly formed corpus luteum on the right. A smaller, involuting corpus luteum is seen at the same level to the left in fig. 3A. In both figs. 3A and B very small, far-regressed corpora lutea can be seen scattered at various points on the ovary. (Slightly reduced below natural size).

Figs. 4A and 4B. Photographs of cystic ovaries of the cow Dorothy of Orono. In both cases the ovary has been slit longitudinally and opened out in order to show the size and distribution of the cysts. No corpora lutea are visible nor were any to be seen on any part of these ovaries. (Relative reduction as in Figs. 3A and B).

Fig. 5. Low power photomicrograph of a section through one of the cystic ovaries of Dorothy of Orono. This shows at the top a normal germinal epithelium and below it the fibrous connective tissue layer (Schleimhautkörper); below this is the zona follicularis showing numerous follicles in various stages of development. At the left at the level indicated by *x* is seen an old atretic follicle scar of entirely normal appearance (x 35).

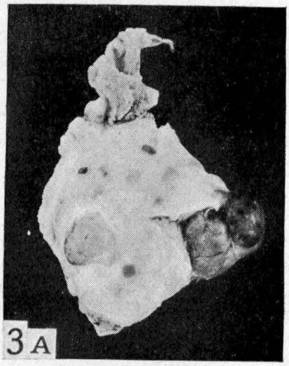
Fig. 6. Photomicrograph of a section of cystic ovary showing normal interstitial cells loaded with secretion at *a*. (x 710).

Fig. 7. Camera lucida drawing of a normal interstitial cell from the cystic ovary. This figure shows the large, plump cell body and distinct outline. Granules of secretion are scattered through the cytoplasm. This cell contains relatively few of these granules of secretion, and is to be contrasted in this particular with cells like those shown in Fig. 6 or Fig. 8. (x 2835).

Fig. 8. Camera lucida, drawing of a normal interstitial cell from a cystic ovary. This cell shows in comparison with Fig. 7, the elongated, somewhat spindle-shape of the cell body due to pressure of surrounding cells, and the extreme condition of loading of the cell-body with granules of secretion. The lighter area in the lower part of the cell indicates the position of the nucleus, the outline of which, however, cannot be seen because of the secretion granules. (x 2835).

Fig. 9. Photomicrograph of a normal Graafian follicle from cystic ovary. This follicle is quite far advanced in its development, the liquor folliculi already filling nearly a half of the follicle. (x 89).

Fig. 10. Photomicrograph showing a normal very young Graafian follicle from cystic ovary. In this case the cell body of the primitive oöcyte completely fills the Graafian follicle. There has been no formation of liquor folliculi, nor proliferation of the follicular epithelial cells. A single row of nuclei of these follicular cells may be seen surrounding the oöcyte. (x 710).



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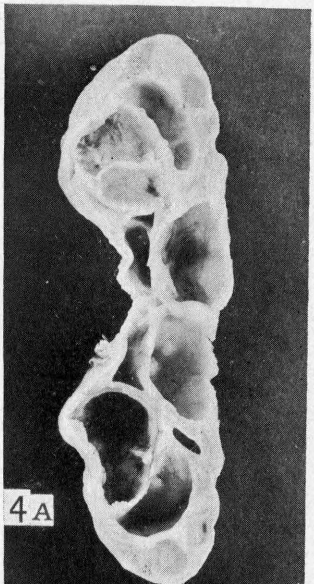

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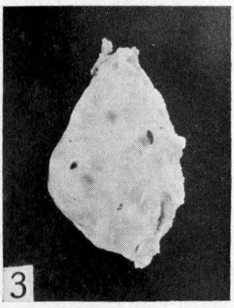

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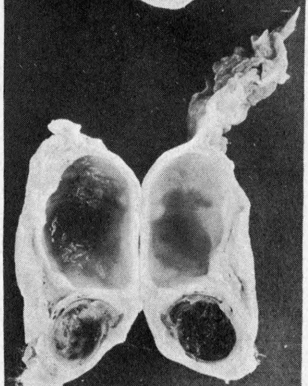

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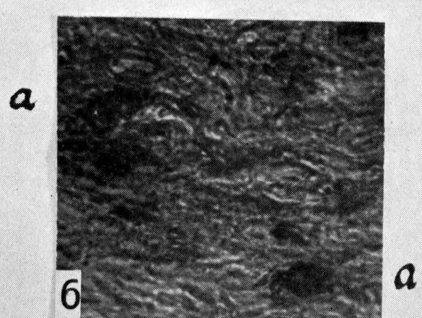
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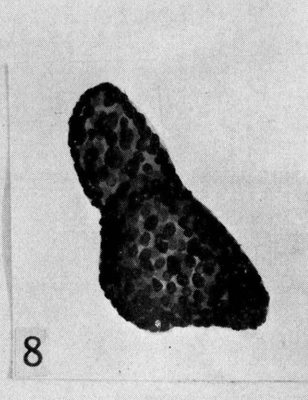
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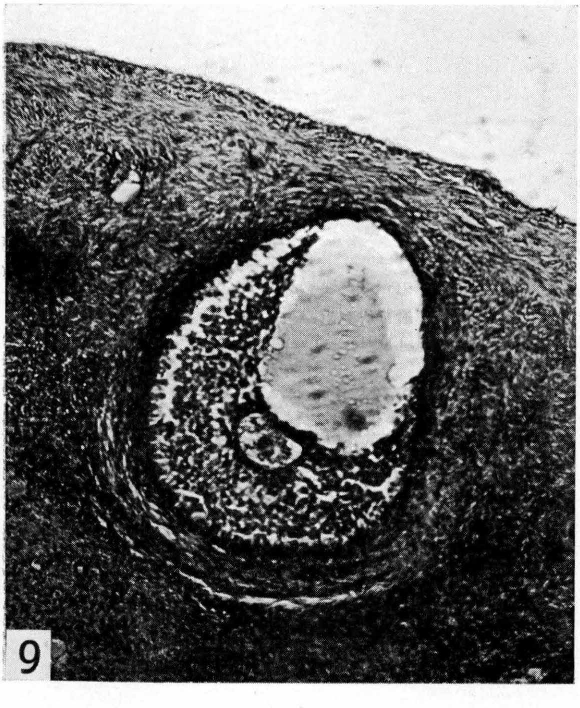
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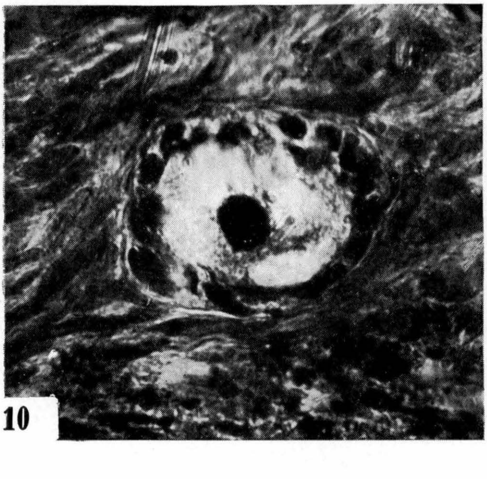
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BULLETIN 238.

LEAFHOPPERS OF MAINE.*

HERBERT OSBORN, CONSULTING ENTOMOLOGIST.

Introductory.

The insects known as leafhoppers are technically included in the group *Jassoidea* but frequently the term is made to include the froghoppers, *Cercopidae,* and some of the *Fulgoridae,* the minute grass feeding species being very similar in habit.

While this report deals mainly with the leafhoppers proper it has seemed worth while to include some mention of the related forms and while less effort has been given to their collection it will be seen that some of the species on account of their abundance and attack on cultivated plants are not to be overlooked in any careful study of this general group of plant feeders and their relation to useful plants.

The principal economic importance rests on their attacks upon such farm crops as oats, timothy, wheat and the various cereal and forage crops, on fruits of various kinds and upon forest and shade trees their occurrence in this connection being very general indeed.

No previous systematic or comprehensive study of the Maine species of this group has been published and but few scattering records of species occur in the references to the Maine fauna, apparently very few specialists having collected here for this group. The Van Duzee catalogue includes a number of species credited as occurring in the state or with the general statement Maine to California, but very few specific citations. My own collection includes a number of species collected by Mr. O. O. Stover who at one time proposed to publish a list of the Maine

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*Papers from the Maine Agricultural Experiment Station: Entomology No. 78.

species but this seems never to have been completed. I have also seen a number collected by Mr. H. G. Barber.

No specimens of Mr. Stover's collecting are preserved so far as I learn at the Maine Station and the species deposited here consisted of a small series determined by Mr. Van Duzee.

While the present list cannot be considered as complete it is probable that most of the more common species and a good proportion of the rarer forms have been secured and certainly most of the species of present or probable future economic importance have been noted.

As compared with the New York list of 175 species it seems somewhat small, but many of the more southern forms of southern New York disappear, while the Adirondacks present many of the boreal species. Furthermore the New York list has been the result of many years of work and includes the results of such specialists as Fitch and Van Duzee.

The leafhoppers affecting the cereal and forage crops constitute a very constant factor and the extent of the drain on such crops is doubtless very much greater than is appreciated. In some estimates made by the writer these insects were taken in grass land at the rate of one and a half to two millions to the acre and in many instances recorded grain fields have been very badly injured. (See Bul. 108 Bur. Ent. U. S. Dept. Ag.) It may be stated that no such serious devastations have been noted so far in Maine but meadows and grass lands have shown their presence in large numbers and of several species. Those most in evidence have been *Cicadula 6-notata, Deltocephalus inimicus,* Say, and *configuratus* Uhl., *Acocephalus striatus, Draeculacephala mollipes, angulifera,* and *noveboracensis* these being discussed somewhat in detail in later pages. The drain from these species while generally overlooked is certainly of economic importance.

The species affecting fruit and garden crops are more commonly noticed as for some of the species the damage is very apparent. This is especially true of the grape leafhopper, *Typhlocyba comes,* which causes the whitening and withering of the leaves and the apple leafhopper, *Empoasca mali,* which affects not only apple but quite commonly such crops as potatoes, beans and other garden crops. This species is common and widely distributed in Maine and under favorable conditions for increase might become a very troublesome pest.

The species affecting forest trees, while a very great number and having a very wide distribution over different kinds of forest trees, are still so widely scattered that it is difficult to suggest any methods by which their numbers may be controlled. Probably nearly every species of forest trees is subject to the attack of some kinds of the leafhoppers and certain species such as the birch, pine, willow, etc., are affected by a number of different kinds which in some cases have become so abundant as to cause serious injury and no doubt are a constant drain upon the growth of the trees. While they do not cause an immediate destruction of the trees it is easy to see that such a drain going on constantly year after year during the period of growth must affect the rate of wood formation and consequently provide a distinct factor in retarding the growth of the forest crop.

This is perhaps at present a somewhat negligible factor because of present methods of the lumbering or forest management as there is possibly a much greater loss from wasteful methods of cutting or from forest fires than can be charged to these insects. However, this should be counted as one factor in the successful growth of a forest crop and it is desirable that the species be known and the particular plants that they affect should be determined and that their life history and habits shall be determined as a basis for any possible general measures that may be suggested from such definite knowledge.

For park and shade trees the problem is somewhat different and there are many cases where direct treatment may be available for the control of the injurious forms. Among the most noticeable ones are the various species of *Oncopsis* affecting the birch, this tree apparently being the favored food plant for a number of different kinds. Often these swarm in large numbers and it is hardly possible to beat any individual birch tree during the proper season without securing specimens of these species.

The conifers are affected by several different forms but the more distinctive ones belong to a related family, the *Cercopidae,* and certain of these species, (*Aphrophora*) occasionally occur in such great abundance that the growth of the trees must be very seriously retarded. Moreover, the punctures which they cause may very likely serve as the points of entrance for various fungus diseases, blights, etc., so that the destructive possibilities are much more serious.

The willows are also very generally infested by several species of *Idiocerus, Pediopsis, Empoasca,* and *Scaphoideus* occurring on these and some of them being restricted very closely to the willow family and in some cases depending upon particular species of this family for their subsistence. While these trees are at present of rather small commercial value their possible value for the making of paper pulp is likely to bring them into importance in the future.

The common alders also support a number of distinct forms of leafhoppers and while the value of this plant is of minor importance as furnishing any particular product, the common occurrence of the clumps and their distinct place in the landscape renders them of no small account.

METHODS OF CONTROL.

There are certain methods of control that may be applied to the various kinds of leafhoppers and a general statement of these may serve to avoid repetition for each species. These methods vary of course for the different groups and may also be affected by local conditions or special methods of cultivation. that may be in vogue for certain crops or for certain localities.

Crop rotation is one of the general measures that is of service here as for many other insects and it may be assumed that the general practice of rotation in connection with a number of the field crops is a probable reason that the leafhoppers are no more injurious to such crops as oats and potatoes.

Clean culture is also to be credited with the reduction of numbers for many species, especially those which develop upon annual plants and migrate to adjacent fields. The careful attention to destruction of such weeds as fox-tail, witch-grass, crab-grass, etc., must have a decided effect on the abundance of the species that work readily on timothy and other pasture or meadow grasses.

Mowing is a measure that may be resorted to for the reduction of meadow species but its greatest usefulness must depend on timing the cutting to the period of greatest abundance of eggs or of very young larvae.

Burning is a most effective method of treatment for many species if the character of the crop permits. It is especially applicable to grass lands which are in condition to be burned over in late fall or early spring as at such times not only the eggs occurring in grass leaves but any hibernating forms are pretty certain to be reached. Observations by Mr. Woods on the burned over tracts of blueberry indicate quite strongly that the method serves a very excellent purpose in reducing the numbers of these insects as well as in other benefits to the crop. A further study of this matter however is needed to establish the extent and duration of the effect for this particular crop.

Spraying—In some instances the use of sprays may be resorted to but the ffect of such treatment has not been thoroughly tested as yet. With modern machinery for spraying it is entirely possible to cover pastures or meadows of ordinary size with a spray of kerosene emulsion or other insecticides and if such an application is made early in the season, at the time to catch the bulk of the newly hatched larvae, the result should be of great advantage. For this purpose a machine with a spread of ten or fifteen feet including a number of nozzles capable of giving a broad-cast spray, accompanied by some device for disturbing the hoppers so that they will jump from the grass and be wet by the spray, should be most effective. Experiments with this method are desirable in order to determine the most effective arrangement of machinery and the expense involved.

The hopper dozer method consists in the use of a strip of sheet iron, ten or fifteen feet in length, coated with coal tar drawn over the surface of the grass land with about the rate of a rapid walk. Its operation depends on the fact that the hoppers when disturbed jump up a few inches from the grass and this means that they will usually fall back upon the tar surface, and be caught. In some experiments of this kind leaf hoppers were caught at the rate of over half a million to the acre. And while some individuals escape it is believed that a large portion may be caught by this method. Various arrangements of the sticky surface may be used and tree tanglefoot would doubtless be as effective as coal tar.

For the species that affect forest trees it is of course impossible to make any direct application and there seems to be little opportunity to use measures of control. It seems possible, however, that when timber is being cut that a little attention to the disposition of branches and twigs, which may include the eggs of these insects, would have some effect in reducing the numbers. If these are cut at the time when eggs are included and simply left scattered in the forest the larvae are hatched, are likely to secure sufficient food to develop, and then be scattered on standing timber that is left and of course cause a greater amount of damage than where the forest has been untouched.

CLASSIFICATION,

As an aid in the recognition of the different kinds of leafhoppers it will be desirable to include certain keys and brief descriptions of the species and it may be remarked that the members of this group are to be recognized generally by their minute size, none of the species reaching more than one-half inch in length and the great majority being from one-eighth to one-fourth inch long and usually rather slender with delicate wings. They rest usually with the legs drawn up well to the front part of the body and in position for immediate jumping and, when disturbed, they give strong leaps which may carry them for several feet or enable them to take wing and travel readily for some distance. The species that are common in grasses and low herbage will be generally recognized by the sudden jumping and short flight when they are disturbed and in some instances, where they occur in considerable numbers, their presence will be noticed, when walking through a meadow or pasture, as there is a distinct swarm of these insects rising as one passes along.

These leafhoppers are to be distinguished from the froghoppers, *Cercopidae* by the structure of the hind tibiæ, these being slender, prismatic in section with two series of small spines along the border while in the *Cercopidae* there are two or three spines along the tibia but a wide circlet or crown of spines at the tip.

Key to the Families of Jassoidea.

A. Elytral nervures forking on the disk
- b. Ocelli located on the disk of the vertex *Tettigoniellidae*
- bb. Ocelli located on border of vertex or between vertex and front *Jassidae*
- bbb. Ocelli located on front distinctly below border of vertex *Bythoscopidae*

AA. Elytral nervures forking at base and running to apex of elytra, ocelli usually wanting *Typhlocybidae*

Key to the Genera of Bythoscopidae.

A. Antennae inserted in a deep cavity beneath a ledge.
- b. Striation of pronotum transverse.
  - c. Side margins of pronotum sharply keeled, of moderate length. *Macropsis.*
  - cc. Side margins of pronotum not sharply keeled very short. *Oncopsis.*
- bb. Striation of pronotum running obliquely from the middle of its front margin to its hinder angles. *Pediopsis.*

AA. Antennae inserted in a feeble cavity, their base free.
- b. Head with eyes wider than the elytra at the base, membrane with an appendix. *Idiocerus.*
- bb. Head with eyes as wide as the elytra at base, no appendix. *Agallia*

Oncopsis pruni Prov.

Bythoscopus pruni Provancher Pet. Faune Canad. III 290, 1890.

Bythoscopus pruni Van Duzee Entom. Amer. VI, 227, 1890.

A little smaller than *fenestratus* and generally darker, the elytra hyaline with veins black, these being accentuated on the cross nerves so as to form irregular cross bands and an apical band or spot. Length 4 to 4.5 mm.

This appears to be one of the most common and widely distributed species in the state. While described as from the plum and occasionally taken on various plants including blueberry, poplar, etc., our collections show it to occur very generally on birch and all other collections seem to be in association with this tree so I believe this may be considered the usual food plant for the larval form. At Orono it has been taken on many dates from June 5th to August 6th mostly on birch. At N. Harpswell Aug. 12; Highmoor Farm Aug. 15th on birch and blueberry at Mt. Katahdin Aug. 20-21st up to table land 4500 ft. elevation, at the latter place probably from willow as no birches were seen. Specimens in the Boston Society of Natural History are from Calais.

The species may be considered as covering in its distribution the birch forests of the state and it must undoubtedly be counted an economic factor in the growth of this timber tree. The insect acquires its growth in the early part of the summer and mainly disappears by the middle of August.

Oncopsis fenestratus Fitch

Athysanus fenestratus Fitch Homop. N. Y. State Cab. p. 60, 1851
Bythoscopus fenestratus Van Duzee Entom. Amer. VI 226, 1890.

Grayish brown with whitish hyaline spots on the elytra and dark patch on the front. About 4.5 to 5 mm in length.

This species has been taken in considerable numbers chiefly from birch but specimens referred here are from willows also, though birch would seem to be the main food plant and the one on which it would have the most importance. On Mt. Katahdin it was found at various altitudes and one specimen evidently belonging here was collected near the summit, 4,500 ft. probably from the scrub willows.

Oncopsis minor Fitch.

Bythoscopus minor Fitch Homop. State Cab. p. 60, 1851.
Bythoscopus minor Van Duzee Entom. Amer. VI 228, 1890.

Specimens referred here resemble *fenestratus* but are smaller and agree well with Van Duzee's description. They are gray brown, the elytra in the female almost entirely hyaline and in the male clouded with tawny brown. Length 4 mm.

Larvae taken in association with males on birch June 11, 1913, and probably belonging to this species are uniformly brown.

Oncopsis variabilis Fitch.

Athysanus variabilis Fitch. Homop. N. Y. State Cab. 1851, p. 60; reprinted in Lintner 9th Rep't 1893, p. 400.

An extremely variable species occurring abundantly during spring and early summer on birches. A common variety is sulphur yellow with more or less of black on the elytra most commonly as a line or stripe along the claval suture. Length 5-6 mm.

Our collections represent Orono, particularly June 3 to Aug. 6, as the species does not persist through the summer and it had disappeared by the time our collections were extended to other parts of the state. I have a record for Mt. Katahdin (H. G. Barber) and specimen in Boston Soc. N. H. are from Calais and Eastport (C. W. Johnson). It must occur over a large part of the state and its attacks on the birch must be a source of injury.

Oncopsis sobrius, Walk.

Bythoscopus sobrius Walk. Homop. 1851. 3 : 874; Fitch, reprinted in Lintner, 9th Rep't. 1893, p. 400; N. Y. State Agricultural Soc. Trans. 1858. 18 : 853.

This species is light colored the head, pronotum and scutellum yellow and the elytra light tawny. The front is full and with vertex and pronotum forms an almost globular front end. Length 4-5 mm.

Very abundant, particularly on birches, but has been taken on ferns and other roadside plants and on oaks but always near birch which is doubtless the normal food plant for the larva. Records for Orono on June 3 and Aug. 5, N. Harpswell Aug. 12, Highmoor Farm Aug. 15, and the species apparently disappears for this region about the middle of August as it has not been taken later. No specimens were secured in the northern part of the state in 1913 but this may have been on account of its being out of season. A record for Auburn July 18 is furnished by Mr. C. W. Johnson.

Oncopsis cognatus Van Duzee.

Bythoscopus cognatus Van Duzee, Trans. Am. Entom. Soc. VI 224, 1890.

This is a large species, gray in color, with rather indefinite markings resembling *fenestratus* but with different genital segment. Length, 5 mm.

A series of specimens taken from hazel in June by Mr. Shaw are referred to this species. It appears to come at an earlier date than many of the other species and if the hazel is a regular food plant it may be counted as a well separated species.

Owing to the small economic value of the food plant it can hardly be counted of much importance and so far it seems to have been found in rather small numbers.

Oncopsis nigrinasi Fitch.

Athysanus nigrinasi Fitch. Homop. N. Y. State Cab. 1851, p. 61; reprinted in Lintner, 9th Rep't, 1893, p. 401.

Usually marked by the conspicuous black color of the front. Length 5 mm.

Van Duzee says. "June to August. Abundant everywhere on hornbeam," (Buffalo, Hemiptera p. 195), but the specimens we have referred to this species, collected by Mr. Shaw are from hazel. Aug. 1 and Aug. 7, and viburnum July 22. There is also a record for July 28 and 31, but without note of food plant.

Pediopsis viridis Fitch.

Pediopsis viridis Fitch. Homop. N. Y. State Cab. 1851, p. 59; reprinted in Lintner, 9th Rep't, 1893, p. 399.

Uniform green without marking, its color blending perfectly with color of the willow on which it lives. Length 4.5 to 5 mm.

Often very abundant and its distribution in Maine evidently covers the entire state as specimens have been taken at Orono, July 22-30, Portland, Aug. 13, Mt. Katahdin Aug. 22, Houlton, Aug. 24, Mars Hill Aug. 25.

The slight commercial value of its food plant makes it of little economic importance but where the willow is of value the species must be counted plentiful enough to be detrimental to the tree.

Pediopsis basalis Van Duzee.

Pediopsis basalis Van Duzee. Am. Ent. Review, 1889, p. 171; Cat., p. 260; Prov. Pet. Faune Ent. Can. 1890, 3 : 295.

Known by the conspicuous dark brown basal marking of the clavus which contrasts with the yellowish color of the other part. Length 5 mm.

Taken at Orono, 1913-1914 and at Highmoor Farm Aug. 15, 1913 on poplar. Only a few specimens have been secured on any occasion and the species is evidently one which occurs ordinarily in small numbers and has little economic importance.

Pediopsis bicolor n sp.

A large black species greenish white below, of form of *basalis* but very differently colored and showing no trace of the dark band on base of elytra. Length 5.5 mm, width 1.5 mm.

Head obtusely angled, the vertex narrow, pronotum roundingly angled in front, the hind border concave, broadly angular at middle, rugae coarse and rather short; elytra long and narrow.

Color smoky black above, the angles of the scutellum showing a more intense coloring and the elytra near the tip with a faintly transparent space noticeable in proper light. Below, face on upper half smoky brown, shading to lighter at middle, but changing rather abruptly to the dingy greenish white of the lower half. Pectus, venter and legs greenish white or, anteriorly, somewhat yellowish, the propleura without black spot. Pygofer with a black spot each side a little behind the middle.

This species presents a very distinct aspect and while it might be suspected of being a black form of some of the known species the fact that it is so light colored below and the difficulty in connecting it with any of the described species warrants a specific description. Two specimens were taken from a broad leaf willow at Orono July 11, 1914.

Pediopsis virescens Fab.

Cicada virescens. Fab. Syst. Rhyng. p. 79.

Pediopsis virescens. var *graminea.* Osborn, N. Y. Ent. Rept. 20, (1905) p. 505. Edwards Hem. Homop., p. 96.

Approaching *viridis* but smaller and more slender with a conspicuous black spot on the base of the hind tibia. Female, length 5 mm, width 1.25 mm. Male, length 4.4 mm, width 1 mm.

Vertex very short, strongly angled, rounded at extreme tip; pronotum sharply angled in front, sloping to front and sides, concave behind or with hind border subangularly excavated.

Color of female light green, elytra becoming transparent toward tip; eyes brown; a black spot at base of tibia; tarsi yellowish brown; male slightly darker than female the elytra in one specimen faintly, in the other distinctly smoky; scutellum with a black triangle in lateral angles, eyes and tarsi as in female and the black spot on base of hind tibiae distinct.

Three specimens, one female and two males, taken in sweeping on a clump of *Cornus* July 22, 1914, near Orono, on Dr. Patch's farm. No nymphs were taken and it is unsafe to regard *Cornus* as positively the food plant as there were willows in the vicinity and as there was a strong wind blowing these individuals may have been carried from these or some of the other trees in the vicinity. However no corresponding forms have been taken in extensive sweeping in the same locality on willows and other native shrubs and trees. The black spot at base of hind tibiae is a very distinct feature and separates the species at once from any others known to me.

This species is apparently identical with the European form and has been recorded for America but once, in my report upon the "Jassidae of New York," (1905). 20th Rept. State Entom. N. Y., p. 505. The New York specimens were referred to the variety *graminea* in which there is a black spot at tip of vertex.

Pediopsis trimaculata Fitch.

Pediopsis trimaculata Fitch Stata. Cab. Nat. Hist. p. 60, 1851.
Pediopsis insignis Van D. Ent. Am. V. 171, 1889.
Pediopsis trimaculata Osborn and Ball Dav. Acad. Nat. Sci. VII 110, 1898.

This species is dull yellowish brown or in the male gray brown with three white spots on the elytra. Length 4-4.25 mm.

A single specimen of this species has been taken at Orono July 25th, 1914.

Pediopsis sordida Van Duzee?

Pediopsis sordida Van D. Can. Ent. XXVI, p. 89, 1894.

One specimen doubtfully referred to this species was taken at Orono July 3, 1914. It agrees quite closely with the description except in some of the color details but heretofore *sordida* has been recorded only from Colorado. It would be undesirable however to describe as a new species the single specimen in hand with the strong probability that *sordida* has an extended range in the northern part of the country. This specimen is 4.5 mm in length.

Pediopsis ferruginoides Van Duzee.

Pediopsis ferruginoides Van D. Ent. Am. V 181, 1889.

This is a dark species with ferruginous coloring but quite variable in intensity, the single specimen taken in Maine referred to the species being darker than the rule. Length 5 mm. It was collected July 15th, 1914 and if correctly placed extends the range from Iowa which is the most easterly point hitherto recorded.

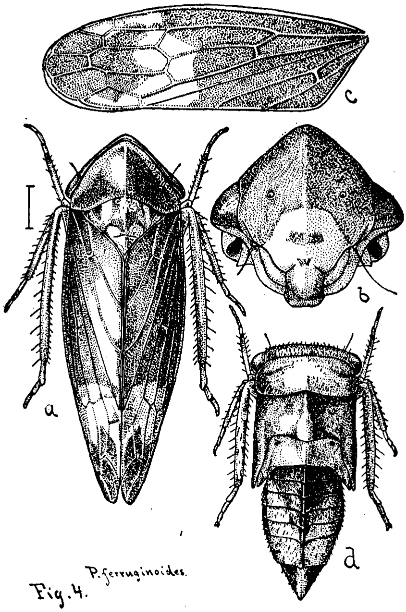

Fig. 11. *Pediopsis ferruginoides:* *a*, dorsal view; *b*, face; *c*, elytron; *d*, nymph. (After Osborn and Ball.)

Pediopsis suturalis Osborn and Ball.

Pediopsis suturalis Osborn and Ball Pr. Dav. Acad. Sci. VII, 67.

Light yellow with a conspicuous black oblique stripe bordering the claval suture. Length 6 mm.

Two specimens taken at Highmoor Farm Aug. 15-16th are so far the only representatives found in the state, and it would seem that it is rather rare though it may have been a little past its season when collecting began.

Pediopsis bifasciata Van Duzee.

Pediopsis bifasciata Van Duzee. Entomologica Americana V. 173.

Gray brown with two fairly distinct bands across the elytra. Length 5 mm. There is considerable variation in different specimens in my collection but the three Maine specimens collected at Orono on poplar July 30, are quite uniform and all are a little more gray and with the two bands more clearly outlined than in most specimens.

The species is credited to cottonwood and poplar but it is apparently of infrequent occurrence and may be considered as of little economic importance.

Pediopsis canadensis Van Duzee.

Pediopsis canadensis Van D. Canad. Ent. XXII, p. 111, 1890.

Greenish or reddish yellow, the elytra brownish with two light bands, one near the base, the other across the apex of the clavus. Length 4.75 mm.

Maine specimens of this species were collected at Orono July 11, 12 and 19, 1914 and have the typical characters of the species, one of the specimens being distinctly reddish brown. It is evidently much less common than some of the other species and it may be considered as having little or no economic importance.

Idiocerus pallidus Fitch.

Idiocerus pallidus Fitch. Homop. N. Y. State Cab. p. 59 (1851).

Idiocerus pallidus Osborn and Ball. Pr. Dav. Acad. Sci. VII, 135.

Light green fading to greenish white in preservation, with two black points on the vertex, otherwise unmarked. Length 5-6 mm.

Common on willows and occurring generally over the state, in some cases taken also from poplar. Orono on poplar and willow July 30th and Aug. 5th larva, Portland Aug. 13th, willow, Highmoor Farm Aug. 15th, poplar, Mt. Katahdin Aug. 22nd, willow, Houlton Aug. 24th, Mars Hill Aug. 25th, Ft. Fairfield Aug. 26th, willow and poplar, Ft. Kent Aug. 28th, 29th.

On account of its very general occurrence and the great abundance of the species feeding through larval stages on willow and poplar it must be counted of economic importance wherever these trees have any commercial or landscape value.

Idiocerus alternatus Fitch.

Idiocerus alternatus Fitch. Homop. N. Y. State Cab. 59 (1851).

Idiocerus alternatus Osborn and Ball. Pr. Dav. Acad. Sci. VII, 131.

Gray with interrupted black and white veins, two conspicuous black dots on the vertex. Length 6 mm.

Another very common species on willow and with a range covering all of the state and to be found on almost every willow tree or bush that may be examined. Collections have been made at Orono July 30th, some larvae but mostly adults, Aug. 5th, Mt. Katahdin Aug. 22nd, Houlton Aug. 24th, Mars Hill Aug. 25th, Fort Fairfield Aug. 26th, Fort Kent Aug. 28th.

Economically this species stands in about the same position as *pallidus* but it is perhaps not quite as abundant and has been taken only from willows.

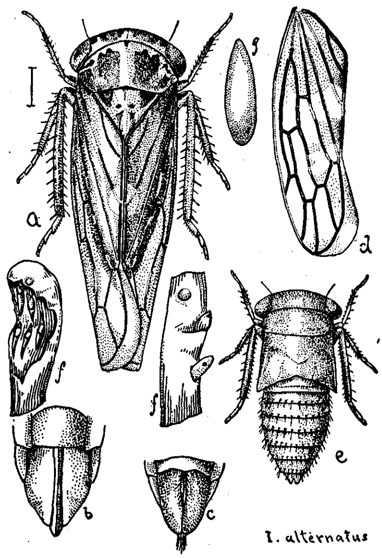

Fig. 12. *Idiocerus alternatus* Fh.: *a,* adult; *b,* female, *c,* male genitalia; *d,* elytron; *e,* nymph; *f,* eggs; *g,* egg enlarged. (After Osborn and Ball.)

Idiocerus suturalis Fitch.

Idiocerus suturalis Fitch, Homop. N. Y. State Cab. 59 (1851).

Idiocerus suturalis Osborn and Ball. Pr. Dav. Acad. Sci. VII, 134.

Light yellow with a conspicuous dark stripe along the line of the united elytra, without interruption. Length 6 mm.

Another common species on the willow but usually less abundant than *pallidus.* It has been reported also for birch but collections in Maine have been limited to willow and poplar. Taken at Orono Aug. 17, '05, Highmoor Farm Aug. 15th, Houlton Aug. 24th, Ft. Fairfield Aug. 26th, Ft. Kent Aug. 28th. It is hardly plentiful enough to be counted of much economic importance.

Idiocerus suturalis Fh. var. *lunaris* Ball.

Resembles *suturalis* of the typical form except that there is a conspicuous cross or lunate interruption of the black sutural stripe. Length 6 mm.

Occurs along with *suturalis* on willows and occasionally on poplars Orono Aug. 7th, Highmoor Farm Aug. 15th, Houlton Aug. 24th, Ft. Kent Aug. 28th.

Idiocerus duzei Prov.

Idiocerus duzei Provancher, Pet. Faune, Ent. Can. III, p. 292, 1890.

One specimen of this species recorded from the collections by Mr. O. O. Stover. It is a large light yellow species with golden iridescence, 7 mm long a little larger than *suturalis* and without the black sutural line.

Idiocerus lachrymalis Fitch.

Idiocerus lachrymalis Fitch. Homop. State Cab. p. 58 (1851).
Idiocerus lachrymalis Osborn and Ball. Pr. Dav. Acad. Sci. VII, 130.

A large gray species with distinct transverse line on front of vertex and with two conspicuous black round dots on vertex. Length ♀ 7 mm, ♂ 5.5 mm.

This is a common species on poplars apparently favoring the aspen and has been taken at Orono July 30th, Houlton Aug. 24th, Ft. Fairfield Aug. 26th, Ft. Kent Aug. 28th. Mt. Apatite collection Bost. Soc. Nat. Hist. In some cases it is plentiful enough to be considered injurious, the larvae especially draining the trees during the early part of the summer.

Idiocerus provancheri Van Duzee.

Idiocerus provancheri Van Duzee. Buf. Soc. Nat. Hist. Bull. V. 194 (1897).
Idiocerus provancheri Osborn and Ball Proc. Dav. Acad. Sci. VII, 127.

This handsome species is chocolate brown with a bright yellow oblique spot across the base of the clavus. Length 6 mm.

From earlier observations this is said to occur on different species of *Crataegus* but our collections in Maine were in all cases made where this tree was not seen and I believe it must have other food plants. At Orono it was taken in the Bangor bog among the scrubby growth of bushes and conifers.

Agallia 4-punctata Prov.

Bythoscopus 4-punctata Prov. Nat. Canad. IV, 376, 1872.
Agallia 4-punctata Van Duzee. Entom. Amer. V, 167, 1889.
Agallia 4-punctata Osborn and Ball. Proc. Dav. Acad. Sci. Vol. VII, p. 48.

This is a broad robust species, gray brown in color and about four millimeters in length. There are four distinct dark dots above, two on the head and two on the pronotum. Length 4 mm.

The species is very generally distributed over the country and we would expect to find it over most of the state especially as it was described by Provancher from Quebec, but it has occurred in the collecting of the season of 1913 only in two localities being taken by Prof. A. P. Morse at Grand Lakes Stream and by Mr. C. P. Alexander at Houlton. In 1914 it was taken a number of times at Orono in July and August.

It feeds on a variety of plants but if the past two seasons are any criterion it will not be of any economic consequence in Maine.

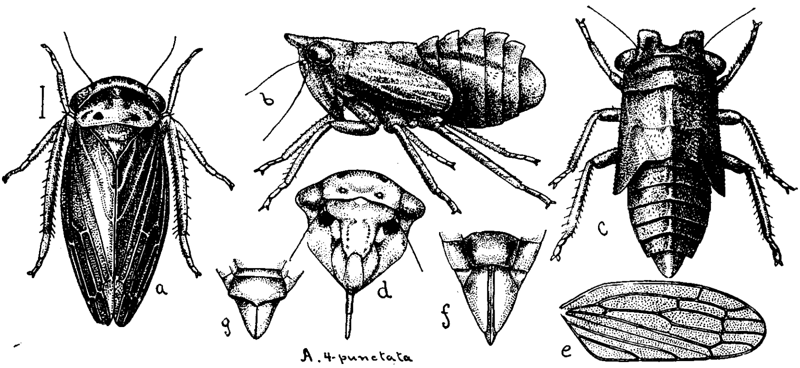

Fig. 13. *Agallia 4-punctata:* *a,* adult; *b,* nymph, side view; *c,* nymph; *d,* face; *e,* elytron; *f,* female; *g,* male gentalia. (After Osborn and Ball.)

Agallia novella Say.

Jassus novellus Say. Acad. Nat. Sci. Phila. Jour. VI, 309, 1831.
Agallia novella Van Duzee. Canad. Ent. XXI, 8, 1889.
Agallia novella Osborn and Ball, Proc. Dav. Acad. Sci. Vol. VII, p. 54.

A slender light colored species with two small black spots on the vertex, a dark line along the suture. Length, 3.5-4 mm.

Not common in collections this season. Collected by Mr. Stover at Dexter. I secured a number by sweeping along the roadside near the Bangor Bog Aug. 5th, and at North Harpswell Aug. 12th and Mr. Alexander collected a few from firs June 10th. An adult female was collected from *Cornus* July 24, 1914, at Orono. It is evidently of little or no economic importance in Maine.

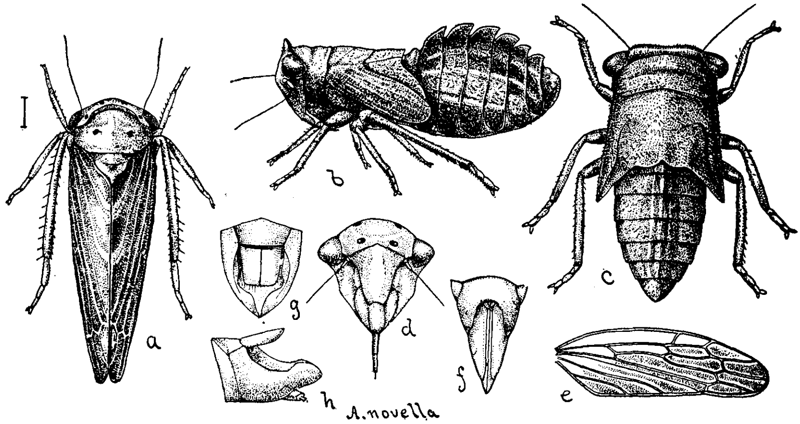

Fig. 14. *Agallia novella:* *a,* adult; *b,* nymph, side view; *c,* nymph, dorsal view; d_1 face; *e,* elytron; *f,* female; *g, h,* male genitalia. (After Osborn and Ball.)

Agallia sanguinolenta Prov.

Bythoscopus sanguinolenta Provancher. Nat. Canad. IV, 376, 1872.
Agallia sanguinolenta Van Duzee, Am. Ent. V, 166, 1889.
Agallia sanguinolenta Osborn and Ball. Pr. Dav. Acad. Sci. Vol. VII, p. 58.

A short robust species usually dark gray or brownish with two large spots on the vertex and two broad spots on the pronotum. Length 3 mm-3.5 mm.

This is by far the most abundant species of the genus in Maine and in fact one of the most abundant and widely distributed species of leaf-hoppers here, as throughout most of the United States. It has been taken at every locality where collections have been made especially in pastures and meadows. Its food is probably largely clover and allied plants but it seems able to survive on a wide range of food plants. In many parts of the country it is a destructive pest in clover and alfalfa fields.

The definite localities of collection are Orono July 24, 28, 29, 31, Aug. 1, 5, 6, 9 from garden plants, peas, etc., and meadows including timothy and clover; North Harpswell Aug. 12, Portland Aug. 13, 14, Highmoor Farm Aug. 15, Mt. Katahdin Aug. 20, 22, at various altitudes up to table land of summit 4500 ft. Houlton Aug. 24th, Mars Hill Aug. 25th, Fort Fairfield Aug. 26th, Fort Kent Aug. 28th.

The species is discussed from the economic standpoint in Bulletin 108 Bureau Entomology U. S. Dept. Agriculture.

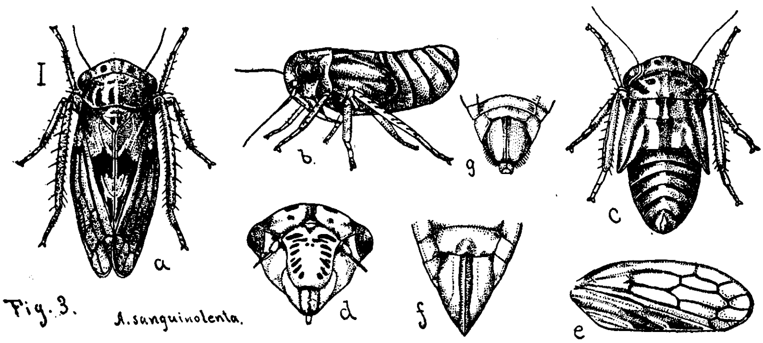

Fig. 15. *Agallia sanguinolenta:* *a,* adult; *b,* nymph, side view; *c,* nymph, dorsal view; *d,* face; *e,* elytron; *f,* female; *g,* male genitalia. (After Osborn and Ball.)

Key to the Genera of Tettigoniellidae.*

A. Antennal sockets usually overhung by a deep ledge, the anterior extremity of which is deflexed and roundly truncate. Anterior tibiae sulcate above or dilated at the extremity. Elytra narrow, not covering lateral margin of abdominal tergum. Head and pronotum usually deflexed.

B. Thorax roundingly six-angular, posterior margin rounding, with a short median excavation. Vertex longitudinally furrowed. Claval veins distant *Aulacizes*

BB. Thorax 4 angular, posterior margin, roundingly emarginate, the anterior and posterior margins nearly parallel. Claval veins often united in the middle or approaching and tied by a cross nervure.

C. Vertex long, triangular longer than width between eyes, side margins nearly straight, face as seen from side nearly straight. *Homalodisca.*

CC. Vertex obtusely rounding, shorter or only equal to width between eyes, face as seen from side roundingly angled. *Oncometopia*

AA. Ledge above antennal sockets small, the anterior extremity as seen from above not projecting, included in the curve of the head. Anterior tibiae slender, round or triangular, Elytra broad, covering the abdominal tergum. Head and pronotum rarely sloping.

B. Elytra not reticulate veined at apex, at most with five apical and three anteapical cells, head not greatly produced.

C. Vertex with margin rounding obtuse, the front inflated.

D. Antennae setaceous, pronotum not twice as long as scutellum, the posterior margin long not strongly emarginate. *Tettigoniella.*

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* Adapted from key by E. D. Ball.

DD. Antennae in the male enlarged at apex. Pronotum more than twice as long as the scutellum, posterior margin short, somewhat emarginate. *Helochara.*

CC. Vertex flat, the margin sharp or line-marked, distinct, vertex and front forming an acute angle, front broadly transversely convex, not inflated. *Diedrocephala.*

BB. Elytra reticulate veined from the apex as far back as the forking of the outer branch of the first sector. Head often produced into a triangle, longer than pronotum. *Draeculacephala.*

Oncometopia lateralis Fabr.

Cicada lateralis Fabr. Ent. Syst. sup. p. 524.
Oncometopia lateralis Ball, Iowa Acad. Sci. Proc. VIII, p. 44.

This species is dark, nearly black, the elytra purplish with yellow lateral line and markings on the head and thorax. Length 7-8 mm.

The larvae are black with yellowish white stripes, the wing pads tinged with purple. Head in front with irregular black and white mottlings, a light stripe starting at the vertex runs to tip of anal segment and a broader stripe each side runs from next the eye across pronotum to bases of wing pads along side of abdomen to apex of penultimate segment, outside of which there is a marginal white stripe. A light stripe on border and disk of wing pads; lower part of face black with yellow dots; thorax and abdomen beneath black with submarginal stripe yellow, legs black lined with yellow.

These markings are characteristic of all the moults observed and agree in the main with the color pattern of the adult. The nymphs develop evidently during the early summer months as they were taken up to August. Their food plant is not certainly determined, but two nymphs were taken on birch July 30th.

Specimens in the Station collection bear records of Orono June 7, 12, 27, 1905, July 2 and 21, 1905, and I took it in 1913 at Houlton Aug. 24th, Mars Hill Aug. 25th, and Fort Kent Aug. 28th, in bog and low ground.

This is a northern species and it may be expected throughout most of the state, but unless in greater numbers than observed so far it can not be considered of great economic importance.

Kolla bifida Say.

Tettigonia bifida Say. Acad. Nat. Sci. Phila. Jour. 1831, 4.

A handsome species with conspicuous black and white transverse bands on head and longitudinal stripes on the elytra. Length 6 mm.

This is one of the species that we would expect to find generally over the state, but I have taken it only near Portland (Stroudwater Aug. 13), (Riverton Park) Aug. 14th. There is a specimen in the Maine Experiment Station collection with record of collection at Pushaw Pond. Possibly it reaches its North Eastern limit in this region.

Tettigoniella gothica Sign.

Tettigonia gothica Sign. Ann. Soc. Ent. Fr. 1854, p. 345.
Tettigonia hieroglyphica, in reference from Eastern states (Nec. Say).
Tettigonia similis Woodw. Ill. State Lab. Bul. 3, 1887, p. 25.

As Ball has pointed out this species must have been the basis for records of *hieroglyphica* in localities east of Illinois.

It is light reddish or grayish green, the head with several lines on the vertex which double on each other, nearly parallel with median line, and prominent spot at apex black. Length 5.5 mm to 6 mm.

It occurs in great numbers in the undergrowth along the margin of thickets and may be collected by thousands in almost any suitable locality.

The larva is light yellow with a dark stripe on each side, a broad median stripe light, narrowing at tip of vertex and on last segment of abdomen. Eye black anteriorly and posteriorly with vertical yellow band including black dot. Beneath with eyes light greenish yellow, tips of tarsi black.

Both larvae and adults have been taken in large numbers at every point where collections have been made from Portland in S. W. and Van Buren and Ft. Kent in N. E. and its distribution may be considered as covering the state. Actual records are at Orono, on oak. June 21, nymphs only Aug. 5, nymphs and adults, N. Harpswell, Aug. 12, Portland, Aug. 13 and 14, Highmoor Farm Aug. 15. Mt. Katahdin up to lower altitude Aug. 20-22, Houlton Aug. 24, Mars Hill, Aug. 25, Ft. Fairfield, Aug. 26, Ft. Kent Aug. 28.

It occurs, however, on a great variety of plants and in such numbers as must become a serious drain. Its great range of food plants will make it a difficult species to control, but in grass land or in fields it is open to same methods of attack as other grass species. The nymphs have been taken from grass land as well as from some shrubs and trees and adults are recorded from birch and willow.

Penthimia americana Fitch.

Penthimia americana Fitch. Homop. N. Y. State Cab. 1851, p. 57; reprinted in Lintner 9th Rep't 1893, p. 397.

A thick bodied dark red or blackish species appearing bluntly rounded at both ends and closely resembling members of the Froghopper family *(Cercopidae)*. Length 5 to 6 mm.

This species would be expected over a considerable part if not the entire state as it is common in N. Y. and westward, but this season has been taken but once, a single specimen being beaten from bushes in the Bangor bog near Orono on Aug. 30th, and one July 10, 1914. Van Duzee gives its distribution as New York to Florida and Mich. so this record extends its known eastward distribution over New England. Evidently it may be disregarded from the economic view point.

It seems hardly probable that it should be so rare or that this represents its limit of distribution and it may be looked for at other points.

Diedrocephala coccinea Forst.

Cicada coccinea Forst. Nov. Sp. Ins. p. 96, 1781.
Tettigonia teliformis Walk. Homop. III, p. 764, 1851.
Diedrocephala coccinea Ball. Pr. Ia. Acad. Sci. Vol. VIII, p. 29, 1901.
(For further synonomy see Ball, l c.)

This is a handsome yellow species with brilliant red and blue or green stripes on the elytra and a black border on the upper margin of the face. Length 5-6 mm.

Specimens of this species will be found in almost every locality where collections may be made anywhere in the eastern states. There are specimens in the collection dated Sept. 10, '05 and '06 and it was collected in 1913 at Grand Lakes Stream (A. P. Morse) Aug. 15-16, at Orono July 29 and Aug. 5th, North Harpswell Aug. 12, Riverton, near Portland, Aug. 14, Highmoor Farm Aug. 16, Mt. Katahdin at lower levels Aug. 22-23, Houlton Aug. 24, and in considerable frequency during summer of 1914. It has been taken on a number of plants as Viburnum, Poplar, Strawberry and especially in damp woods on ferns where the larvae are also abundant in mid summer. These latter are yellow with bright red stripes on the wing pads.

While quite abundant, observations so far have not indicated serious attack upon any cultivated crop.

Draeculacephala noveboracensis Fitch.

Aulacizes noveboracensis Fitch. Homop. N. Y. St. Cab. p. 56, (1851).
Diedrocephala noveboracensis Osborn and Ball. Pr. Ia. Acad. Sci. IV, p. 177, 1897.
Draeculacephala noveboracensis Ball. Pr. Ia. Acad. Sci. VIII, 37, 1901.

This species which has been recorded as occurring from Vermont to Vancouver Id., has been taken in abundance at Orono on its usual host plants, the coarse grasses of low ground, and wherever these grasses have any commercial value the species may be counted injurious.

It is one of our larger leafhoppers and while a conspicuous insect away from its food plant its slender form and bright grass green color merge so closely with the plant stems and leaves that it is seldom seen till beaten or swept into the collecting net.

The head is less angular than in *mollipes* or *angulifera* and the lines and dots somewhat coarser. Length about half an inch.

Adults and nymphs are both taken during July but by the latter part of this month nearly all have matured. In localities further south two broods are recognized but this is not yet determined for Maine.

Our records cover Orono, July and Aug., N. Harpswell Aug. 12, Portland Aug. 13, Highmoor Farm Aug. 16, Mt. Katahdin, from 600 to 1500 ft. Aug. 20 and 22, Ft. Kent Aug. 28, and it has been taken generally wherever collections have been made on its usual food plants.

Draeculacephala angulifera Walk.

Tettigonia angulifera Walker, Homop. III, p. 771, (1851)
Diedrocephala angulifera Van Duzee Ent. News, V, 156.
Draeculacephala angulifera Ball. Proc. Ia. Acad. Sci. VIII, p. 35, (1901).

This is a large green leafhopper resembling very closely the *noveboracensis* from which it differs in having a slightly sharper pointed head with finer lines and smaller dots nearer together at the apex. It is about half an inch in length.

Adults have been taken in large numbers during late July and early August at Orono and the drain they cause in the grasses where they occur must be of no little importance. Aside from the coarse grasses of lowlands it has occurred in large numbers in timothy meadows and while it may have been feeding mainly on some of the coarser grasses mixed with the timothy it appeared to occur on the timothy as well and it may therefore be counted of greater importance. The larvae must get their growth largely before the first of August as adults are the abundant stage at this time.

Additional locality records are, Portland Aug. 13, Princeton Aug. 16, (A. P. Morse), Kineo Aug. 17, Mt. Katahdin 600 ft. and 4700 ft. on tableland, Houlton Aug. 24, Van Buren Aug. 27th, Ft. Kent Aug. 28th.

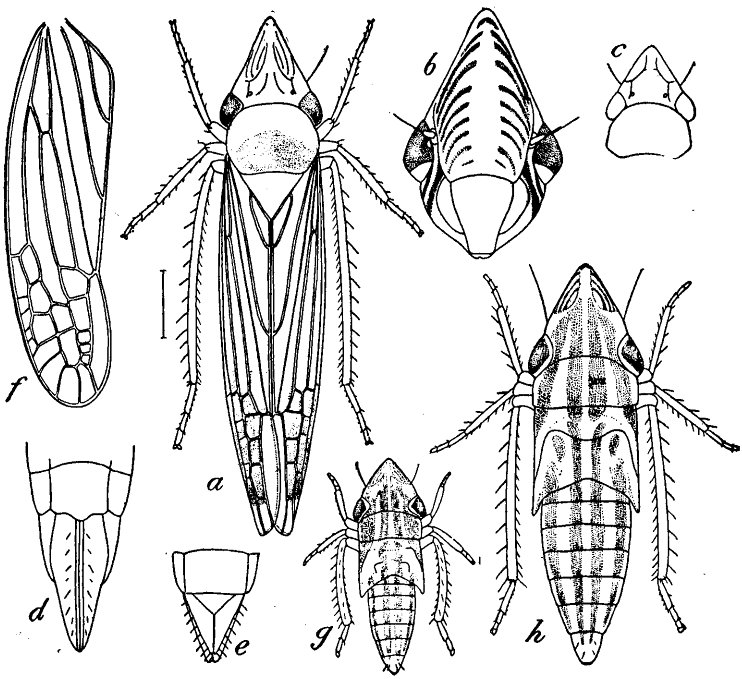


Fig. 16. *Draeculacephala mollipes: a,* Adult from above; *b,* face; *c,* vertex and pronotum; *d,* female genitalia; *e,* male genitalia; *f,* wing; *g, h,* nymphs. All enlarged. (From U. S. Dept. Agric. Bureau of Entomology—Bul. No. 108).

Draeculacephala mollipes Say.

Tettigonia mollipes Say. Acad. Nat. Sci. Phila. Jour. (1831.)
Draeculacephala mollipes Ball. Ia. Acad. Sci. Proc. VIII, p. 33, (1901.)

Bright green the head yellowish and very sharply angled, with very delicate lines. Beneath usually dark sometimes nearly black. Length 6-7.5 mm.

This is one of the most abundant species in the country ranging from Canada to Central America and found almost universally in grass lands on both wild and cultivated grasses. A detailed account of the species with figures will be found in the writer's bulletin on "Leafhoppers affecting Grasses and Forage Crops." (Bull. 108, Bur. Ent. U. S. Dept. Agric.)

In Maine it has been found abundant in all the southern sections. Orono July 11, 19, 26, '05. On willow (doubtless near grass) July 22, 1913. Larvae from marsh grass June 26. Adults from swamp grass June 13. Field grass June 18. Strawberry bed July 22. Timothy Aug. 1. Meadow Aug. 4 and in many other collections from meadow and pastures. Also Princeton Aug. 16, N. Harpswell common in low ground pasture Aug. 12. Portland Aug. 13, in meadow near Riverton Park Aug. 14. In pastures and meadows at Highmoor Farm Aug. 15. At Mt. Katahdin on the table land at about 4500 ft. Aug. 21, Houlton Aug. 24, Mars Hill Aug. 25, Ft. Kent Aug. 28. In the latter locality it was very scarce only a few specimens being taken and it seemed to be replaced even in upland pastures and meadows by *Helochara communis.*

Helochara communis Fitch.

Helochara communis Fitch. Homop. N. Y. State Cab. p. 56, (1851).

This species is one of such universal distribution that it merits a brief description even though it may not be considered of great economic importance.

The adult is a dark green, sometimes almost blackish green and the surface of the body roughly pitted, the length a fourth of an inch or a trifle more. The nymphs are pale green with striations of the head faint, the wing pads in the last instar reach to base of the third abdominal segment.

It is usually found in great abundance in boggy places and feeds upon the grasses common to such places. It is no doubt the cause of a severe drain upon the plants but as such plants have a very constant moisture supply the effect of their work is not very apparent and as the grasses are such as have a minor importance for forage the insect may be counted of less consequence than some of the species of fewer numbers that feed upon important farm crops. A fuller account of the species may be found in Bulletin 108 Bureau Entomology U. S. Dep. Ag.

The Maine records include Orono where specimens have been taken many times during the summer of 1913 and Grand Lake Stream and

Princeton, collected by Prof. A. P. Morse, North Harpswell Aug. 12, Portland Aug. 14, Mt. Katahdin Aug. 21, Mars Hill Aug. 25, Ft. Fairfield and Phair Aug. 26, Van Buren Aug. 27, Ft. Kent Aug. 28-29. In the northeastern part of the state it occurs very commonly on uplands in pastures, meadows and oatfields and was even taken on potato vines so it must be counted of greater economic importance than where it is confined to boggy or swampy lands. It probably selects succulent plants and its distribution is affected by climate or season.

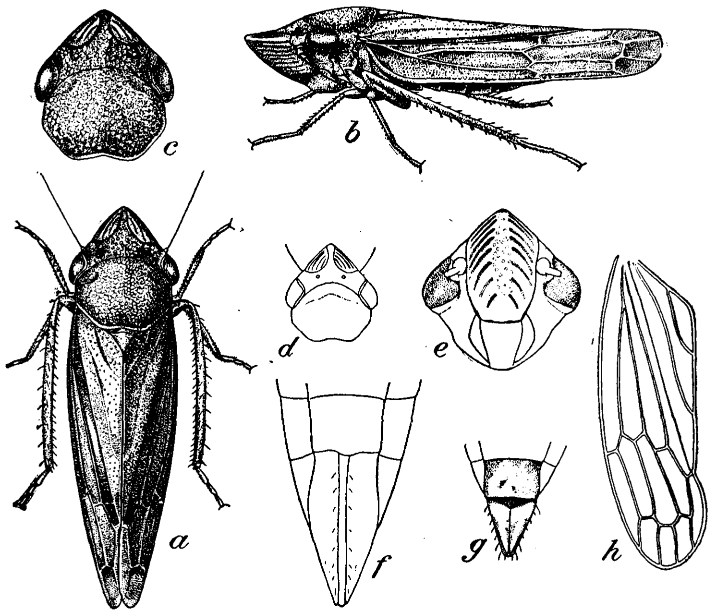


Fig. 17. The bog leafhopper *(Helochara communis): a,* Adult; *b,* side view; *c,* head and pronotum of female; *d,* head and pronotum of male; *e,* face; *f,* female genitalia; *g,* male genitalia; *h,* elytron. All enlarged (From U. S. Dept. Agric. Bureau of Entomology—Bul. No. 108.)

Eucanthus acuminatus Fabr.

Cicada acuminata Fabricius. Ent. Syst. IV 36, 40, 1794.
Eucanthus orbitalis Fitch. Homop. N. Y. State Cab. 57, 1851.
Eucanthus acuminatus Osborn and Ball. Proc. Ia. Acad. Sci. IV, 182.

Black with white markings on head and elytra. The vertex is depressed, the ocelli near the forward part of the disk, elytra with white stripes parallel to the veins. Length 5 mm.

This species has been found very sparingly in Maine, one record July 22 on *Viburnum* for Orono and another for Mt. Katahdin where a few specimens were taken at an altitude of about 1500 to 1600 feet, also one specimen near Orono, July 10, 1914. It has never been recorded as occurring in any great abundance and though its distribution covers a large range of the northern United States and of Europe it is not counted of economic importance.

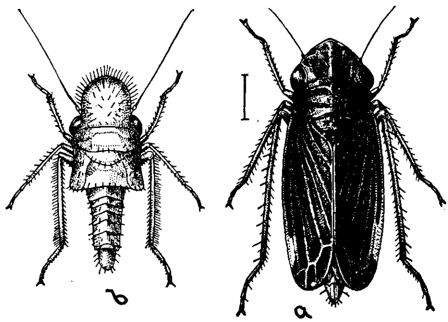


Fig. 18. *Eucanthus acuminatus* Fab.: *a*, adult; *b*, nymph. (After Osborn and Ball.)

Gypona octolineata Say.

Tettigonia octolineata Say. Jour. Phila. Acad. Nat. Sci. IV, p. 340, (1824).

Gypona octolineata Spangberg. Spec. Gyponae p. 8.

This is a large green species with dense reticulations over the entire elytra including the clavus and in some specimens the veins and cross veins are brilliant scarlet. There are eight fulvous stripes running from vertex across the pronotum. Length 8 to 10 mm.

One of the most generally distributed species occurring on a great variety of plants including grasses low herbage and bushes and trees.

Taken on birch July 22nd adult, birch and alder sweepings in woodland July 31 at Orono, North Harpswell Aug. 12th, Portland Aug. 13th, larva and Aug. 14th, Riverton Park, Highmoor Farm Aug. 15th, Mt Katahdin Aug. 22nd, Houlton Aug. 24th, Fort Kent Aug. 28th.

The species has undoubtedly some economic importance as its larvae feed on many plants of value but they are so widely scattered that any very effective means of control seems doubtful. Where abundant on grasses or shrubbery sprays may be used and in some situations the burning of dead leaves would doubtless help.

Gypona flavilineata Fitch.

Gypona flavilineata Fitch. Homop. N. Y. State Cab. p. 57, (1851).

Similar to *octolineata* but without reticulations on the clavus, slightly larger and usually lighter colored. Length ♀ 10 mm. ♂ 9 mm.

This form indicated by Say as a variety of *octolineata* and later described as a distinct species by Fitch is difficult to separate if long series are in hand but there is hardly such complete gradation from one to the other, especially as represented in Maine, as to warrant absolute merging of the two forms into one species. Specimens of this form have been collected at Orono, Portland Aug. 13-14th, Highmoor Farm Aug. 15th. It is usually taken from trees and has not in any case I believe been collected from bogs. It is usually less abundant than *octolineata* and so far as observed hardly plentiful enough to be counted of much economic importance.

Gypona cana Burm.

Gypona cana Burmeister Gen. Ins. pl. 16 No. 10.
Gypona quebecensis Prov. Nat. Can. IV, 352 (nec V. D.)
Gypona cana Van D.

Light yellowish green with a slight bronzy tinge especially after drying. The elytra are only faintly reticulate at tip not at all on clavus or base of corium. Smaller than the other species known in Maine. Length ♀ body 7 mm. to tip of elytra 8-9 mm. ♂ body 6.5 mm. to tip of elytra 8 mm.

One specimen determined by Van Duzee bears date of Sept. 10, 1905, and specimens have been taken during 1913 at Orono Aug. 5th, Highmoor Farm on blueberry Aug. 15th, Grand Lake Stream Aug. 15th by Prof. A. P. Morse, Mt. Katahdin Aug. 22nd, Houlton Aug. 24th, Ft. Kent Aug. 28th. While specimens have been taken in a number of situations and from a variety of plants this species has appeared especially common in low ground and boggy places and a number were collected in the bog south of Orono and at Houlton on plants growing among the sphagnum. There are some puzzling variations in the amount of elytral reticulation but there seems to be a fairly constant general facies upon which one can separate this form from the others occurring in the state. One specimen, also referred to this species, (*quebecensis* Prov?) is smaller and darker green with very few reticulations at tip of elytra, taken from poplar July 30th at Orono.

Except for its occurrences on blueberry the species has not been noted in sufficient numbers on any plant of economic value to be counted injurious in any of the collections this season.

Key to Genera of Jassidae Occurring in Maine.

A. Ocelli on vertex at or near margin and remote from eye *Acocephalina*

a. Head flattened with acute edge (less sharp in *albifrons* male) *Acocephalus*

aa. Head with vertex rounded to front, minute species about 3 mm. *Xestocephalus*

AA. Ocelli on margin between vertex and front *Jassina*
b. Inner sector of elytra twice forked three ante-apical cells in elytra.
c. Head flattened, margin thin, acute, sometimes foliaceous. *Parabolocratus*
cc. Head margin usually angular or rounded not sharp edged or if so only on anterior portion.
d. Elytra with two cross veins.
e. Vertex produced and usually angled on border, front very long and narrow. *Platymetopius*
ee. Vertex usually less angular, front broad, clypeus narrow at tip. *Deltocephalus*
dd. Elytra with one cross vein between sectors. *Scaphoideus*
ccc. Head broad usually blunt edged.
f. Elytra usually short, seldom longer than abdomen, often very short and wings wanting.
g. Head broad ovipositor short little if any longer than pygofer. *Athysanus*
gg. Ovipositor long exceeding pygofer.
h. Gray or with golden iridescence *Athysanella*
hh. Black robust head very blunt. *Driatura*
ff. Elytra usually long exceeding abdomen, mostly large species with short heads.
i. Elytra with fine ramose lines not restricted to transverse band. *Phlepsius*
ii. Elytra without ramose lines or if present restricted to cross band behind middle.
j. Vertex with transverse furrow. *Eutettix*
jj. Vertex without furrow
k. Pronotum strongly curved in front, side very short *Thamnotettix*
kk. Pronotum less curved nearly as long at side as at middle, side carina long. *Chlorotettix*
bb. Inner sector not forked, two ante-apical cells in elytra. *Cicadulina*
l. Wing with 3 apical areoles *Cicadula*
ll. Wing with 2 apical areoles. *Balclutha*

Acocephalus striatus. (Linn.)*

This species has been one of the very abundant ones in Maine and its general occurrence in pastures and meadows, also grain fields and upon variety of other plants places it among those which must be counted of economic importance. The adult is quite variable. The females ranging from a light green or pale yellowish or straw color to nearly brown with

*The synonomy of this species is confused and I follow Van Duzee's Catalogue in the reference to Linnaeus.

numerous flecks of brown or black. The males are dark colored, or gray with a rather conspicuous yellowish band across the pronotum. They are somewhat smaller than the females and the angle of the head usually slightly more acute. The length of the female is about 6 mm, of the male 5mm

Adults of this species are common during August and September and since well developed nymphs were quite plentiful in August it would appear that there was a spring deposition of eggs and that the nymphs developed during mid-summer, reaching maturity by August and the bulk of the individuals becoming mature the first of September. Whether they hibernate as adults or deposit eggs in autumn has not been determined.

The species is generally distributed over the state occurring whereever collections were made and it has been noted for New York so that it may be considered as occupying a considerable range of the northern part of the country. It is apparently identical with the European form but whether a recent introduction or simply a survival of the common distribution for northern countries of Europe and America dating back to an earlier geological period it seems impossible to say.

Apparently the most available treatment for this species would lie in the application of the hopper-dozer method, although if eggs are deposited in the stems of grass or other plants, where burning would be possible, the utilization of the burning method in late fall or early spring would probably give the best results. Rotation of crops would seem of little avail as the species has evidently a wide range of food plants and is doubtless able to fly readily from field to field in search of suitable food plants. A further study of the species to determine more exactly its mode of hibernation and the number of generations is desirable.

The results of life history studies on this species during the summer of 1914 will appear in a later bulletin.

Acocephalus albifrons Linn.

Jassus mixtus Say. Van D. Catalogue, p. 288.

This is a dark species with the front light gray or whitish, the males with brown elytra often interrupted with whitish or semi-transparent spots.

Occurs in considerable abundance at a number of localities. Females were taken abundantly at Highmoor Farm in a lawn, but appeared only where there was some admixture of timothy, and did not appear where this grass was absent.

Orono Aug. 9th in meadow near Stillwater, Riverton Aug. 14th, Houlton Aug. 24 on grassy hillsides, Fort Fairfield Aug. 26.

Found abundantly in timothy meadows in summer work of 1914 and a study of its habits will appear in the bulletin on life histories.

Xestocephalus pulicarius Van Duzee.

Xestocephalus pulicarius Van Duzee. Buf. Soc. Nat. Sci. Bul. 5, 1894, p. 215.

A small dark brown species with light yellowish spots on prothorax and elytra. Length 2.5 mm.

This is somewhat infrequently taken but seems to occur pretty commonly in places where *Carex* grows and it is evidently fairly common on the food plant given by Van Duzee. *Carex vulpinoidea.*

Taken at Orono in the Orono bog, Aug. 29, at North Harpswell Aug. 13, Houlton Aug. 24th, Cherryfield Sept. 5th, 1913.

Xestocephalus fulvocapitatus Van Duzee.

Xestocephalus fulvocapitatus Van Duzee. Buf. Soc. Nat. Hist. Bull. V. 25, 1894.

Differs from *pulicarius* in being slightly larger the head fulvous and unmarked, the pronotum and elytra are brown faintly marked with lighter spots. Length 3 mm.

This species was separated from *pulicarius* by Van Duzee on the larger size and fulvous color of head and he says "in company with the preceding (*pulicarius*) of which it may prove to be a variety." It appears to be closely related and often found associated but material in hand will hardly warrant combining the two species as this form appears to maintain a fairly constant difference in different localities.

Specimens for Maine have been taken in company with *pulicarius* in the Bangor bog near Orono from *Carex* Aug. 31st.

Xestocephalus nigrifrons n sp.

Size and general structure of *fulvocapitatus* but mostly jet black, lower part of face including most of frons, black. Length female 3 mm.

Head rounded, nearly as wide as pronotum, ocelli near together and close to the front margin of the vertex; face tumid, polished, sutures obscure; pronotum rounded in front sloping to sides slightly excavated posteriorly.

Color black with a few white points, vertex black at base, brownish near apex, ocelli white with black central dot, face brown above, two transverse wavy lines on margin next vertex, rest of face polished black, pronotum and scutellum black, the latter with four white points, two at base and one each on hind border opposite the suture, elytral picture like *fulvocapitatus* but basal part black, two white dots on clavus, several on basal half, apical part semitransparent with smoky patch on apex. Beneath black, legs light brown.

Genitalia: Female ventral segment similar to *fulvocapitatus* but more distinctly notched at middle.

One specimen Orono, Maine, Aug. 10, 1913. This may possibly be a black variety of *fulvocapitatus* but it is widely different from any specimens I have seen especially in the color of face. From *coronatus* O. & B. it differs in larger size and especially in color pattern of pronotum and elytra.

Parabolocratus major, n. sp.

Similar to *viridis* but larger, the vertex more broadly rounded and with the margins drawn out into a thinner edge, the anterior border of pronotum less distinctly arched; the elytra shorter, reaching only to base of pygofer in female. Color uniformly green, similar to *viridis* though usually a little lighter green, the black line under the margin of the head wanting in the females, the tip of elytra in males and of ovipositor in females tinged with light brown. Length of female 7.5 to 8 mm. and male 5.75 to 6 mm.

Head broad, anterior border broadly rounded, the margin very thin, length at center about three-fourths the width between eyes; occiput slightly concave, front only slightly convex, clypeus, parallel sides about one-fourth longer than wide, lorae narrow nearly reaching margin of cheek; pronotum about twice as wide as long, anterior border slightly arcuate between the eyes, hind border convex; elytra short, in female reaching base of pygofer, in male extending slightly beyond tip of abdomen; venation as in *viridis*.

Genitalia: Last ventral segment distinctly longer than preceding; hind border distinctly convex and sinuate, the pygofer with lower margin produced apically and distinctly though obtusely angled exceeded by the ovipositor by about one-fourth its length. Male valve very short sometimes hidden, plates narrowing shortly to about the middle and extended in slender upcurved acute points margined with fine cilia, the tips reaching the lower angle of pygofer which is produced dorsally appearing obliquely truncate in lateral view.

Specimens of this form have been taken at Orono 1913 and 1914, also at Castalia, Ohio July 27, 1900, Columbus Aug. 30, 1904, and a series of three females and four males at Steubenville, Ohio, Aug. 1904.

At Cedar Point, Ohio, 1910-1911 this form was taken both as nymphs and adults in considerable numbers on the swamp meadow grass *Calamagrostis canadensis* which appears therefore to be its normal food plant. This with the apparent constancy of the adult characters seems to confirm the definition as a distinct species, *viridis* where observed in larval form has occurred only on *Stipa spartea*.

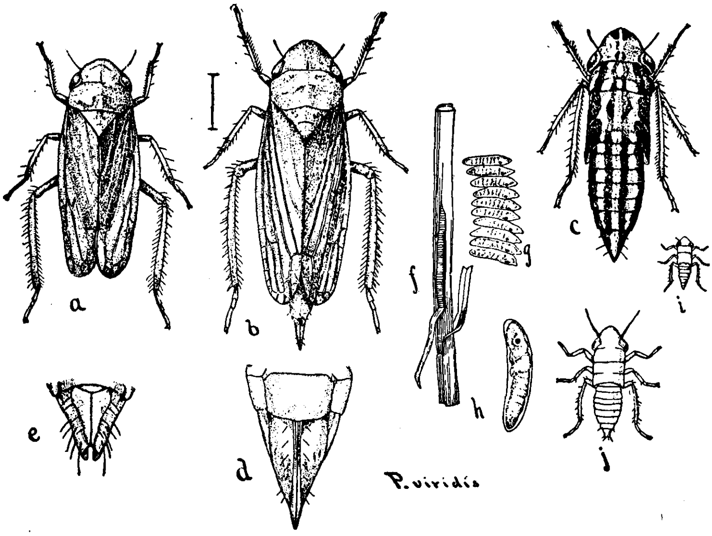


Fig. 19. *Parabolocratus viridis*: *a*, Male; *b*, female; *c*, nymph; *d*, female genitalia; *e*, male genitalia; *f*, eggs in stem; *g*, eggs, enlarged; *h*, single egg, still more enlarged; *i*, *j*, young nymphs. All enlarged. (After Osborn and Ball.)

Platymetopius acutus Say.

Jassus acutus Say. Acad. Nat. Sci. Phila. Jour. VI. 306, 1831.

Platymetopius acutus Uhler U. S. Geol. & Georg. Surv. Bull. 1877 III, 473.

Platymetopius acutus Osborn, Bulletin 108 Bur. Entom. U. S. Dept. Agriculture.

Head sharply pointed, vertex twice as long as width between eyes, face yellow with brown border, a white stripe parallel to edge of vertex, front very narrow and long. Color above brownish and fulvus, often with bronzy luster. Length 5 mm.

This species which occurs from the Atlantic to the Pacific is perhaps the most abundant species of the genus in Maine and as it has a wide range of food plants including a number of valuable cultivated crops, it is of economic importance. Specimens have been taken at Orono on a number of occasions between Aug. 1st and Sept. 5th, in most cases in adult stage. Also at Grand Lakes Stream Aug. 15th and 16th by Prof. A. P. Morse, at North Harpswell Aug. 12th, Portland Aug. 13th and 14th from bushes, grass and sweet fern, Highmoor Farm Aug. 15th from willows, potato and various plants, Mt. Katahdin Aug. 20-22 up to summit 5000 ft. elevation, Houlton Aug. 24th, Mars Hill Aug. 25th, Fort Kent Aug. 28th.

The larval form of this species has a characteristic black border running from the head along the sides to the last segment of the abdomen narrowing sometimes in the central part of the abdomen and the included area is yellow or in some cases bright red for the central part.

As the larvae are usually found in grass or weeds and low herbage along fences and roads it is probable that clean culture and the burning of leaves and litter where practicable will have a good effect in reducing the numbers.

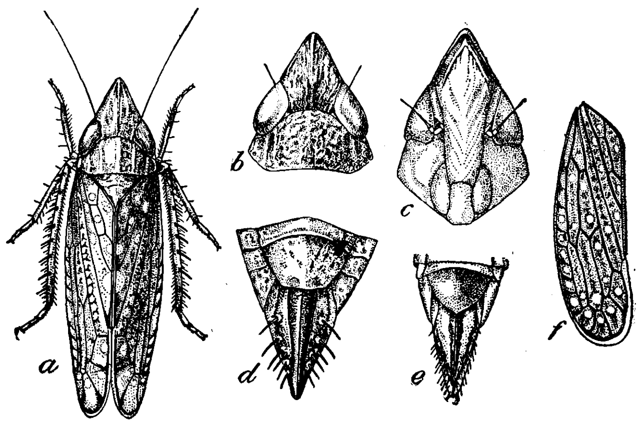


Fig. 20. The sharp-nosed leafhopper *(Platymetopius acutus)*: *a*, Adult; *b*, vertex and pronotum; *c*, face; *d*, female genitalia; *e*, male genitalia; *f*, elytron. All enlarged. (From U. S. Dept. Agric. Bureau of Entomology—Bul. No. 108.)

Platymetopius cuprascens Osborn.

Platymetopius cuprascens Osborn 20th Rept. N. Y. State Entomologist p. 517 (1905).

This species has the form of *acutus* in general but the vertex is longer and more acute, the face is entirely yellow without the brown border of *acutus* the last ventral segment of the female is long and has a distinct median carina on the posterior half. Length 5 mm.

A single specimen of this species was taken at Mars Hill Aug. 25th, also one specimen Ft. Kent Aug. 28th. These are exact duplicates of the type specimen which was collected by Mr. Van Duzee at Phoenicia, N. Y. Several females and males taken at Orono Aug. 5, 8, 11, 22, 24, 1914.

Male, form of female with elytra a trifle less flaring in the specimens in hand.

Vertex long, acutely pointed but scarcely as sharp as female.

Color, above blackish from crowded black or fuscous lines and dots. Light border of vertex and dots of elytra as in female, face greenish white in strong contrast to dark color above.

Genitalia,—valve very long two or three times length of preceding segment and nearly twice the length of the plates, subangularly rounded behind, central part with smooth yellow or spotted disk and dark spotted border, plates short, broad at base, outer edge strongly curved, the tips running into very short blunt spatulate processes and not reaching end of pygofer, surface with scattered short bristles.

One male taken in 1913 and several in 1914 associated with females in same ground evidently on same food plan but amongst mixed vegetation.

While these have not been found mating with *cuprascens* females the very striking similarity except in coloration and size, the fact that this form includes only males and the lighter cuprescent form only females and their association in a very restricted area leaves no reasonable doubt as to the connection.

Platymetopius frontalis Van Duzee.

Platymetopius frontalis Van Duzee Canad. Ent. XXII 112, (1890).
Platymetopius frontalis Osborn Bull. 108 Bur. Ent. U. S. Dept. Aricul-ture.

Dark brown or nearly black the face bright yellow on the central part with a distinct brown or black border. Vertex acute but shorter than in *acutus* much shorter in male. Length 4 mm.

This species has been recognized but once this season and this time only from a nymph collected at the Bangor bog on Aug. 5th. The species is common however in New York and New England and it seems certain that it must have a more general occurrence in the state. It ordinarily occurs in grass-land and is very frequently taken in adult form from oak trees.

The nymph is characterized by the broad black margin of prothorax and abdomen enclosing a bright yellow stripe extending from head to tip of abdomen.

Platymetopius magdalensis Prov.

Platymetopius magdalensis Provancher Faun. Ent. Can. p. 275 (1 spm.).
Platymetopius obscurus Osborn Ohio Nat. V, 274 (1905).
Platymetopius obscurus Van Duzee Annals Ent. Soc. Am. III, p. 229.

Similar to *acutus* but with the face distinctly brown. Length 5 mm.

This species is common to a large section of the eastern U. S., but apparently restricted locally to low ground or boggy situations. It was taken at the Bangor bog, near Orono Aug. 5, 1913 at N. Harpswell Aug. 12, 1913 where it was taken mainly if not entirely from blueberry clumps and the leaves of these plants showed much spotting and deadening evidently from these or other leafhoppers.

Associated with this species in some instances but often occurring as well marked forms by themselves is a lighter variety, the upper surface and face having a bright cinnamon brown color. As other characters seem to relate it here and as the nymphs are decidedly different from those of *acutus* I will call them tentatively var. *cinnamoneus*. In one instance a ♀ *magdalensis* was found in copulation with ♂ of the variety *cinnamoneus* which would strengthen the view that these forms are varietal. This variety has been taken almost exclusively from bog plants and was especially abundant in the Bangor bog, near Orono, large numbers being collected there Aug. 5 and 30, 1913 and again in July 1914. Other localities are Mt. Katahdin, Houlton and Ft. Kent.

The adult forms are 4.5-4.75 mm., the males 4 mm. in length.

As these forms occur abundantly in blueberry patches it is probable that they are among the injurious species affecting this crop.

They are probably destroyed in the burning over of the patches and where this is practiced regularly it will keep them in check.

Platymetopius angustatus Osborn.

20th Rept. N. Y. State Entomologist p. 518 (1905).

This species is small light olive green and the female is 5 mm. long, the male slightly smaller.

A single specimen of female was taken by Mr. C. P. Alexander at Fryeburg Sept. 5th, 1913.

Scaphoideus jucundus Uhler.

Md. Acad. Sci. Trans. Vol. I, p. 34 (1889).

Several specimens of this handsome species were taken by Mr. C. P. Alexander at Fryeburg Sept. 5th, 1913.

Scaphoideus scalaris Van Duzee.

Scaphoideus scalaris Van Duzee. Entom Amer. VI, 51.
Scaphoideus scalaris Osborn, Cinc. Soc. Nat. Hist. Jour. XIX, p. 198, (1900).

Gray brown, the cross veins of elytra dark, those of the costa not strongly oblique. Smaller and lighter colored than *lobatus* and without the orange crossband on vertex of *auronitens*. Length 5 mm.

This species is apparently quite rare in Maine as it has been taken at only a few localities, Orono Aug. 13th, 14th, Houlton Aug. 24, Mars Hill Aug. 25th, and Fort Fairfield Aug. 26th, in each instance but one or two specimens. One record is "on blueberry."

Scaphoideus lobatus Van Duzee.

Scaphoideus lobatus Van Duzee, Buf. Soc. Nat. Hist. Bull. V 199, (1894).
Osborn Cincinnati Soc. Nat. Hist. Jour. XIX, p. 199, (1900).

This species has something of the appearance of a *Phlepsius* but the head is more pointed and with a sharp edge. The white ground is marked with fine black lines and dots and there is a series of three ivory white spots along the commissue of the elytra. Length 6 mm.

This is a rather rare species wherever it has been taken and its range runs from Maine to Iowa; but it has occurred in Maine this season only at a few points. I took two specimens at Riverton Park near Portland on Aug. 14th, and Mr. Alexander secured one at Houlton Aug. 24th. Its food plant is unknown but it occurs on grassy hillsides in mixed vegetation.

Scaphoideus auronitens Prov.

Scaphoideus auronitens Provancher Pet. Faun. Canad. III, 277 (1889).
Scaphoideus auronitens Osborn Cinc. Soc. Nat. Hist. XIX, 194, (1900).

Light brownish with golden luster and with a clear orange cross band on the vertex and dark veins to elytra. Length 6 mm.

Evidently rather rare in the state or else its food plant has not been commonly met. Three specimens were secured at Riverton Park near Portland Aug. 14th, and it was taken at Fort Kent Aug. 28th. It has been found in both adult and larval forms in New York on *Geranium robertsonian* and occurs only in shaded wooded places.

The larva has been described in my report on the Jassidæ of N. Y.

While an interesting species and one which may be looked for anywhere in Maine that its food plant occurs it can not be counted of economic importance.

Scaphoideus carinatus Osborn.

Scaphoideus carinatus Osborn. Jour. Cinc. Soc. N. H. XIX, p. 201, (1900).

This is a large light gray species with a distinctly carinate female ventral segment. Length female, 6.5 mm.

A specimen of this species taken at Orono Aug. 5, 1913. As in other places this species seems to occur in great rarity, but this may be due to its occurrence upon some obscure plant or under such conditions as to escape collection.

Scaphoideus productus Osborn.

Scaphoideus productus Osborn. Jour. Cinc. Soc. Nat. Hist. Vol. XIX, p. 200, (1900).

This species is larger than *immistus* and heretofore has been recorded only from the Mississippi valley. The specimens collected in Maine at Orono in August of 1913 and 1914 are covered well by the description of the species and while they seem to differ a little in general facies and some minor details from the types in my collection the differences seem too slight to warrant separation as a distinct species. It has been swept from blueberry and I have taken nymphs which may belong here from blueberry clumps but never with such restriction as to demonstrate their dependence upon this plant.

Scaphoideus luteolus Van Duzee.

Scaphoideus luteolus Van D. Bull. Buf. Soc. N. H. V, p. 210.

This species is close to *immistus* but usually lighter colored and there is a distinction in the male genitalia which is usually a fairly certain means of distinction. The specimens in hand are all males and represent collections at Orono, N. Harpswell, and Ft. Kent in Aug. 1913. The species is evidently much less abundant than *immistus.*

Scaphoideus immistus Say.

Jassus immistus Say. Acad. Nat. Sci. Phila. Jour. VI, 306, (1831).
Scaphoideus immistus Uhler. Md. Acad. Sci. Tr. I, 33 (1889).
Scaphoideus immistus Osborn. Cinc. Soc. Nat. Sci. XIX 204.

Whitish with dark markings, the head with a conspicuous cross band on the vertex. Cross veins at end of costal space very oblique and conspicuous. Length 5 to 6 mm.

As elsewhere throughout a large part of northern United States this is the most abundant and generally distributed *Scaphoideus* in Maine. It occurs usually on or adjacent to willows and the variety common in this state is probably developed on this plant or vegetation associated with it. In other regions it seems to be much more variable but this would suggest the possibility that there are in reality several closely related species feeding on different plants but too much alike in appearance to be separated where they occur together.

The species has been taken at Westbrook (Stover); Orono Aug. 2nd and 5th, adults, and North Harpswell Aug. 12th, Portland Aug. 13th and 14th, Highmoor Farm Aug. 15th, Mt. Katahdin Aug. 22nd, Houlton Aug. 24th and Ft. Kent Aug. 28th.

Its occurrence upon plants of slight commercial value renders it of little economic importance and it may be ignored in this respect.

Deltocephalus productus Walker.

Jassus productus Walker. List Homop. Ins. Brit. Mus. III, 891, (1858).
Deltcccephalus bilineatus Gillette and Baker, Hemip. Colo. p. 85.

This species has a distinctly acute head, the basis of Walker's name *productus,* and there are two fulvus or brownish stripes across the pronotum and on base of vertex changing to black at the center and followed by two black triangular spots that reach the front border converging to the tip. General color light gray or straw with fuscous spots in the apical cells of the elytra. Length 4 mm.

This species seems to have been very rare especially in the eastern part of the country as after the description by Walker it was not recorded till the discovery by Gillette and Baker in Colorado. I have one specimen taken in Ohio and a specimen collected by Dr. C. M. Weed at Hanover, N. H. I collected one specimen at Mar's Hill Aug. 25th on the summit of the hill, also one specimen, Orono Aug., 1914. It doubtless occurs on some kind of grass or sedge but the particular species is unknown.

Deltocephalus sayi (Fitch).

Amblycephalus sayi Fitch. Homop. N. Y. State Cab. 1851.
Deltocephalus sayi Osborn & Ball, P. I. Acad. Sci. 1897.

A short rather robust species dark brown to blackish with distinct transverse bands on vertex and a fairly distinct band across elytra. Length 2.5 to 3 mm.

Abundant in meadows and grass lands generally. July 25 to Aug. 29th at Orono, N. Harpswell August 12, common, Portland August 13, common, Portland (Riverton Park) August 14, common, Highmoor Farm August 15, common, Mt. Katahdin August 21, up to table land, 4500 ft., Houlton August 24, Mar's Hill August 25, Ft. Fairfield August 26, Phair August 26, Ft. Kent August 28, Mt. Desert Island August 31, on Dry Mt.

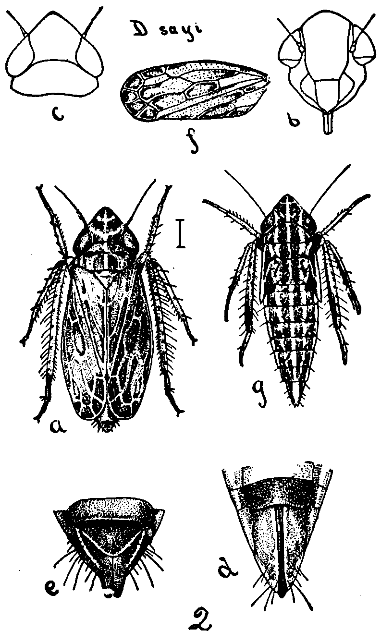


Fig. 21. Say's leafhopper *(Deltocephalus sayi)*: *a,* Adult; *b,* face; *c,* vertex and pronotum; *d,* female genitalia; *e,* male genitalia; *f,* wing; *g,* nymph. All enlarged. (After Osborn and Ball.)

Deltocephalus misellus Ball.

Deltocephalus misellus Ball Canad. Ent. XXXI, p. 191.

This is quite similar to *sayi* but a little smaller and usually slightly lighter in color. It occurs commonly on Canadian blue grass and has been taken at Orono in both 1913 and 1914 in sufficient abundance so that it may be considered of some economic importance.

Deltocephalus obtectus O. & B.

Deltocephalus obtectus Osborn and Ball. Davenport Acad. Nat. Sci. VII, p. 78.

This species is about the size of *misellus* but with quite distinct reticulations on the clavus. Length 2.5-3 mm.

This was taken at Kittery June 26th, 1914, and the species does not appear to be common or widely distributed in the state.

Deltocephalus infumatus n. sp.

Small dark brownish or smoky with light veins on the elytra. Length ♀ 2.5 mm., ♂ 3 mm.

Vertex rather broad subangulate and slightly conical in front, twice as long at middle as next the eye and slightly broader than middle length. Front broad, narrowing from below the antennae to base of clypeus. Clypeus distinctly narrowed at tip, lorae rather narrow and long but not reaching border of base, pronotum very short at sides; scutellum very small; elytra in female short, reaching only to base of pygofer, apical cells very much reduced.

Color: vertex, pronotum, except hind margin, scutellum, cross veins and elytra mostly dull brown. The vertex with an indented transverse double spot, scutellum with dark cross, elytra with whitish cross veins, the costal and apical portion whitish. Legs with tibiae and spines brownish, cheeks with brownish spot on the side, exterior border of face brownish.

Genitalia: Female last ventral segment scarcely longer than preceding, hind border with shallow notches on either side of a narrow middle tooth. Pygofer broad with short bristles at tip. Male—valve short, broadly rounded or very faintly angulate at the middle. Plates broad, rather short, margins upturned, disc polished, tips reaching scarcely to tip of pygofer.

Described from a number of specimens taken at Orono, Maine, July 3rd, 9th, 1914, also taken at Orono, Houlton, Van Buren and Ft. Kent in 1913. This species is about the size of *obtectus*, but has distinct markings and the sooty black color is a distinction.

This species agrees very closely with specimens I have from Edinburg, Scotland, which answer quite well the description of *D. pulicaris* Fall.

Deltocephalus minki Fieb.

Deltocephalus minki Fieb. Verh. Zoöl. Bot. Ges. in Wien. 1869.
Deltocephalus minki Fieb. Van Duzee "Catalogue," Tr. Am. Ent. Soc. XXI, p. 292.

Light straw yellow above, dark, often black below, the head obtusely pointed. Length 3 to 4 mm.

A very abundant species in meadows and along roadsides apparently not restricted to any species of grass but possibly more common on blue grass. Adults abundant July 28th. 29th. A few nymphs.

At this season and for many of the fields near Orono this species seems to replace *inimicus* in importance. Adults appear in collections for Orono, common in meadow, Aug. 5 and 9, No. Harpswell Aug. 12, meadow, Portland Aug. 13, meadow, not abundant, adults, Houlton Aug. 24, grass land, low ground, Van Buren Aug. 27, Ft. Kent Aug. 28. Also quite abundant during the season of 1914.

Deltocephalus sylvestris Osborn and Ball

Deltocephalus sylvestris O. & B. Iowa Acad. Sci. Proc. IV, 213.

This is a small slender species a little larger than *melsheimeri* with the head a little less pointed and the elytra faintly marked. Length 3-3.5 mm.

Collected at Orono July 31st, Aug. 2nd, Highmoor Farm Aug. 15th, Grand Lakes Stream Aug. 16, Princeton Aug. 16th, Mt. Katahdin, 1000-1500 ft., Aug. 20-22, Houlton Aug. 24th, Kineo Aug. 17th, Fort Kent Aug. 28th.

This species is usually found in or near woods and upon annual grasses.

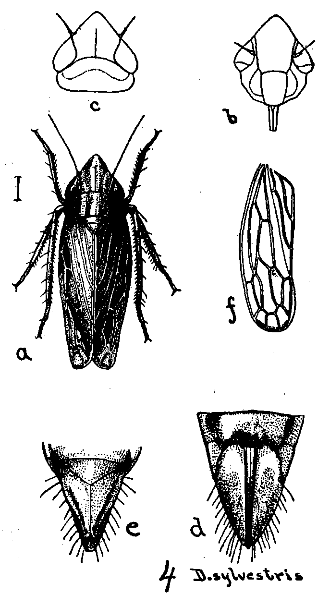


Fig. 22. *D. sylvestris:* *a,* adult; *b,* face; *c,* vertex and pronotum; *d,* female; *e,* male genitalia. (After Osborn and Ball.)

Deltocephalus melsheimeri Fitch.

Amblycephalus melsheimeri Fitch. Homop. N. Y. State Cab., p. 61, 1851.
Deltocephalus melsheimeri Osborn, Rept. N. Y. Entomologist, 1904, p. 521.

A very small and slender species with sharply pointed head pallid color and very narrow black border on central part of female segment. Length 2.5-3 mm.

This is usually abundant on its particular host plant, *Danthonia spicata,* and has been collected this season (1913) at Orono, Mt. Katahdin, Aug. 22, 600, 1000, 1500, 1900 ft., Houlton Aug. 25th, Fort Kent Aug. 28th.

Deltocephalus apicatus Osborn.

Deltocephalus apicatus Osborn. Can. Ent. XXXII, p. 285.

Light brown with the head and apex of elytra light yellow. Length 2.5 to 3 mm.

Has been taken in a number of meadows around Orono July 29 to August 7. Only adults being seen.

Its usual food plant (*Panicum huæchuchæ*) has been recognized in practically all places where it has been taken.

Plenty in field near Stillwater Aug. 9 in patches of *Panicum huæchuchæ,* Veazie August 6, Houlton August 24, abundant in meadow, N. Harpswell, plenty in meadow with *Panicum,* Portland Aug. 14th, common, Highmoor Farm Aug. 15th, pasture, common.

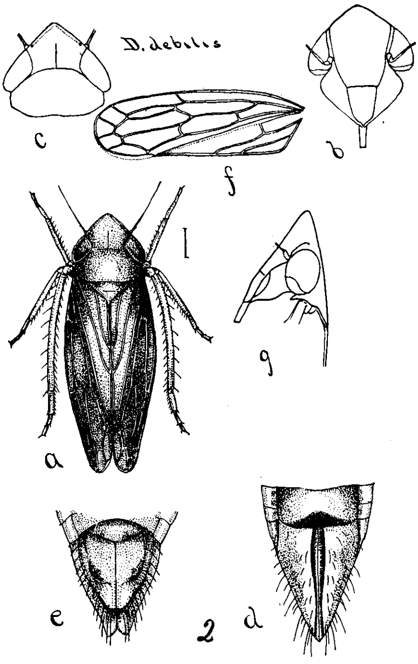


Fig. 23. *D. debilis: a,* adult; *b,* face; *c,* vertex and pronotum; *d,* female; *e,* male, genitalia; *f,* elytron; *g,* side view head. (After Osborn and Ball.)

Deltocephalus debilis Uhler.

Deltocephalus debilis Uhler. U. S. Geol. and Geog. Sur. Bul. Light grass green above, below darker, especially the frontal arcs, but without the solid black of *abdominalis* which it approaches very closely in many characters. Length 4 to 4.5 mm.

Specimens referred here were taken at Orono, August 5, 1913.

Deltocephalus abdominalis Fab.

Deltocephalus abdominalis Fab. Syst. Rhyng, p. 98, 61. A rather large grass green species with the upper part of the face intensely black, the lower central part light yellow, the abdomen black, except margins of segments and sides of ovipositor. Much like *debilis* but slightly larger and distinguished by the black color on the face and underside of abdomen. Length 5 mm.

This species occurring in northern Europe and America is a common species along our northern border and in Maine specimens have been taken at Houlton Aug. 24th, Fort Fairfield Aug. 25th, and Fort Kent Aug. 28th, as it feeds in grass and wheat and occasionally appears in large numbers it must be counted injurious.

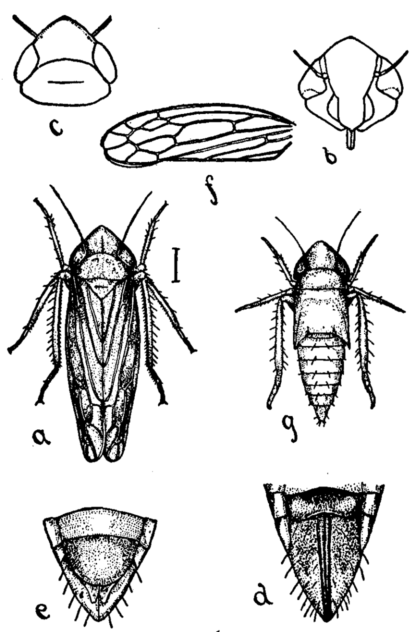


Fig. 24. *Deltocephalus affinis:* *a,* Adult; *b,* face; *c,* vertex and pronotum; *d,* female genitalia; *e,* male genitalia; *f,* wing; *g,* nymph. All enlarged. (After Osborn and Ball.)

Deltocephalus affinis Gillette and Baker.

Deltocephalus melsheimeri Van Duzee, Am. Ent. Soc. Trans. XXI, 292.
Deltocephalus affinis Gillette and Baker, Hemip. Colo. p. 84.

Light gray, faintly marked, the head obtusely angled and broad, the elytra sometimes faintly marked with fuscous. Larger and with much blunter head than *melsheimeri*. Length 4 mm.

While this is a common and at times an extremely abundant species in states farther west it has been taken very sparingly in Maine and evidently does not occupy an important economic place. Our specimens were secured at Orono June 18th and 19th and I took it at Portland Aug. 13th, Highmoor Farm Aug. 15, 1913. Also at Elliott and Kittery June 26, 1914.

Deltocephalus nigrifrons Forbes.

Deltocephalus nigrifrons Forbes, 14th Rept. Ill. State Entomologist, p. 67, (1884).
Deltocephalus nigrifrons Osborn and Ball. Pr. Ia. Acad. Sc., IV, p. 218, (1897).

Light gray or yellowish above, the face almost entirely black by coalescence of frontal black arcs and sutural lines. A row of black dots bordering the front of the vertex and turning down in front of the eyes. Elytral veins often bordered with fuscous but the color varies greatly in intensity. Length 5 mm.

This species which often swarms in immense numbers in oats, wheat and annual grasses over a large part of the country must be exceptionally rare in Maine as only a single specimen has come to light each season, these being collected at Orono Sept. 12, 1913, and July 6, 1914. They are of the typical dark form and marking with the facial lines dark and the elytral markings well defined.

Deltocephalus configuratus Uhler.

Deltocephalus configuratus Uhler. U. S. Geol. and Geog. Sur. Bull. 1871. 4 : 511.
Deltocephalus configuratus Van Duzee. Buf. Soc. Nat. His. Bul. 4 : 198.
Deltocephalus configuratus Osborn and Ball. Pr. Ia. Acad. Sci. Vol. IV, p. 209 (1897).

Light ashy gray, the head with two darker transverse bands and the last ventral segment with a black polished central spur. Length ♂ 4 mm. ♀ 4.5-5 mm.

Quite abundant in timothy meadows and grassland at Orono as adults, Aug. 5 to 29th, N. Harpswell Aug. 12, common in meadow and pasture, Portland Aug. 13, common in meadow near salt marsh, Portland (Riverton Pk.) Aug. 14, common in meadow, Highmoor Farm Aug. 15, common in meadow and pasture, Mt. Katahdin Aug. 21, 1913, on tableland 4500 ft.

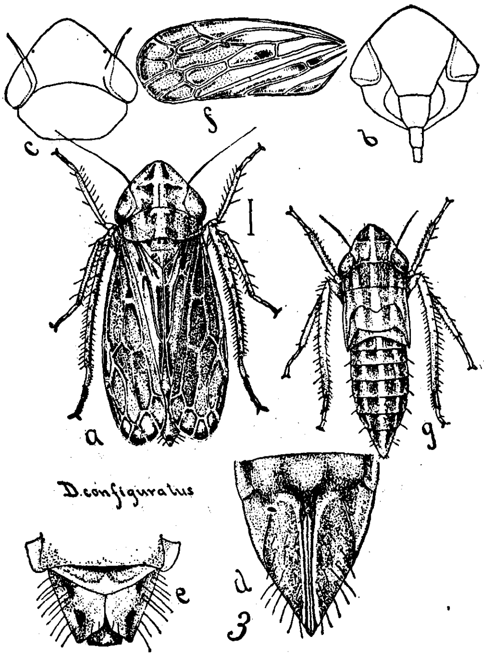


Fig. 25. *Deltocephalus configuratus: a,* Adult; *b,* face; *c,* vertex and pronotum; *d,* female genitalia; *e,* male genitalia; *f,* wing; *g,* nymph. All enlarged. (After Osborn and Ball.)

THE DESTRUCTIVE LEAFHOPPER.

Deltocephalus inimicus Say.

Jassus inimicus Say. Jour. Acad. Nat. Sci. Phila. VI, p. 305, (1831).
Deltocephalus inimicus Osborn and Ball. Pr. Ia. Acad. Sci. IV, 215 (1897).

This species which is so serious a pest in grasslands and occasionally in wheat and oats in the south and west, especially in some parts of the Mississippi valley is one of the common species in Maine but for the past season it was not taken in such an abundance as to indicate as great an economic importance as in some other localities.

It is a small gray species with three pairs of round black dots,—one pair on the head, another on the prothorax and a third on the scutellum. The claval cells are reticulate with brown or blackish squares. Length 5 mm.

The larvae of this species are quite distinctly marked after the first moult. A black border passes from behind the eyes to near the tip of the abdomen, the rest of the body being light yellow or whitish. There are for more southern localities and probably for Maine at least two distinct broods each summer and winter is passed in the egg stage.

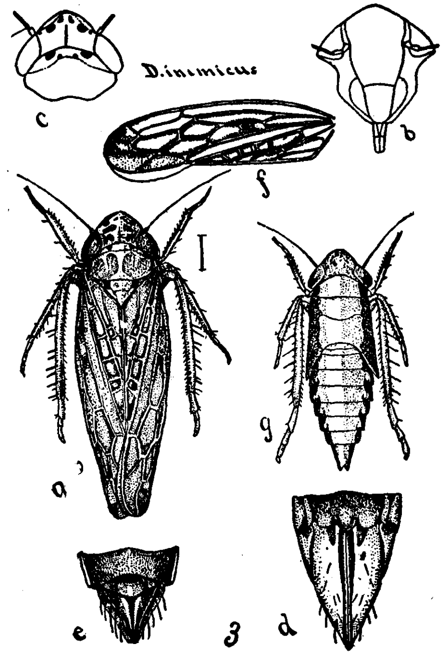


Fig. 26. The inimical leafhopper *(Deltocephalus inimicus)*: *a*, Adult; *b*, face; *c*, vertex and pronotum; *d*, female genitalia; *e*, male genitalia; *f*, elytron; *g*, nymph. All enlarged. (After Osborn and Ball.)

Eggs hatch in early spring and the young of the first generation reach their maturity the later part of June, and the eggs deposited by adults of this generation hatch in a short time and the young develop during mid-summer and reach maturity by August or early September. Their development is irregular enough so that considerable numbers of nymphs and adults may be found at any time during the summer and early autumn but ordinarily adults are only found in late fall or early winter and it appears quite certain all deposited eggs before winter and that the winter is passed then in the egg stage. How far this life cycle will apply to the condition in Maine it is somewhat difficult to say but from the abundance of well developed nymphs and adults in late August and early September it seems probable that the two generations are produced about as in the latitude of Iowa and New York.

The range of food plants in this species is considerable but it seems to favor blue grass as its first choice of food plant and the distribution of the species is apparently quite in agreement with the distribution of this grass. According to observations mapped in Bulletin 108 the southern line of distribution runs into Kentucky and Tennessee, and northward to include a part of Colorado and the northwestern states to Washington. All of which is included in the general distribution of blue grass while to the south of this where the sod grasses do not reach, this species of leafhopper has not been observed. In Maine it is less abundant and its place seems to be occupied in considerable part by *D. minki,* and *misellus* and *Athysanella acuticauda,* all of which are com-

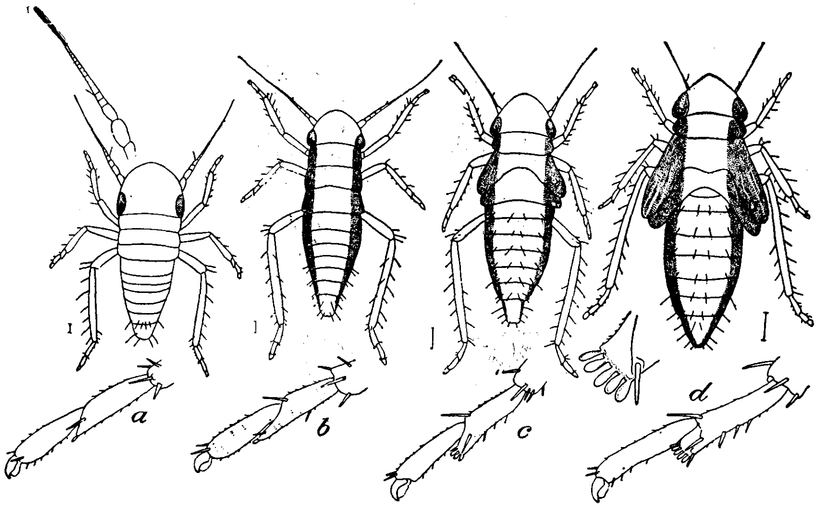


Fig. 27. The inimical leafhopper (*Deltocephalus inimicus*): Nymphal stages; *a,* newly hatched; *b, c, d,* later stages, the details of tarsal appendages shown below. All enlarged. (From U. S. Dept. Agric. Bureau of Entomology—Bul. No. 108).

mon in the vicinity of blue grass and especially on Canadian blue grass.

The measures of treatment for the species that are the most available would seem to be the burning of the grasslands where practicable in late fall or early spring. This measure not only applies to *inimicus* but to the related forms occurring in the same locality.

Athysanus curtisii, Fitch.

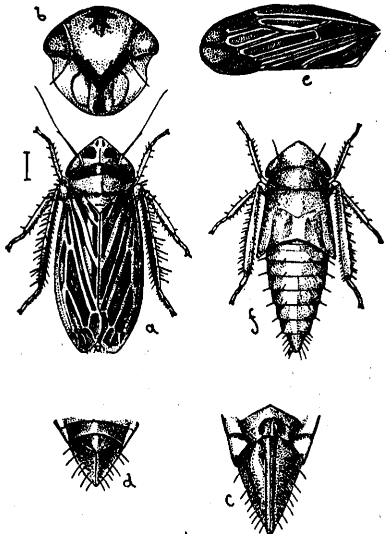
Athysanus curtisii Fitch. Homop. N. Y. State Cab. p. 61, 1861.

Athysanus curtisii Osborn, Bull. 108 Bur. Ent. U. S. Dep. Ag.

This is a small species with yellow and black stripes and two large round black spots on the vertex. Length 3 mm.

Usually an abundant species in grassy woodland but has been very seldom seen this season and when collected it has been in rather open pastures and meadows. It may be a rather rare species in the state and if so has no economic significance.

It was taken at Orono on the University grounds July 28th and Sept. 5th, and I took a few specimens at Fort Kent on Aug. 29th, but it was evidently quite scarce. While somewhat more common in 1914 it was in no place found in abundance.



a curtisii

Fig. 28. *Athysanus curtisii:* *a,* Adult; *b,* face; *c,* female genitalia; *d,* male genitalia; *e,* elytron; *f,* nymph. (After Osborn and Ball.)

Athysanus anthracinus Van Duzee.

Athysanus anthracinus Van Duzee Can. Ent. Vol. 26, p. 136, 1894.
Athysanus anthracinus Osborn and Ball Ohio Naturalist II, 241.

A black shining species with rather blunt pointed head with tips of femora and the fore and middle tibiae yellow or white. Length 4 mm.

This has been taken in small numbers at Orono July 30th and 31st in woods pasture and Aug. 5th in meadow, July 11, 1914, nymphs and adults in grass,—roadside and fence row.

Athysanus plutonius Uhl.

Athysanus plutonius Uhler U. S. Geol. Survey Bul. 3, 1877.
Athysanus plutonius Osborn and Ball Ohio Naturalist, II, 240.

Closely related to *anthracinus* but uusally lighter brown or dull blackish with faint yellow lines on head and thorax and the head more sharply angled than in that species.

One specimen is in the Experiment Station collection determined by Van Duzee, collected at Orono July 26, 1905. I took it at Portland in meadow Aug. 13th-14th, at Mt. Katahdin on tableland Aug. 21st at 4500 feet elevation, at Fort Kent Aug. 28th and Kineo Aug. 17.

Athysanus obsoletus Kirschbaum.

Athysanus obsoletus Kirschbaum. Die Athysanus Arten v. Wiesbaden, p. 7, 1858.
Athysanus obsoletus Van Duzee. Buf. Soc. Nat. Hist. Bull. V, p. 199.
Athysanus obsoletus Osborn and Ball. Ohio Naturalist II, p. 239.

Pale straw color with obsolete or faint markings. Head bluntly angulate. Smaller and lighter colored than *extrusus* which it resembles pretty closely. The male pygofers are short and do not extend beyond plates and have only short teeth instead of style like appendages. Length 4 mm.

This species is common in North America and Europe but is distinctly a northern form occurring in the northern U. S. and Canada. Specimens have been taken in Maine at Orono in timothy meadow Aug. 1st and 2nd, at Van Buren Aug. 27 and at Houlton Aug. 24th. It is hardly plentiful enough to be counted of economic importance. It was more common in collections made July and Aug., 1914 at Orono in timothy meadows.

Athysanus extrusus Van Duzee.

Athysanus extrusus Van Duzee Canad. Entom. XXV, 283, 1893.

A gray brown species with yellowish indefinite markings, short wings hardly reaching the end of the abdomen and with a rather short protruding ovipositor. Length 5 mm.

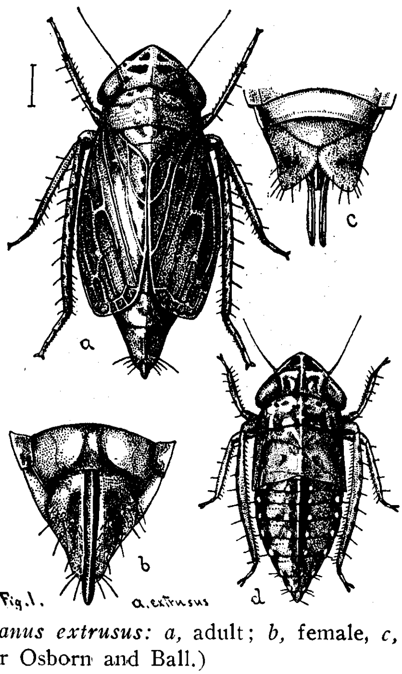


Fig. 29. *Athysanus extrusus: a,* adult; *b,* female, *c,* male, genitalia; *d,* nymph. (After Osborn and Ball.)

This species has nowhere occurred in any large numbers but it has been taken at a number of different points and is evidently pretty generally distributed over the state. Taken in low ground timothy meadow Aug. 2 and 5th at Orono, Grand Lakes Stream by Prof. A. P. Morse Aug. 16th, North Harpswell Aug. 12th, Fort Kent Aug. 26th. It is hardly abundant enough to be counted destructive but since it occurs in pastures and meadows and as a grass feeder it must be to the extent of its abundance an injurious species.

Athysanus striatulus Fallen.

Cicada striatulus Fall Hem. Suec. II, 45, 1826.

Athysanus instabilis Van Duzee. Can. Ent. XXV, 284, 1893.

Athysanus striatulus Osborn and Ball. Ohio Naturalist II, 242.

This species is of the size and form of *vaccinii,* which it quite closely resembles, but it is of a dark brown color and without tawny tinge, the legs dark, femora twice annulate with pale. Length female 4.5, male 4 mm. Width 1 mm.

This species occurs in boggy and swampy places and has been taken at a number of points in Maine, sometimes occurring in considerable abundance but its food plants are commonly the species that occur in wet lands and except for blueberry have comparatively little economic value. The larvae have been taken in bog Aug. 5th.

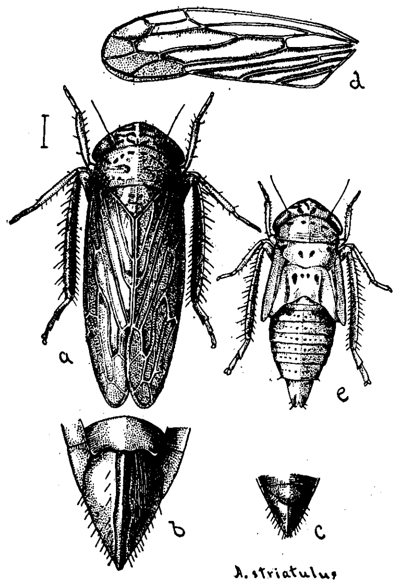


Fig. 30. *Athysanus striatulus: a,* adult; *b,* female, *c,* male genitalia; *d,* elytron; *e,* nymph. (After Osborn and Ball.)

Athysanus arctostaphyli Ball.

Athysanus arctostaphyli Ball. Entom. News Vol. X, p. 172 (1899).
Athysanus arctostaphyli Osborn and Ball. Ohio Naturalist 11, 243.

Smaller than *vaccinii* which it resembles in form and color pattern. Maine specimens are darker, almost black, the light portions of the head and elytra much reduced. Length ♀ 3.5 mm ♂ 3 mm.

This species was taken on Mt. Katahdin at levels of 4700 and 5000 ft. Two specimens were taken at level of 4750 by Mr. C. P. Alexander and I secured one additional specimen at Ft. Kent. The Katahdin specimens are darker and the fuscous markings more confused than in Colorado or Mt. Washington (N. H.) specimens but there seems no sufficient basis to consider them distinct. The Ft. Kent specimen from a much lower level than the Katahdin specimens is a trifle nearer in distinctness of markings to the Colorado specimens. All are smaller than the type specimens from Colorado but agree quite closely with a series that I have from Mt. Washington, N. H.

Athysanus elongatus n sp.

Similar in color and markings to *arctostaphyli* but much more elongated. Black with yellow or whitish lines and dots. Elytra much longer than the abdomen. Length ♀ 4.5 mm. ♂ 3.25 mm., to tip of elytra.

Head produced, distinctly angulate, one-half longer at middle than next the eye but length at middle less than half the width between the eyes; pronotum strongly arched in front slightly emarginate behind; elytra long, apical cells long and entirely beyond the tip of abdomen.

Color:—black, ocelli red, ring around the ocellus, oblique and median lines meeting at the apex, two round spots back of ocelli and two short elongately triangular transverse spots between them on vertex, yellow; numerous minute irrorations on pronotum, four central dots and four marginal dots on scutellum, yellowish white; veins of elytra and central part of areoles whitish or subhyaline; front black, with small whitish arcs; clypeus with two basal spots and lorae with submarginal spot whitish the four forming a transverse row; median line of front and sutures faintly whitish; apex and subapical spot on femora whitish as are the bristles of the tibiae.

Genitalia: Female last ventral segment equal to preceding, truncate. Male valve short rounded behind; plates narrow three times as long as valve, pointed at tip, narrowly ciliate.

Except for the extreme difference in form this species might be considered as a very long form of *arctostaphyli*. Specimens were taken at Orono, Maine, July 3rd, 1914; Mt. Katahdin at 4700 and 5000 ft. Aug. 21st; Portland Aug. 13th, Cherryfield on blueberry Sept. 5th, Ft. Kent Aug. 29, 1913. A specimen was collected by Prof. H. G. Barber, Mt. Katahdin Aug. 19th, 1902 and he has also sent me a specimen labeled "Dilley Ore," which evidently belongs here though the latter, with one specimen taken at Mt. Katahdin between 1000 and 1500 ft. have the spots on the face larger and yellowish spots on side of last ventral segment and pygofer of female.

Athysanus angustatus n sp.

Narrow, smaller than *elongatus* equally slender, black with yellow markings, elytra mostly whitish. Length ♀ 4 mm. ♂ 3.25 mm. to tip of elytra.

Head subangulate in front, one-third longer at middle than next eye, about one-third as long at middle as width between the eyes; pronotum arched before, truncate behind, lateral margin very short; elytra long, apical areoles entirely beyond the tip of the abdomen.

Color black, the hind border of vertex and front border of pronotum with irregular yellow spots; scutellum with outer angles yellowish, leaving middle of stripe black; elytra yellowish hyaline, veins whitish bordered with faint fuscous, more evident in males; face black the frontal arcs, most of the cheeks, two large spots on clypeus and a large central spot on lora, yellow; fore and middle femora black on basal half, apical half and tibiae, also hind femora, except narrow black line, yellow; thorax black; venter black, margin yellow, pygofer of female orange yellow; tergum black.

Genitalia: Female last ventral segment slightly longer than the preceding, truncate; male valve small, short, rounded behind; plates narrowed to blunt points, about three and one-half times as long as valve.

This species appears to belong in the *striatulus* group though in some respects it approaches *striola* and would doubtless be included in *Limotettix* as defined by Edwards. Specimens were taken at Orono Aug. 1st, Kineo Aug. 17th, Mt. Katahdin at levels of 1000, 4500 and 4700 ft. Aug. 21, 1913. I have also two specimens kindly given me by Mr. E. P. Van Duzee which he collected at Lake Placid, N. Y. Aug. 12, 1904.

Athysanus vaccinii Van Duzee.

Athysanus striatulus Fall (Fall) (?) (*vaccinii* nov.) Van Duzee Entom. Amer. VI, 134, 1890.

Athysanus vaccinii Osborn and Ball, Ohio Naturalist II, 242.

This species is quite similar to *striatulus* and occurring in similar situations is likely to be confused with that species. It is lighter colored somewhat tawny in tinge especially in front, olive testaceous above and blackish below, the tips of the fore and middle femora and all the tibiae orange. Length female 4.5 mm, male 4mm, width 1 mm.

This is an especially common species in boggy places and may be taken in immense numbers in almost any of the wild low ground that is supplied with a rank growth of blueberries and other bog loving species. It was described as an inhabitant of the cranberry from New Jersey but evidently has a wide range of food plants and while it must be counted injurious when feeding on blueberries, cranberries or other valuable plants it undoubtedly lives in large part on plants of no economic value. Collections have been made at Orono July 18, '05, North Harpswell Aug. 12th, Portland Aug. 13th, Fort Kent Aug. 28th, Highmoor Farm pasture Aug. 15th by myself and at Grand Lakes Stream Aug. 1st, by A. P. Morse.

Athysanus humidus n sp.

Light rusty brown usually unicolorous in females, male with fuscous or blackish markings. Length ♀ 3.60 mm ♂ 2.75 mm.

Head angulate, vertex two-thirds longer at middle than next the eye, about two-thirds as long as width between the eyes; Pronotum short, slightly emarginate behind; elytra slightly exceeding the abdomen.

Color: Female light rusty brown, unicolorous, the elytra a shade lighter than the head or subhyaline, with veins faintly whitish. Below uniformly rusty brown except tibial spurs which are darker. Male as in female or slightly darker but with faint irrorations on pronotum and borders of elytral veins fuscous; sutures of face, and the venter and tergum, black; the last ventral segment except median spot and the valve and plates brown.

Described from numerous specimens collected in the Bangor bog near Orono Aug. 5 and 31 and in a bog near Houlton Aug. 24, 1913.

This species especially the males suggest characteristics of *vaccinii* and it seems probable that it is derived from the same stock. These

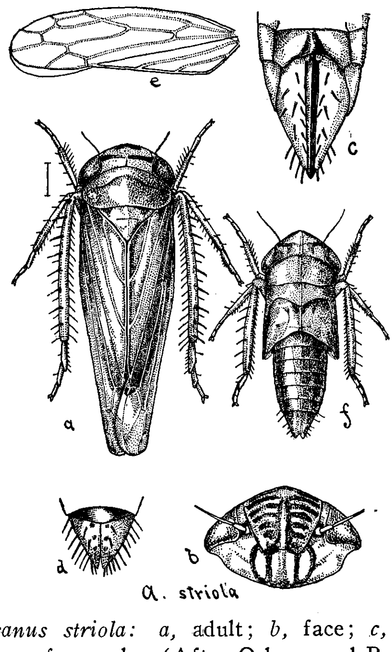


Fig. 31. *Athysanus striola:* *a,* adult; *b,* face; *c,* female, *d,* male genitalia; *e,* elytron; *f,* nymph. (After Osborn and Ball.)

with the group of *striatulus, arctostaphyli, elongatus* and *angustatus* constitute a group of rather variable forms that have most probably all diverged from a common stem. This species however has never been taken outside of distinctly bog conditions and seems to favor the saturated locations supporting an abundant growth of sphagnum. It appears to be similar to the European *russeolus,* which I have not seen, but the description indicates a quite different detail in marking.

Athysanus striola Fallen.

Cicada striola Fallen. Acta Holm. XXVII, 31, 1806.

Athysanus striola Osborn and Ball. Ohio Naturalist II, p. 235.

This is a rather large species very broad in front and tapering sharply to end of wings, yellowish green with a broad black band across the face just below the margin of the vertex.

It occurs only in low ground on coarse grasses, possibly also on sedges and I have never seen it in such numbers as to warrant calling it of much economic importance. It has been taken at Orono Aug. 2nd when it was swept from grasses in low boggy ground among clumps of alder, birch, etc., at Cherryfield Aug. 8, (Wm. Woods), at Mt. Katahdin at the summit 5300 ft. and at Fort Kent Aug. 28th.

Athysanella acuticauda Baker.

Athysanella acuticauda Baker.

A short winged gray species with two conspicuous black round spots on the front of the head. The female ovipositor is much extended and pointed and with the abdomen gives the insect a sharp-wedged appearance. Length, female 4 mm, male 3 mm.

This species occurs in immense numbers in rather dry locations especially in upland pastures and meadows on the dwarf grasses to which they seem especially well adapted in coloration and habit. It seems particularly to frequent Canadian blue grass. A long-winged specimen of this species taken at Orono Aug. 8, 1914, shows close similarity to *Athysanus* venation.

Abundant at Orono Aug. 29th, North Harpswell Aug. 12th, Portland Aug. 13th-14th, Highmoor Farm Aug. 15th, Mt. Katahdin Aug. 21st on tableland 4500 ft., Fort Kent Aug. 28th and will undoubtedly be found in all parts of the state in suitable situations.

Driatura gammaroidea Van Duzee.

Athysanus gammaroidea Van Duzee. Buf. Soc. Nat. Hist. Bul. Vol. V, p. 209, 1894.

Driatura gammaroidea Osborn and Ball. Dav. Acad. Nat. Sci. Proc. VII, 89.

This is a peculiar looking species quite black with a wide vertex very short wings and a long, sharply pointed ovipositor. Length, ♂3 mm ♀ 4 mm.

The species was originally described from Kansas but later taken in Iowa and then in New York and the collection of the species at Portland this summer two specimens from roadside grasses Aug. 14th near Riverton Park extends its range considerably father east. It is quite possible it may be found farther north or east but it is seldom plenty, does not fly and is not very easily observed so it will be difficult to state its limits of distribution till more extended collecting has been done. It is too scarce to be counted of any economic importance.

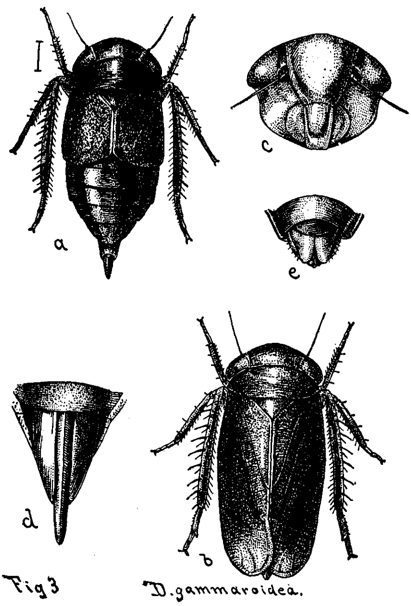


Fig. 32. *Driatura gammaroidea: a,* adult, short winged; *b,* long winged; *c,* face; *d,* female, *e,* male, genitalia. (After Osborn and Ball.)

Thamnotettix waldana Ball.

Thamnotettix waldana Ball. Canad. Ent. Vol. XXXV, p. 229, 1903.

A single female specimen referred to this species collected at Ft. Kent Aug. 28th, 1913. Dr. Ball's specimens were taken in Colorado, but this specimen agrees very perfectly with his description and notwithstanding the fact that the geographical range is so greatly extended I feel confident in the identification.

Thamnotettix eburata Van Duzee.

Thamnotettix eburata Van D. Canad. Ent. XXI, p. 10, 1889.

This species is similar to *clitellarius* but larger and there are no spots on the front and the pronotum is entirely brown. Length 6 mm.

A specimen of this species kindly loaned to me by Mr. C. W. Johnson of the Boston Society of Natural History is labelled Fort Kent, Me. and bears date of Aug. 19th, 1910. Doubtful records are Orono Aug. 1, 1913 and Fryeburg Sept. '13 (C. P. Alexander), Mt. Katahdin Aug. 22, '13.

THE SADDLE-BACKED LEAFHOPPER.

Thamnotettix clitellarius Say.

Jassus clitellarius Say. Jour. Acad. Nat. Sci. Phil. VI, 309, 1831. Complete Writings II, 384, 1869.

This widely distributed species is to be recognized by the conspicuous saddle-shaped yellow spot on the back, when the wings are closed, with a rich chocolate brown color varied with yellow on front of head across pronotum and along the front borders of the wing. Length 5-5.5 mm.

The species while of very general occurrence is never noted as very abundant and need not be counted as of probable economic importance. It occurs in the undergrowth of thickets and woodland but has not been determined as restricted to any one food plant.

It has been collected at Orono as adults July 29th and Aug. 7th, at Portland Aug. 13th.

KENNICOTT'S LEAFHOPPER.

Thamnotettix kennicotti Uhl.

Thamnotettix kennicotti Uhler. Proc. Am. Ent. Soc. II, 161, 1863.

This is a large and rather striking species of rich brown color and with two conspicuous black spots on margin of the head. Length 6.5-7 mm.

It occurs generally through the eastern U. S., but in Maine I have taken it only at N. Harpswell where it was beaten from bushes in a pine grove, and at Mar's Hill Aug. 25th. A specimen in the Bost. Soc. N. H. from Ft. Kent carries its distribution to the extreme northern part of the state.

Thamnotettix cockerelli Ball.

Brown above with minute flecks of blood red on head and pronotum and on veins of elytra. Length 5.4 mm.

This species was described from Colorado but specimens collected in some numbers on *Salix rostrata* at Fort Kent agree so closely with the description that they are referred here. Specimens in hand also, from Cherryfield Sept. 5, 1913 (Wm. Woods), and Orono Aug. 15th, 1914.

Thamnotettix morsei n sp.

Similar to *cockerelli* but with two black spots on front close to vertex. Minutely flecked with crimson dots. Length 5.25 mm.

Vertex slightly longer at middle than next eye, front narrowing sharply to clypeus. Clypeus nearly twice as long as wide, slightly enlarged at tip.

Color: Yellow brown; face, vertex, pronotum and scutellum with minute red flecks which on elytral veins merge into lines. Beneath yellow.

Genitalia; male valve short, rounded behind, plates broad at base, narrowed at middle with slender acuminate tips that reach tip of pygofer.

Described from two males one collected at Grand Lakes Stream by Prof. A. P. Morse, Aug. 16, 1913, the other at Orono on willows Aug. 25, 1913.

Aside from the two spots on front it differs from *cockerelli* in the genital plates.

Thamnotettix rufescens n sp.

Brown with reddish suffusion and conspicuous red eyes. Length 5 mm. Vertex one-half longer at middle than next eye, front with nearly parallel sides to below eye, narrowing abruptly to clypeus; clypeus widening toward tip. Pronotum uniformly rounded in front, sub-emarginate behind.

Color, light brown with coppery reflections, eyes red, elytra semi-transparent, metallic, venter black, last ventral segment and genitalia brown.

Genitalia,—Male. Valve narrower than plates, rounded subangular behind; plates wide, roundingly narrowed at near acuminate tip; finely ciliate.

One specimen Fort Fairfield Aug. 26, 1913.

Thamnotettix belli Uhl.

Jassus belli, Uhler, U. S. Geol. Survey Bull. III, 471, 1877.
Thamnotettix belli Van Duzee, Psyche VI, 306.

This a small light yellow species with oblique lines on the elytra and a distinct yellow band across head and pronotum. Two small round black spots on front next vertex. Length, 5 mm.

This is a western species described from Colorado and apparently common there. Van Duzee gives its distribution as Colorado, Canada, Mich., and in my New York list a single specimen was referred to this species though not agreeing entirely with western specimens. Three specimens collected at Orono by Mr. Shaw June 6th, July 7th and 18th extends its distribution into Maine and shows that it occurs early in the summer and one of the specimens is marked from "Hazel." These specimens agree well with Colorado specimens in my collection. Also Mt. Katahdin 3000 ft. Aug. '02 (Barber).

Thamnotettix belli var *brunneus* n var.

Similar to *belli* in size and form and in female genitalia but without the black spots of vertex and with no yellow band on pronotum or yellow lines on elytra. Length 5 mm.

Head as in *belli* roundingly subangular in front about one-third longer at middle than next the eye.

Color rich brown, vertex yellow in front and brown on posterior half, face yellow, tinged with brown with two conspicuous black round spots close together and close to the border of vertex; pronotum, scutellum and eyltra solid brown with no traces of yellow lines, the elytra becoming semi-transparent at apex. Beneath yellow with the last ventral segment and pygofers brown.

Genitalia: female, last ventral segment long, evenly rounded and simple on hinder border.

This form has been taken on several occasions and does not seem to show any intergradation with *belli* in color pattern but it agrees so closely in genitalia and in size and form that until males or a larger series of individuals is in hand it seems best to consider it as simply a variety. Specimens have been taken at Orono July 8th and 29th, 1913 and July 3rd, 1914.

Thamnotettix chlamydatus Prov.

Athysanus chlamydatus Prov. Pet. Faune Ent. Can. III, p. 339 (1890).
Thamnotettix infuscata Gillette and Baker. Hemip. Colo. 98.
Thamnotettix punctiscuta Gillette and Baker. Hemip. Colo. p. 99.

Brownish with a greenish olive tinge especially when fresh. Scutellum with two distinct dark spots. Length 5.5 mm.

This was fairly common at Orono being taken on several occasions June 3 and 30, July 7, 8, 9, 29, Aug. 1 and 7 and at Mt. Katahdin Aug. 22. Some of the specimens were swept from birch and hazel and the latter particularly seems likely to be its food plant.

This species was described from Canada and Colorado and has been recorded from Sault Ste Marie, Mich., Lake Placid, New York in the Adirondacks, and these records for Maine gives it a considerably wider range though still limited to the distinctly northern fauna.

Thamnotettix melanogaster Prov.

Jassus melanogaster Provancher Naturaliste Canadienne IV, 378, (1872).
Thamnotettix melanogaster Prov. Pet. Faun. Canad. III, 284, (1890).

Bright yellow, often tinged with orange, the border of the vertex with four distinct black spots in a row; venter black as also the tergum of abdomen. Length 5 mm.

This is a quite common species in low ground occurring on coarse grasses and sedges. It was taken at Orono Aug. 2, North Harpswell Aug. 12th, Mt. Katahdin Aug. 22nd and at Ft. Kent Aug. 28th. It is occasionally found in sufficient abundance to be counted injurious to the grasses on which it occurs.

Thamnotettix decipiens Prov.

Thamnotettix smithi Van Duzee Can. Ent. XXIV, p. 266, (1892).

Thamnotettix decipiens Provancher Pet. Faun. Canad. III, 285, (1890).

This species is recognized by the black band running between the eyes at upper border of front close to margin of vertex. Length 5 mm.

Specimens from Ft. Kent referred here are a little larger than described by Van Duzee but agree well with Iowa specimens. They were taken Aug. 28th as adults. The larvae not recognized.

Greenish yellow with distinct veins, the dots on the vertex arranged two on the front border and one each side a little behind the border near the eye. Length 5 mm.

This is a very common species on coarse grasses and sedges in lowland and marshy ground especially in the northern part of the state. Mt. Katahdin Aug. 20-21, Houlton Aug. 24. Plenty in sedgy low spots among willow clumps, Mars Hill Aug. 25, few in low spots among sedges in spite of cold wind. Ft. Fairfield Aug. 26th, Phair Aug. 26th, Van Buren Aug. 27th, Ft. Kent Aug. 28th, sedges, Orono at the Bangor bog Aug. 30th on sedges, larva and adult, mostly adults and quite plenty.

Where the foodplants of the species have any economic value this species may be counted injurious as it occurs in sufficient numbers to cause damage.

Thamnotettix inornata Van Duzee.

Thamnotettix inornata Van Duzee Am. Ent. Soc. Trans. XIX, 303, (1892).

Light yellow and without spots or markings, otherwise is similar to *melanogaster,* though usually of lighter yellow color. Length 5.25 mm.

This has not appeared very frequently in the collections of the summer and always in small numbers. Orono Aug. 2, swept from low ground grasses and sedges, Mt. Katahdin Aug. 22.

Thamnotettix fitchi Van Duzee.

Thamnotettix fitchi Van D. Ent. Am. VI, p. 133, (1890).

Similar to *melanogaster* but smaller with four squarish spots on front border of head encroaching on vertex, wings pale brown with yellow veins. Length 4-5 mm.

The specimens referred to this species collected at Orono July 3, 8, 9 and 15, 1914 lack the parallel light lines usually present on the pronotum but in other characters I find no satisfactory basis for separation.

The species has occurred here only in limited numbers and upon coarse grass in low or moist spots in pastures and its economic importance may be considered as negligible.

Thamnotettix ciliata Osborn.

Thamnotettix ciliata Osborn.. Proc. Iowa Acad. Sci. V, 244, (1898).

Slender light green with no conspicuous markings above, the veins of elytra faint, beneath light yellow or whitish, a black spot on each side of the last ventral segment of the female. Length 5-5,5 mm.

Apparently a rather rare species in the state as only two specimens have appeared in the collections of the season, taken at Orono on Aug. 2nd in a timothy meadow in a low spot probably including some sedges.

As this species was described from specimens taken in Iowa and has not hitherto been recorded for any point further east it is a rather intertesing matter to find it at such a distance and to extend the range of the species by so large a jump.

Thamnotettix placidus Osborn.

Thamnotettix placidus Osborn, Report State Entomologist N. Y. 20th (1905) p. 536.

This is a bright yellow species with more orange tint than the related species and with no black markings above except the tergum and with the underside dark yellow except for black tip of beak and a series of black points on the middle of the venter. Length 5 mm.

This species was described from specimens taken at Lake Placid in the Adirondacks and it is interesting to record its collection at Orono Aug. 7th and Aug. 13th, thus giving it a considerably wider distribution. It was swept from coarse grass among willow clumps. Its restricted distribution and small numbers make it of little economic interest.

Eutettix. strobi Fitch.

Bythoscopus strobi Fitch Homop, N. Y. State Cab. p. 58, 1851.
Phlepsius strobi Van Duzee. Ent. Soc. Trans. XXI, 249.
Eutettix strobi Ball. Dav. Acad. Nat. Sci. XII, p. 44, (1907).

This is a medium sized species, light brown with a tint of rosy, fine lines on the pronotum and elytra but not clearly irrorate, the head subangulate, a trifle longer at the middle than next the eye and with a faint transverse furrow. Length, 5-5.25 mm.

While described from pine the larvae have been found to feed on lambs quarters (*Chenopodium*) which makes its economic importance slight.

It has occurred but very rarely in the summers collecting, once at Orono when it was swept from birch and again at Ft. Fairfield where it was collected from bushes in a fence row. It is evidently of too rare occurrence to be of economic importance in the state even if its food plant were of value.

Eutettix subaenea Van Duzee var.?

Several specimens collected by Mr. C. P. Alexander at Fryeburg Sept. 5, 1913, fall in this species as defined by Ball, but will constitute perhaps a distinct variety as they do not agree precisely with any of the forms he has described. They come near *marmorata* or *lurida* but have prominent black spots on head.

Eutettix johnsoni Van Duzee.

Eutettix johnsoni Van Duzee. Canad. Ent. XXVI, 137, (1894).

This is a handsome little species golden yellow in color with whitish semitransparent spots on the wings and with a row of conspicuous black spots bordering the front next the vertex. Length, 5 mm.

While never appearing in any abundance it has been taken at a number of localities in the state and may be considered as quite generally distributed. At Orono it was taken sweeping in woods on mixed herbage around alder and birch clumps, Aug. —. Along roadside and from scrub oak Aug. 5th and at Veazie Aug. 6th; North Harpswell Aug. 12th, in open woods; Portland Aug. 14th at Riverton Park in open woodland and in most of these cases it has been adjacent to oak.

The species is too rare to be counted of economic importance and so far as can be determined concerning its food plant it does not attack anything of value.

Eutettix vitellinus Fitch.

Accephalus vitellinus Fitch. Homop. N. Y. State Cab. 1851, p. 57, reprinted in Lintner. 9th Rep't, 1893, p. 397.

Eutettix (Parcmesus) vitellinus Ball. The Genus Eutettix Proc. Davenport Acad. Sci. Vol. XII, p. 67 (1905.)

This large and handsome species is of a bright yellow color with whitish transparent spots and some light brown shadings on the pronotum and elytra on the latter forming an oblique band.

But few specimens have been taken and it may be concluded that the species occurs rather sparingly although pretty generally distributed. It has been taken at Orono from pine July 29, poplar July 30, North Harpswell in pine woods August 12, Highmoor Farm Aug. 15, Houlton Aug. 24, Mars Hill Aug. 25, on lower part of the hill and up about half way to summit, Ft. Fairfield Aug. 26, Ft. Kent Aug. 28.

THE IRRORATE LEAFHOPPER.

Phlepsius irroratus Say.

Jassus irroratus Say. Acad. Nat. Sci. Phila. Jour. VI, 308, 1891.

Phlepsius irroratus Van Duzee. Ent. Am. VI, 93, 1890.

Dark fuscous gray with numerous close irrorations the last ventral segment of the female with toothed margin. Length 6-7 mm.

This is one of the most abundant and widely distributed species of the genus throughout the eastern U. S., but it seems to be confined in Maine to the southern and eastern portion of the state. To the north it appears to be replaced by *apertus*.

One specimen taken at Orono in pasture July 31st, Portland Aug. 14th, Highmoor Farm Aug. 15th, Mt. Katahdin Aug. 22, 1913, and an adult male at Orono on *Cornus* July 24, 1914.

While distinctly an economic species in some parts of the country it would appear from the scarcity and limited occurrence in Maine that it may be disregarded in this respect.

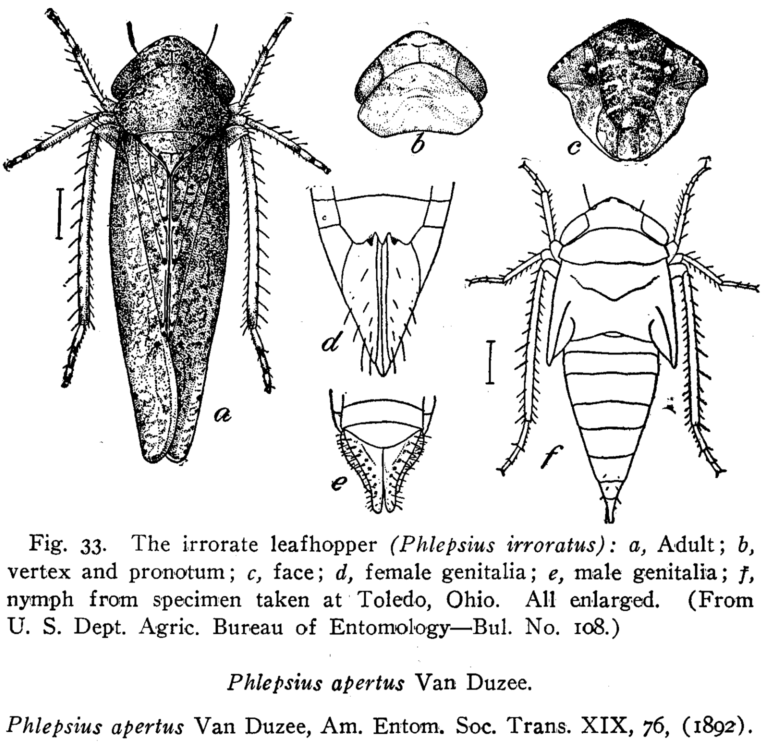


Fig. 33. The irrorate leafhopper *(Phlepsius irroratus)*: *a*, Adult; *b*, vertex and pronotum; *c*, face; *d*, female genitalia; *e*, male genitalia; *f*, nymph from specimen taken at Toledo, Ohio. All enlarged. (From U. S. Dept. Agric. Bureau of Entomology—Bul. No. 108.)

Phlepsius apertus Van Duzee.

Phlepsius apertus Van Duzee, Am. Entom. Soc. Trans. XIX, 76, (1892).

This is about the size and much the appearance of *irroratus*, dark gray in color distinctly irrorate but with a more distinct pale band across the elytra near the base. It is most positively known by the wide deep excavation of the middle part of the last ventral segment of the female. Length 6 mm.

The species seems to replace *irroratus* throughout the northern part of the state, especially where *irroratus* is rare or in some localities apparently wanting. It was taken in fair numbers at the base of Mt. Katahdin Aug. 22nd and in abundance at Houlton Aug. 24th, Mars Hill Aug. 25th, Ft. Fairfield Aug. 26th and Ft. Kent Aug. 28th and 29th. At the latter place it was especially abundant in pastures and meadow lands and would seem to have the same economic importance that *irroratus* has in the Mississippi valley.

The larval form has not been determined but will pretty certainly be found in the grasslands where the adults occur.

Phlepsius maculellus n sp.

Approaching *maculatus* in general appearance but sufficiently different to make reference to that species uncertain. Head short. Dark maculations rather coarse. Length 6 mm.

Head as wide as pronotum, slightly produced but little longer at middle than next the eye, faintly subangulate; vertex sloping, with a faint transverse impression, rounded to the front; front broad, slightly tumid, narrowing uniformly to base of clypeus; clypeus widening to tip, one-half longer than wide. Pronotum strongly arched anteriorly, slightly concave on hind margin.

Color, light brown marked with fuscous, the head, pronotum and scutellum light brown with minute fuscous irrorations; front densely irrorate with fine lines and dots; elytra maculate, white, with large spots and ramose lines of fuscous.

Genitalia, male valve broad nearly as wide as preceding segment, hind border obtusely angular, plates very broad and short, width and length about equal, outer border strongly curved and the margin set with a close row of short hairs.

One specimen, male, taken at Orono Aug. 5, 1913 in boggy lowland. While this species has some resemblance to *maculatus,* which was described from female only, the agreement is not close enough to warrant reference to that species. It is possibly the male of some described species but until it can be definitely related to the proper form it had better stand under a separate name.

Phlepsius decorus O. and B.

Phlepsius decorus Osborn and Ball. Proc. Iowa Acad. Sci. IV, 230, (1897).

A broad dark gray species with rather conspicuous light markings on pronotum and along inner border of elytra. Length, 5 mm.

This species was described from specimens taken in Iowa and it has since been taken in Iowa and New York and Ohio but not in New England. It was a matter of interest therefore to find it in Maine and as a few specimens were taken at the base of Mt. Katahdin on the river at mouth of Abol stream and a specimen at Mars Hill half way up the mountain, it carries its distribution well to the northeast. It lives in wet places on sedge or coarse grass and at Mt. Katahdin was taken from rank growth along the river bank and at Mars Hill in a little patch of sedge marking what was evidently a springy place in the side hill but which at the time of my visit was quite dry. The species has no economic importance and may be ignored in this respect unless it becomes far more abundant than it has appeared at any point yet.

Phlepsius fulvidorsum Fitch.

Jassus fulvidorsum Fitch. Homop. N. Y. State Cab. p. 62, 1851.

Phlepsius fulvidorsum Van Duzee. Am. Ent. Soc. Trans. XIX, 74, p. 11, Fig. 10 (1892).

This is easily separated from all the species but *collitus* by the light fulvous color of the head and pronotum. The head is distinctly longer at the middle than next the eye and angular instead of rounded. The elytra are dark fuscous closely irrorate. Length 6 mm.

This is rather a common species in the northeastern part of the United States but has usually been taken in the vicinity of conifers and Van Duzee says "always on hemlock, spruce, or pines." It has been taken in considerable numbers the present season (1913) and often on other plants than conifers though never far distant from some of the various species that are so universally distributed through the state. However, it has been so frequently taken on blueberry and in rough pasture land that I doubt if it is confined to the conifers, especially in the larval stages. The following records show its wide distribution in the state and the range of plants. Orono on birch and strawberry July 22, in blueberry patches and on pine and hemlock July 29th. Sweeping near birch and alder clumps July 31st. In Bangor bog Aug. 5th, Black Cap Mt. Aug. 6th, North Harpswell Aug. 12th. Common in woods including juniper and other conifers and blueberry. Portland Aug. 14th in grass near woods, Highmoor Farm Aug. 15th, on blueberry and other bog plants, Grand Lakes Stream Aug. 15th, (A. P. Morse) Mt. Katahdin, up to 3000 ft. Aug. 20-22, Houlton Aug. 24th on blueberry in bog, Bar Harbor on Dry Mt. near summit Aug. 31, also taken in Aug. 1914.

From its frequent occurrence on blueberry I conclude that it must be one of the species that cause the many discolored spots on the leaves of the plant and in several instances these were so common as to be worthy of consideration as of economic importance.

Phlepsius collitus Ball.

Phlepsius collitus Ball. Canad. Ent. Vol. XXXV, p. 227 (1903).

This species closely resembles *fulvidorsum* but the vertex is shorter and the elytral markings more distinct. Length 5 to 6 mm.

Specimens have been taken at Orono in limited numbers Aug. 5, 14 and 23, 1913 and July 3rd, 1914. They were swept from low herbage near alder clumps and one specimen is marked "Alder" but I think it is more probably dependent on some other plant for its development.

Phlepsius incisus Van Duzee.

Phlepsius incisus Van D. Trans. Am. Ent. Soc. XIX, p. 72, 1892.

Two specimens of this species one ♀ collected at Orono Aug. 7, and the other ♂, Portland Aug. 14, 1913. In the latter specimen the plates are more acute than usual but I believe it is properly referred here.

Phlepsius humidus Van Duzee.

Phlepsius humidus Van D. Trans. Am. Ent. Soc. XIX p. 288, 1892.

Specimens collected at Highmoor Farm Aug. 15th and 16th, 1913.

The species is characterized by broad body and sharp edged vertex and is one of the largest species occurring in the state. Length 7-7.5 mm.

Phlepsius franconiana Ball.

Phlepsius franconiana Ball. Canadian Entomologist, Vol. XXXV, 1903, p. 228.

I have taken one specimen, female, of what is evidently this species, at Orono July 3, 1914. It has very much the appearance of *Eutettix strobi* and indeed in some points especially the "three white bands" on elytra it fits Fitch's description better than the form assigned to that species.

As the female has not been described I may give the essential characters here. The vertex is distinctly angled, as much so as in *fulvidorsum* and slightly upturned at tip with a sharp edge, twice as long at middle as next the eye. The color agrees with Ball's description but there are but three instead of "four white points in a triangle" at apex of scutellum and the light bands of elytra are apparently wider being pearly white and including some fine ramose lines while the black points are mostly confined to the brown bands. The last ventral segment is twice the length of the preceding, produced at middle with shallow indentations each side and blunt lobes laterally. Length 6 mm.

This species has the vertex of *fulvidorsum* and nearly the color pattern of *apertus* but the bands are strikingly transverse in which it is very different from *strobi.* As compared with that species the second white band is just in front of the apex of clavus instead of just behind it.

The species is evidently rare as Ball described it from a single male and but one female has been taken here. It was taken at margin of woods which included pine and other conifers as well as a mixture of other plants.

Chlorotettix galbanata Van Duzee.

Chlorotettix galbanata Van Duzee Psyche VI, 310.

Yellowish green or whitish green when fresh, fading to a dull straw color, the head rounded in front, slightly produced, about one-fourth longer at middle than next the eye, the last ventral segment of female deeply cleft. Length 6 mm.

A single specimen taken at Portland Aug. 13th is the basis for our record this being taken from grass in or near the salt marsh at tide level. In this specimen the last ventral segment is cleft entirely to base and the inner margins of the resulting lobes are nearly parallel, the inner angles right angled, but unless these slight differences should be found constant in a full series it would not suffice to separate it as distinct. The species has been found abundant in Ohio and may be an economic species but it must be infrequent in Maine and needs no economic discussion at present.

Chlorotettix unicolor Fitch.

Bythoscopus unicolor Fitch. Homop. N. Y. State Cab. p. 58, 1851.
Athysanus unicolor Southwick. Science XIX, 288, 1892.
Chlorotettix unicolor Van Duzee. Psyche, VI, 306, 308, 1892.

Light green, the wings hyaline, head broadly rounded and wider than pronotum. Length 7-8 mm.

This widely distributed species is the most abundant of the genus in Maine and often occurs in such abundance on the rank grasses of low ground and salt marshes as to be of economic interest. Orono, July, 1905, on strawberry, July 22, 1913, willow July 30th, North Harpswell Aug. 12th, Portland Aug. 13. Very plenty on Marsh Meadow and adjacent higher ground on coarse grass, timothy, etc., Riverton Park Aug. 15th, Highmoor Farm Aug. 15th, Mt. Katahdin Aug. 22, Houlton Aug. 24, Fort Kent Aug. 28th, Grand Lakes Stream Aug. 15th, (A. P. Morse) Princeton Aug. 16th, (A. P. M.).

Chlorotettix tergatus Fitch.

Bythoscopus tergatus Fitch. Homop. N. Y. State Cab. 58, 1851.
Athysanus tergatus Southwick. Science XIX, 288, 1892.
Chlorotettix tergatus Van Duzee. Psyche, VI, 306, 309, 1892.

Slightly smaller than *unicolor* and smoky yellowish rather than green, the head obtusely rounded in front. Length 8 mm.

This species has been taken only at Mt. Katahdin near the base at an altitude of about 1500 feet and at Portland on coarse grass near the tide flats. It is too scarce to be of any economic importance.

Chlorotettix lusoria Osborn and Ball.

Chlorotettix lusoria O. & B. Iowa Acad. Sci. Proc. IV, 226, 1896.

This looks very much like *tergatus* in color and in size but the head is much more pointed the vertex being much longer at middle than next the eye. Length 7-7.5 mm.

This appears to be quite rare in Maine, one specimen being taken at Orono, Aug. 6th, and one at Mt. Katahdin, 1000-1400 ft., Aug. 22. The locality farthest to the east hitherto recorded is eastern N. Y.

Neocoelidia tumidifrons Gillette and Baker.

Neocoelidia tumidifrons G. & B. Hemip. Colo. p. 104.
Neocoelidia tumidifrons Osb. & Ball. Iowa Acad. Science IV, 183, 1897.

One specimen, female, of this peculiar species was taken at Orono, July 3rd, in a boggy pasture. It agrees well with the description of the female as given by Osborn and Ball, but lacks the black spots on the scutellum as described for the male in the original description.

Light green female unmarked, male with two black spots on scutellum, the head rounded, subconical in front, the frons swollen. Length 4.5 mm.

As this species was described from Colorado and has not hitherto been recorded for localities east of Iowa this record gives it a very much wider range. It is evidently quite rare here and certainly has no economic importance at present.

Jassus olitorius Say.

Jassus olitorius Say. Acad. Nat. Sci. Phila. Jour. VI, 310, 1831.
Jassus subbifacciatus Say. Acad. Nat. Sci. Phila. Jour. VI, 310, 1831.
Jassus olitorius Van Duzee Buf. Soc. Nat. Hist. Bul. V, 200.

The female of this species has a brown color with two lighter bands across the elytra, and the male is darker, the head yellow and there are no distinct bands on the elytra. Length ♀ 6, ♂ 5 mm.

This species is not represented by any specimens in the Maine collections, but I am confident that it was seen in the field, though no definite record appears. While it is quite a common species in the eastern United States generally it seems to reach an eastern or northern limit within the state. Provancher records it for Ottawa, Canada, but not for Quebec.

Cicadula variata Fallen.

Cicadula variata Fallen. Acta. Holm., XXVII, 34, 1806.
Cicadula variata Van Duzee, Buf. Soc. Nat. Hist. Bull. V, 200.

Usually a little larger than *6-notata* the vertex with two round black spots near the hind border and two angular black spots at the front which extend down on to the front. The elytra vary in intensity but dark specimens show a dusky stripe enclosing a paler spot on inner margin making a round spot on closed wings. Length 4 mm.

The species varies in depth of color and in some specimens referred here the spots on the vertex are faint or even wanting. It is distributed over northern Europe as well as America but is usually much less abundant than *6-notata*. Our Maine specimens were taken at Orono, Aug. 5th and North Harpswell Aug. 12th.

European records mention it as occurring on oak but American records seem to have omitted mention of food plant.

Cicadula suffusa n sp.

Light greenish, the elytra milky translucent, vertex with two large round black dots, anterior portion and under part of base tinged with orange red. Length 5 mm.

Vertex short, rounded, slightly angular in front, narrowing to base of clypeus, clypeus long, scarcely widened at apex. Pronotum rather short, elytra with costal obscure.

Color yellowish green, the head, especially anterior part of vertex and base of front, tinged with orange red, two rather black spots behind anterior border of vertex. Pronotum greenish, scutellum yellowish green, elytra greenish milky, veins, yellowish at base, brownish toward tip. Underneath yellow. Pectus and disk of vertex and ovipositor black.

♀ last ventral segment longer than preceding. Hind margin simple, ovipositor reaching only to tip of pygofer.

This species has been recognized from a number of localities. One specimen from Chicago, Ill.., collected by J. G. Sanders. 7-21-03. One specimen Sault St. Marie, Canada, July '04, collected by Parish. Four specimens Orono, Maine July 18th and 31st, Ft. Kent Aug. 28th, 1913, July 18th, 1914.

This species is distinctly characterized by the prominent black spots on vertex and bright orange-red coloration of the front part of head. It evidently has a wide range although it has been rarely secured.

Cicadula pallida n sp.

Small light gray species with orange-yellow vetex and face without distinct spots or bars. Length 2.5 to 3 mm.

Vertex obtusely angulate, broad; front narrowing uniformly to base of clypeus. Clypeus elongate narrowing to tip, lorae large, narrowing, apically, touching border of face; pronotum short, strongly arched in front, truncate behind; scutellum short; elytral veins distinct.

Color vertex and anterior border of pronotum yellow tinged with orange. Face dull yellow with suffusion of brownish, posterior part of pronotum and scutellum yellowish, elytra pallid, subhyaline, smoky toward apex, veins whitish except near tip, brownish at apex. Below yellowish, venter black, last ventral segment pygofer and ovipositor yellow, tip tinged with orange or brown. Genitalia of female,—last ventral segment truncate behind, ovipositor reaching tip of pygofer, short, transverse scarcely angled at tip. Male valve long, rounded posteriorly. Plates broad at base, narrowing at middle, terminating in slender acuminate points, distinctly ciliate, extending to tip of pygofer.

Described from a number of specimens collected at Orono, Maine August 30, 1913. This species is slightly smaller and broader than the average *6-punctata*. The uniform absence of spots, with the orange tinge and pallid elytra seem to give it a well marked separation.

Cicadula slossoni Van Duzee.

Cicadula slossoni Van Duzee. Can. Ent. XXV, 281 (1893).

Smaller and darker colored than *variata* or *6-notata* with vertex dots more like *6-notata* and wing pattern more like *variata*. The vertex with two small dots near base, two broad quadrangular spots between eyes, usually a median black line and with conspicuous frontal arcs. The elytra in darker specimens show a pale whitish round spot on the combined claval areas. Length 2.5-3 mm.

Collected in considerable numbers from grass in a boggy tract of a pasture at Orono, Aug., July 31st, and at North Harpswell Aug. 12th. At Highmoor Farm Aug. 15th it was swarming by millions on a *Juncus* in wet land with *Helochara communis*. At Mt. Katahdin it was taken on the tableland and summit Aug. 21st, at altitudes of 4500 to 5300. Also taken at Kineo Aug. 17 on golf links and at Fort Kent in low ground pasture.

While heretofore this has been counted a rather rare species the great numbers observed in pastures must give it economic importance, especially if the species of *Juncus* on which it lives are considered of any forage value.

Cicadula potoria Ball.

Cicadula potoria Ball. Canad. Entom. XXXII, 346.

A very small nearly black species, the females with two narrow yellow or white lines on the vertex, the males with head entirely black. The head is distinctly produced, much more so than in *slossoni*. Smaller and darker than *slossoni*. Length 2 mm.

This was taken in considerable abundance at North Harpswell Aug. 12th, in low ground from a small grass probably a species of *Juncus*. The species was described from specimens taken at Ames, Iowa; and this occurrence at so remote a locality without its appearance at intermediate points is of interest. No doubt it will be found in intervening territory if collections are made from the proper plants at the proper season. It is so small as to be very easily overlooked even after being taken into the net.

Cicadula 6-notata Fallen.

Cicada 6-notata Fallen. Acta. Holm. XXVII 34, 1806.
Cicadula 6-notata Southwick. Science XIX, 288, 1892.
Cicadula 6-notata Osborn. Bull. 108 Bur. Ent. U. S. Dep. Ag.

This is a small yellow species easily recognized by the six black dots on the vertex. The front has a double series of black arcs. Length 4 mm.

The larvae have the form of the adults and the black dots of the vertex have the same arrangement as in the adults.

This is one of the most generally distributed species encountered in the state and it must probably be counted one of the most injurious on account of its numbers and the crops affected. It has been observed at Orono, being fairly common in oats and timothy July 31st on the Station grounds but not so abundant as to occasion marked injury, and on Aug. 1st both larvae and adults were noted in timothy. It was also

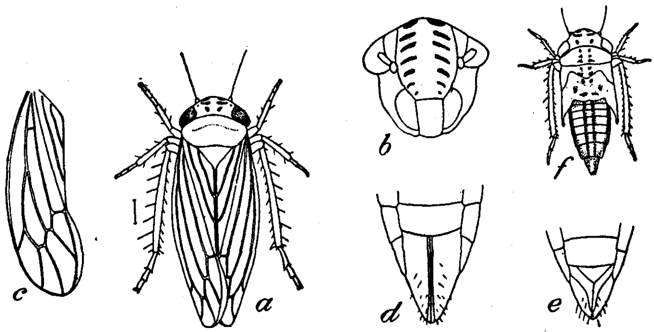


Fig. 34. The six-spotted leafhopper *(Cicadula 6-notata)*: *a*, Adult; *b*, face; *c*, wing; *d*, female genitalia; *e*, male genitalia; *f*, nymph. All enlarged. (From U. S. Dept. Agric. Bureau of Entomology—Bul. No. 108.)

taken on garden plants Aug. 9th. Other records are North Harpswell, Aug. 12th, where it was quite plenty on oats and fairly common in pastures, especially low ground. Portland, Aug. 12th, in marsh meadow and adjacent to grass, Highmoor Farm Aug. 15 on oats, grass, timothy, potatoes, Mt. Katahdin Aug. 21st, Houlton Aug. 24th, Ft. Fairfield Aug. 25th, Phair Aug. 25th, common on oats and grass, Ft. Kent Aug. 28th, oats and grass, Princeton Aug. 16th, Kineo Aug. 17th.

At Highmoor Farm this species was found quite abundant and considerable injury to oats could be credited to it. The leaves showed much evidence of punctures often associated, probably followed by, attacks of rust or fungous disease. In many instances as had been observed by Dr. Surface, punctures at the base of the glumes passing through to the kernel were evidently responsible for injury to the grain.

It occurred also on many other plants, commonly on grasses, timothy especially; but a more unusual occurrence was noticed on potatoes and corn. This occurred probably only on the ripening of the adjacent oats and migration of the hoppers as no larvae were observed on either of these crops. The occurrence on corn is especially interesting as it is, I think, not only the first occurrence for this species but the first time I have encountered any of the jassids living on this crop. In no case was the insect present in excessive numbers and still the injury to oats was sufficient to deserve attention.

The results of a study of the life history of this species in 1914 will appear in a forthcoming bulletin.

Balclutha punctata Thunb.

Cicada punctata Thunberg. Act. Ups. VI, 21, (1782).
Jassus punctatus Walker. Homop. 877, III.
Gnathodus punctatus Fieber. Verh. Zoöl. Bot. Ges. in Wein. XVI, 505.
Typhlocyba punctata Fitch. Prov. Pet. Faune Canad. III, 301, 1890.
Gnathodus punctatus Van Duzee. Am. Ent. Soc. Trans. XXI, 307.

Varies from light gray to green but distinctly marked with a number of black spots on the elytra. The head is short, rounded in front nearly the width of the pronotum, the body long and slender. Length 4 mm.

This is a widely distributed and very common species throughout the state as also throughout a great range in North America and Europe. It is found most commonly in grassland or on cereal crops but appears to have a wide range of food plants. In Maine it has been taken in numbers from meadows especially those including timothy and clover at Orono, North Harpswell, Portland, Highmoor Farm, Mt. Katahdin, Houlton, Fort Fairfield, Mars Hill, Phair, Fort Kent. Also common in oats at Orono, Highmoor Farm and Mars Hill. Other localities without special record of food plants are Grand Lakes Stream, Aug. 16th. (A. P. M.) Ambajejus, Aug. 19th, Kineo, Aug 17th. Adults have been taken from July 29th to Aug. 28th but larvae have also been noticed as late as latter part of July.

The species is to be counted of distinct economic importance and there can be no doubt that meadows especially suffer a considerable loss from their drain upon the grass. From what is known of the life history it is quite certain that the measures used for the summer treatment of other species will be of value and it is probable that where practicable the burning in late fall or early spring will prove useful.

Balclutha impictus Van Duzee.

Gnathodus impictus Van Duzee. Canad. Entom. XXIV, 113, (1892).

Similar to *punctatus* but usually light green or gray with no trace of spot. The head somewhat more produced or rounded. Length 4 mm.

Specimens of this species are recorded for Orono, July 28th, Aug. 5th, North Harpswell Aug. 12th, Portland, Riverton Park, Aug. 14th, Mt. Katahdin Aug. 22nd.

Lack of the black spots seems to be about the only decisive character separating this form from *punctatus* but the facies is usually sufficiently different to give confidence in the separation. It is much less common and hence may be ignored from the economic standpoint.

Typhlocybidae.

The members of this group are as a rule readily separated from the other Jassidae by the four longitudinal veins of the elytra which run without forking to the cross nervures. The apical cells are four and with very few exceptions the ocelli are wanting. The following key to the genera is given by Prof. Gillette and includes all the known American genera and all of these except *Alebra* have already been taken and it is probable that *Alebra* will yet be found as two species have been recorded for New York, and one or both of these should occur in Maine.

Key to North American Genera.

A. Sectors of the posterior wings ending in a marginal vein.
B. Elytra with an appendix beyond the clavus *Alebra.*
BB. Elytra without appendix
C. Two apical cells in posterior wing *Dicraneura*
CC. One apical cell in posterior wing *Empoasca*
AA. Sectors of the posterior wings ending in wing margin, no marginal vein.
Sectors 8 and 2 uniting so that only three veins extend to the margin *Typhlocyba*
All four sectors extending to the wing margin *Eupteryx*

Genus *Dicraneura.* Hardy.

The species of this genus found in Maine are slender with pointed heads and are readily separated from the related forms by the marginal vein in the hind wing, absence of appendix and presence of two apical cells in hind wing. The Maine sepcies may be more readily placed by help of the following key.

A. Elytra with a deep triangular cell on costal margin *cruentata.*
AA. Elytra with apical cell on costal margin lanceolate or wanting.
a. Elytra milky white, nervures indistinct *communis.*
aa. Elytra yellowish or pinkish.
b. Venter yellow *fieberi.*
bb. Venter nearly or entirely black *carneola.*

Dicraneura communis Gillette.

Dicraneura communis Gillette. Proc. U. S. Nat'l Mus. XX, 718.

Light gray or whitish without markings, the head pointed. Length 3 mm.

This species has occurred in considerable abundance in some localities, the records being Orono, Aug. 5th; Black Cap. Mt., Aug. 10th; Portland, Aug. 13th, where it was taken from grass near the tide water or salt marshes, and Highmoor Farm from grass and oats. At Portland and Highmoor Farm especially it was plentiful enough to be counted of economic importance.

Dicraneura cruentata Gillette.

Dicraneura cruentata Gillette. Proc. U. S. Nat'l Mus. XX, 717.

This is a milky white species with a black point at the end of the clavus. The head is rounded in front not so distinctly pointed as *communis.* Length 3 mm.

Evidently this species is quite rare or else closely confined to one food plant. Our only record is from two specimens taken from witch hazel at Orono, Aug. 13th. I refer it to this species though these specimens lack any red marking or smoky discoloration mentioned by Gillette but in other respects they agree closely and unless it be found that these features are constant it can not be separated. I am not aware that the food plant has been recorded hitherto, and no observations have been made on its life history. The species has evidently little economic interest.

Dicraneura fieberi Löw.

The occurrence of this species in cultivated grasses makes it one of the species to be recognized as of economic importance although so far it has been observed only in small numbers in Maine.

It is a small slender species about 3.5 millimeters long, of a light yellow color with no conspicuous markings, but some specimens show a distinct orange tinge on the front of the head.

It has been taken at Orono in timothy meadow not abundantly, but along with other species it must add its share to the drain upon the hay crop.

The species has a wide range throughout Europe and North America whether of recent introduction or not cannot be stated and in some localities it has been observed in such abundance as to have a distinct economic importance. Adults occur in mid-summer, Aug. 1st at Orono, and it is certain that nymphs develop earlier in the season but no exact data on time of appearance or number of generations here have been secured.

Dicraneura carneola Stal.

Typhlocyba carneola Stal. Stett. Ent. Zeit. XIX, p. 196 (1858).
Dicraneura carneola Gillette. Proc. U. S. Nat'l Mus. XX, 722.

Light yellow the head produced, vertex roundingly angled before, without markings but there is frequently a suffusion of rosy color on head, thorax and elytra, differs from *fieberi* in less produced head and presence of dark markings on abdomen. Length 3.30 mm.

The basis of separation between this species and *fieberi* seems slight especially as with the Maine specimens it is possible to find many cases where the black markings of the abdomen are more or less developed and with no other positive character one may be at a loss to distinguish them.

Highmoor Farm Aug. 16, Portland Aug. 15, Orono Aug. 1, 1913.

Carneola has been a quite abundant and injurious species in the western part of the country and as it occurs on grasses, oats, wheat, etc., it deserves a more careful study to determine its abundance and distribution in the state the extent of its attack upon different cultivated crops and such facts as to its early stages as may suggest measures of control.

Empoasca smaragdula Fallen.

Cicada smaragdula Fallen. Hemip. Suec. Cicad. p. 53, 1829.
Empoasca smaragdula Gillette. Typhlocybidae U. S. Nat. Mus. Proc.

Light yellowish green with a distinct smoky or black stripe following the sutural line of the elytra. Length 4 mm.

This is a common species over a large portion of the United States as well as Europe and in Maine is met with on willows generally. It was taken this season at Orono, on Viburnum July 22, on willow Aug. 5th; Portland, Aug. 13th; Highmoor Farm, Aug. 15th; Mt. Katahdin, Aug. 22nd; Houlton, Aug. 24th; Ft. Kent, Aug. 28th.

While commonly present it has not been noted in excessive numbers and it may be counted as of rather slight economic importance.

Empoasca atrolabes Gillette.

Empoasca atrolabes Gillette. Proc. U. S. Natl. Museum XX, 736.

Dark green without markings except a distinct black spot at end of clavus, the tarsi blue. Last ventral segment with a deep notch at each side of the hind border leaving a central produced lip as seen from ventral face but, with a slightly different angle, this lip is shortened to have the appearance shown in Gillette's figure. Length 3.75 mm.

This is a very abundant species on the alder and is sometimes taken on plants adjacent to this bush but the alder must be its favorite food plant if not the exclusive host plant for the growth of the larvae, as specimens have been taken in large numbers from clumps of alder bushes when surrounding bushes showed few or none.

It occurs all over the state and our records show captures at Orono, Aug. 10, '05, July 30, '13; North Harpswell, Aug. 12th; Grand Lakes Stream, Aug. 16th; Highmoor Farm, Aug. 15th; Phair, Aug. 26th; Fort Kent, Aug. 26th.

The economic status of this species depends on the value assigned to its host plant, the alder, which is one of the most common shrubs of the state. Inasmuch as its foliage adds much to the scenic beauty of the state it may be fair to count it as having economic value and its insect pests therefore injurious.

Empoasca unicolor?

This species is interesting as one of the rather rare cases where a leafhopper has adapted itself to feeding on coniferous trees. The specimens taken so far were all secured from arborvitae or from other conifers where the food plant was noted.

The insect is about three and one-half millimeters long, of a dark green color with no markings and very well matched in color with the leaves of the plants on which it occurs.

While not in large numbers it was found distributed on a number of different trees near the station building Aug. 2, and was found on both arbor vitae and white pine Aug. 5th. In present numbers it can not be counted as of much economic importance and unless it shows a tendency to increase excessively at times it may be ignored from the practical point of view.

Empoasca obtusa Walsh.

Empoasca obtusa Walsh. Proc. Bost. Soc. N. H. IX, p. 316, 1864.

Light green the head very slightly produced, female 4.25 to tip of wings, 3.25 to tip of ovipositor.

Taken on willow at Orono, July 30; at Veazie on Aspen poplar, Aug. 6th; Ft. Fairfield, Aug. 26; Ft. Kent, Aug. 28 and 29; common willow, Highmoor Farm, Aug. 15th; Portland, Aug. 13th; N. Harpswell, Aug. 12, 1913.

Some of these specimens show a slight sinuation of the last ventral segment of the female but otherwise seem to agree much better with *obtusa* than with *aureoviridis* Uhl. However these species are evidently very closely akin.

While sometimes fairly common they can hardly be said to have much economic importance in the numbers in which they usually occur.

THE APPLE LEAFHOPPER.

Empoasca mali.

This species was found in considerable numbers affecting not only apple trees but potatoes and beans and while not in such abundance as to cause great destruction, it is easy to conceive that they may so increase as to cause the same serious losses that have been accorded to it on apple and alfalfa in other parts of the country. It is a minute green species with about 6 whitish dots along the front border of the pronotum its length is about 3 mm. The life history of this species has been studied quite extensively in Minn., Iowa, and Missouri and while there is some disagreement as to the condition in which the winter is passed, the main points in the life cycle are fairly well known. The usual method of hibernation for the other species of this family is in the adult stage. Adults being secreted under leaves or rubbish in thickets and other somewhat protected places and these hibernating adults migrate during early spring to deposit eggs upon the various food plants but especially upon apple. According to R. L. Webster, who has studied the species particularly for Iowa, there is hibernation of eggs in the twigs of apple or other plants and appearance of young in early spring. Dr. Hasemann considers that the usual method of hibernation for Missouri is in the adult stage. As no observations have been recorded concerning this point for Maine it is impossible to say positively but the practical bearing would not seem to be of very great significance for this region as the early appearing nymphs from either hibernating adults or eggs, would be open to attack about at the same time.

The young hoppers are light green or yellowish and occur especially upon the underside of the leaves and usually ranged alongside the mid-rib or larger veins of the leaf. The development of the larvae is rather rapid and for Maine it is probable that at least two generations may be produced as both adults and nymphs were found in mid-summer.

The distribution of this species covers all of the state and its range of food plants is apparently about the same as for other sections as it was noted upon a number of different host plants, although especially upon apples, potatoes and beans. Upon the latter it was found fairly common at Highmoor Farm and Houlton. At Highmoor Farm its occurrence on beans was indicated by very distinct spots upon the leaves. The attack clearly showing that a large abundance of the hoppers would result in a very distinct withering of the plants.

The treatment of this species depends upon the plants affected, the use of two measures, the spraying and the so-called "shield" method. The success of the spraying for the species has been somewhat varied, the writer having found in treating an outbreak on potatoes that a spray of kerosene emulsion seemed to be very effective, while some observations have shown that the results were quite unsatisfactory, especially as applied to the adults. Dr. Hasemann recommends for apple a very heavy spray especially while the insects are in the nymphal stage in the early part of the season so as to secure practically extermination and prevention of the later broods. With potatoes a special spray which was directed so that the adults in leaping from the plants were certainly wet by the solution seemed however, very effective and an adjustment of the spraying machinery so that a similar result could be obtained on apple trees or nursery rows, ought, it seems to me, to be equally effective. The shield method consists in the use of a sheet of paper or canvas covered with tar or "tangle-foot" carrying it along

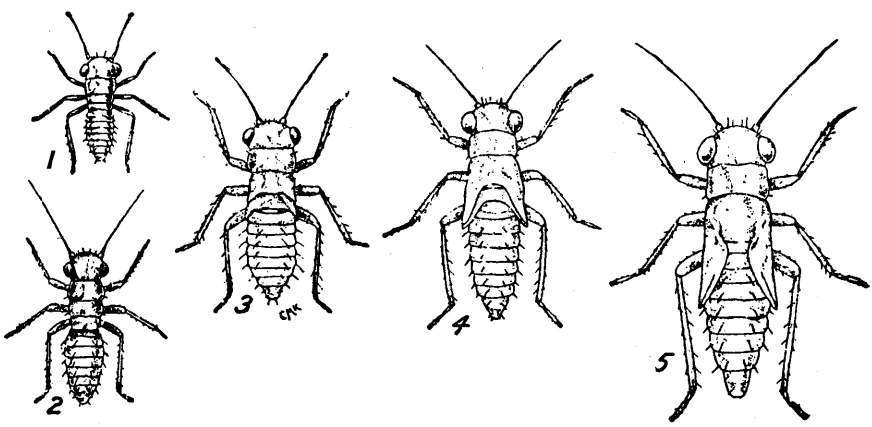


Fig. 35. *Empoasca mali*, nymphal stages 1 to 5. (After R. L. Webster, Iowa Exp. Sta. Bulletin.)

close to the plants and disturbing the plants so as to make the hoppers jump up against the shield where they will be caught in the sticky material. Such an apparatus mounted on wheels and drawn through nursery rows has been recommended for freeing nursery stock from the species and some similar adjustment may be made for potatoes or beans in field rows.

Eupteryx nigra Osborn.

Eupteryx nigra Osborn. Rept. N. Y. State Entomologist, XX, 543.

Above black except anterior border of vertex and costal border of elytra; below greenish white except pygofers which are smoky black. Length 3.75 mm.

Collected on ferns at Orono July 29th, Aug. 5th, Bar Harbor Aug. 31st, July 10, 1914.

These specimens agree very closely with the description and types which were females but a male taken July 29th differs in the darker front, the absence of white costa and the dark color of the abdominal segments, the margins only being white.

The females agree in all details except that the central abdominal segments have dusky bands. The original description was based on a specimen taken at Jamaica, Long Island and one from Columbus, Ohio, so the present records considerably extend the range of the species. The species is of no particular economic importance but is of interest as one of the few species that occur on ferns.

Eupteryx flavoscuta Gillette.

Eupteryx flavoscuta Gillette. Proc. U. S. Nat'l Mus. XX, 749 (1898).

Yellow beneath and suffused with smoky black above the front border of the vertex, a quadrangular spot on central base of pronotum and the scutellum, border of costa at center and a more or less extended spot on commissure, yellow. Length 3 mm.

Our specimens were collected at Orono, July 8th, Aug. 5th, and at Mt. Katahdin Aug. 20-22nd, Kineo, Aug. 17th. They agree well with Gillette's description but most of our specimens are darker above and the yellow spots on costa and clavus would seem to be larger and more brightly colored. They occur on ferns and usually in very small numbers.

Typhlocyba obliqua Say.

Tettigonia obliqua Say. Acad. Nat. Sci. Phila. IV, 342, 1825.

Erythroneura obliqua Fitch. Homop. State Cab. N. Y., p. 63, 1851.

Typhlocyba obliqua Gillette. Proc. U. S. Natl. Mus. XX.

Light yellow with two distinct oblique red stripes on the elytra following the line of the claval suture, one on the clavus and the other on the disk of the corium. Length 3.5 mm.

This species is less common than the *comes* which is so universally common on grape but it sometimes appears in large numbers. The Maine specimens are recorded for June 11 as taken from "sweet grass," but it is probable that they had scattered from some other plant.

Typhlocyba vulnerata Fitch.

Erythroneura vulnerata Fitch. Homop. N. Y. State Cab. p. 62, 1851.
Typhlocyba vulnerata Gillette. Proc. U. S. Natl. Mus. XX.

Dark gray or purplish with yellow spot and some slender red lines, with a dark spot at end of clavus. Length, 3.5 mm.

This species appears to have been rarely observed in the state though in other parts of the country it is often abundant. One record for Orono, Aug. 22nd, 1911.

THE GRAPE LEAFHOPPER.

Typhlocyba comes Say.

Typhlocyba comes Say. Jour. Acad. N. S. Phila. IV, p. 343 (1825).
Erythroneura vitifex Fitch. Tr. N. Y. State Agr. Soc. XVI, p. 392 (1856).

Minute pale yellow with bright red spots and three black points on the elytra. Length 3 mm.

This is the very common and widely distributed species occurring on grape vines and it doubtless occurs everywhere in the state where grapes are grown. Records run north to Ft. Kent. It has not been observed in as great abundance here as in some other parts of the country but I have not had opportunity to inspect vineyards to any great extent and cannot assume that there is any lack of abundance as a general thing.

Where grape growing is of importance attention to the ordinary means of control is desirable. Spraying with the tobacco decoctions or extracts and the shield method of capture are the main reliance.

The species is a variable one but Gillette has considered the *vitifex* of Fitch as covered by the original description of *comes* of Say.

Typhlocyba comes var, *ziczac* Walsh.

Erythroneura ziczac Walsh Proc. Bost. Soc. Nat. Hist. IX, p. 317, 1864.
Typhlocyba comes variety *ziczac* Gillette Pr. Nat'l Mus. XX, 761.

This variety of *comes* has been taken abundantly from *Cornus* at Orono in July, 1914. It differs from the typical form in the zigzag brown marking of the elytra which are darker than in the *vitis* form.

Typhlocyba comes var *vitis* Harris

Tettigonia vitis Harris. Enc. Am. VIII, p. 43, 1831.
Typhlocyba comes var *vitis* Harris Gillette. Pr. U. N. M. XX, p. 760.

This is probably the most common variety in this section of the country and differs from the other varieties in the more distinct yellow color and the small but bright red spots on the elytra.

Typhlocyba querci Fitch.

Typhlocyba querci Fitch Homop. N. Y. State Cab. p. 63 (1851).
Typhlocyba querci Gillette Proc. U. S. Nat'l, Mus. XX, 766. (1898).

White, the elytra semitransparent with three smoky spots in the ends of the discal cells next the cross veins. Length 3 mm.

Specimens of this species have been taken at Orono, Aug. 1st and 5th July 29th; in Deering Park, Portland, Aug. 14th. There is also a specimen in the station collection credited to "Me." but without locality or date.

The species is known to occur at times in enormous numbers and in such cases must cause a serious drain on the trees affected. While the typical form occurs regularly on oak, specimens of this as well as of the varieties are found on other trees. At Monmouth a number were taken from Buckeye but an oak tree was near at hand and migration even for nymphs an easy matter. Where so abundant as to require attention kerosene emulsion or a tobacco solution spray is recommended.

Typhlocyba querci var *bifasciata* Gillette and Baker.

Typhlocyba bifasciata Gillette and Baker, Bull. 31, Colo. Agr. Exp. Sta. p. 111, 1895.
Typhlocyba querci var *bifasciata* Gillette Proc. U. S. Nat'l Mus. XX, 766.

This well marked variety of *querci* has been taken in a larger number of localities in the state than the typical *querci* and while quite common it has not at any place been found swarming in such immense numbers as I have noticed in other states.

This variety differs from the typical form in the presence of two broad smoky brown or black bands on the elytra. The general color is yellow, the scutellum smoky black. Length 4 mm.

Specimens have been taken at Orono July 31, Aug. 5th and 12th; North Harpswell, Aug. 12th; Portland (Riverton Park) Aug. 14th; Mt. Katahdin, Aug. 22; Houlton, Aug. 24th; Ft. Fairfield, Aug. 26th; Van Buren, Aug. 27th.

Typhlocyba lethierryi Edw.

Typhlocyba lethierryi Edwards. Hemip.-Homop. British Islands, p. 216.
Typhlocyba lethierryi Gillette. Proc. U. S. Nat. Museum, XX, p. 771.

Similar to *rosae* but sulphur yellow instead of pale yellow. The bright yellow terminates at apical cross nervules. Eyes dark and ovipositor black. Length 3.5 mm.

Our specimens were taken at Orono Aug 18th and 24th, 1914. Edwards states that it occurs on various trees but more particularly on the elm. So far, it has been noticed only in small numbers.

Typhlocyba tenerrima Herrick-Schaeffer.

Typhlocyba tenerrima Herrick-Schaeffer. D. Ins. p 124, 10 u. 164.16 (vide Melichar).

Typhlocyba tenerrima Gillette. Proc. U. S. Nat'l Museum XX, p. 770.

A slender pale yellow species with a series of dark spots in front of the cross nervures and black spots at ends of outer cross nervures and inner and outer apical nervule. Length 3 mm.

Specimens collected at Orono July 20th, Portland Aug. 13, Van Buren Aug. 27th, 1913.

Typhlocyba commissuralis Stal.

Typhlocyba commissuralis Stal, Stett. Ent. Zeit., XIX, 196, (1858).

Typhlocyba commissuralis Gillette. Proc. U. S. Nat'l Mus. XX, 769. (1898).

White with a black commissural line. Closely resembling *rosae* except for the black stripe running along the inner border of elytra. Length 3.5-4 mm.

This species was described from Sitka, Alaska, and Gillette has added records for Vancouver Island and Cimarron, Colorado. I have not seen any records for localities farther east and consequently the record for Maine gives it a greatly extended range. The food plants mentioned by Gillette are alder, willow and weeds. The species is closely related to *rosae* but larger and Gillette says that the commissural line is wanting in some specimens in which case they are not distinguishable from *rosae* except by the slightly larger size.

The species evidently has no economic importance in Maine as aside from its extreme rarity it does not attack plants of special value.

The specimens on which our record is based were taken at Van Buren Aug. 27th, 1913, and Orono Aug. 18th and 19th, 1914.

The Rose Leafhopper.

Typhlocyba rosae L.

This minute and widely distributed species has been taken at Orono in 1913 and 1914, and while not in such numbers as are sometimes noted the leaves on some of the bushes affected showed a very decided whitening from their punctures. It will doubtless be found generally distributed over the state wherever roses are cultivated. Portland, Aug. 14. Westbrook (Stover).

This species is nearly white without any conspicuous dark markings, about three millimeters long quite slender and usually conspicuous only when the numbers have become sufficient to give the leaves a spotted or whitened appearance.

Since it is the only common species affecting the rose there is little difficulty in identifying it.

The delicate white cast nymphal skins adhere to the leaves and are a sure indication of the presence of the insect even if adults or living nymphs are not seen. On Aug. 2nd, when observations were made only adults and nymphal skins were observed. The young develop during the early summer and it is supposed that adults pass the winter hidden among dead leaves and other rubbish at the surface of the ground. Where the insect becomes troublesome a kerosene emulsion, or tobacco decoction spray may be used. Specimens apparently belonging here have been taken also from the witch hazel.

INDEX TO GENERA.

BULLETIN 239.

STUDIES ON BEAN BREEDING. I. STANDARD TYPES OF YELLOW EYE BEANS.[1]

By RAYMOND PEARL and FRANK M. SURFACE.

HISTORICAL.

Several years ago the Experiment Station began some breeding work with beans. The immediate problem for which the work was undertaken was to procure true-breeding strains of Yellow Eye beans. A great deal of difficulty has been experienced by bean growers in securing strains which would come even reasonably true to seed. In spite of careful seed selection for many years strains of these beans often continue to throw small numbers of black, solid yellow, mottled or white beans every year. Many of the large growers complain that in order to secure a good price for their crop it is necessary to hand-pick their beans every year.

At the time our work was started it was believed that it would be a relatively simple matter to secure pure-breeding strains but our experience has shown that this is not the case. It has been generally supposed that the bean flower is normally self-fertilized; that is, that the pistil or female portion of the flower is fertilized by pollen from the same blossom. It was believed that this fertilization always takes place before the blossom opens. Three years ago we found that this is not *always* the case, but that cross-pollination could be, and under our conditions often was, brought about by bumble-bees (*Bombus* sp.).

If one watches a large bumble-bee working in a bean field

[1]Papers from the Biological Laboratory, Maine Agricultural Experiment Station, No. 84.

it will be seen that when he lights on the lower petals of the flower the long pistil is forced out until it touches his body. This pistil is covered with pollen from its own flower and some of this is rubbed onto the bee's body. When he visits the next flower the operation is repeated and some of the pollen from the first flower may be left on the pistil of the second. Where more than one kind of beans are grown in the same or adjoining fields they are almost certain to be mixed. The mixing is all done by the large bumble-bees since the honey bees are too small to trip the petals and force out the pistil.

For this reason it has been necessary to carry on the bean breeding under other conditions. In 1913 there was built at Highmoor Farm a bean cage 25 x 50 feet which was enclosed on both top and sides with screen wire. This effectually excludes all insects which might cross-pollinate the bean flowers.

By this means it will be possible to secure strains which will breed true to all their characters. However, this matter has greatly delayed the bean breeding work of the Station. It is now necessary to test each strain several years inside this cage to find whether it is breeding true or not. When this has been ascertained the most promising strains will be multiplied in isolated plots and the seed offered to the growers of the State. In order to maintain such a strain pure it will be necessary for the grower to plant only one kind of bean or at least to have the different kinds so separated that there will be no danger of crossing by the bumble-bees.

One of the first difficulties which arose in connection with this breeding work was the absence of any standard for the different classes of yellow eye beans. Inquiries among several of the large bean growers of the State showed that in the majority of cases each man had a different idea of the correct type for the Old Fashioned or the Improved Yellow Eye bean. Further inquiry among the dealers, both in and out of the State, showed that not only were these men not united on the question of type, but that often their ideas were quite different from those of the growers.

Obviously such a condition of affairs is not conducive to the best interests of the bean growers. For this reason it seemed that the first thing to do was to attempt to establish standard types for these classes of beans. If these types are accepted by the dealers, and the growers will direct their efforts towards the production of beans of the desired types, it will add much to the bean growing industry of the State.

With a knowledge of these facts, the Experiment Station Council in 1912 passed a resolution requesting the Station to coöperate with the State Department of Agriculture, the Maine Seed Improvement Association and the Boston Chamber of Commerce, looking towards the establishment of standard types of Maine yellow eye beans.

During the past three years correspondence has been carried on with many of the growers and dealers within the State in order to learn their ideas regarding these varieties. In addition, personal conferences have been held with members of the Boston Chamber of Commerce and particularly with several of the large bean dealers in Boston.

Through these efforts definite ideas have been obtained as to what the growers regard as typical of these varieties. Also what is of still more importance, we have learned the types which the dealers want and for which they are willing to pay the highest prices.

In the following pages the information obtained in these ways will be discussed. A standard type for each of the classes of beans dealt with will be proposed. In preparing these standards we have kept foremost in mind the demands of the market. It is obviously useless to develop a type of bean for which there is and can be no market. In the second place we have aimed to establish a type which the breeder can easily produce and maintain.

In doing this it has not always been possible to include the ideas of local growers. For these reasons there will undoubtedly be some criticism of these standards. This would obviously occur whatever type is selected for a standard. These standard types have been selected after much careful study on our part. However, not being content with our own judgment in the matter, we have sent the manuscript and figures of this bulletin to the principal wholesale dealers and jobbers in beans in Boston for criticism. The final results embody their suggestions, and the standards here proposed are acceptable to them. Consequently if the growers in the State will aim to produce beans of these types they may be assured that their beans will find a ready market. Further, if a large portion of the growers will unite in the production of such Maine standard types it will not be long until the fact is recognized in the large markets. If it comes to be known that Maine is producing a uniform standard type of Improved Yellow Eye beans, for example, there will be a much greater demand for Maine grown beans of this kind.

Bean Production in Maine.

Before discussing the standard types proposed it will be worth while to consider briefly the relative importance of the bean crop in this State. According to the last United States census (1910) Maine ranked fifth among the states in the production of dry edible beans. Some idea of what this means may be gained from the following figures taken from the Census Report (Vol. 5). The figures give the production in 1909 of the five largest bean producing states.

Michigan	5,282,511	bus.
California	3,328,218	"
New York	1,681,506	"
Wisconsin	154,570	"
Maine	87,565	"

From this table it is seen that although Maine occupies fifth place it is very far below the remaining four states in absolute production. We further learn from the Census Report that the production of beans in Maine has decreased from 137,290 bushels in 1899 to 87,565 bushels in 1909. It is not our purpose to analyze the causes of this decrease of over 36 per cent. Our inquiries and observations however indicate that a considerable portion of this decrease is due to inability to maintain pure breeding strains. It has been the custom of many growers to plant several varieties in the same field. Our experiments have shown that under such conditions many of the beans will be cross-pollinated by the bumble-bees. The results of this crossing are not visible the first year, but when such seed is planted the second year it will break up into all sorts of types. Even if no further crossing took place, it would require several years selection for the grower to obtain pure breeding seed again. But new crossing will take place every year and consequently in spite of rigid selection the beans become more and more mixed each year. To our knowledge the bumble-bees have in this way put more than one large grower out of business.

The first thing that the bean grower must realize is that his seed must be produced in an isolated field where there is little opportunity for crossing with other varieties. In Circular No. (510-5-15) of this Station we have attempted to give some directions which will aid the grower in producing and maintaining pure breeding strains. But in order to do this successfully the grower must limit himself to one, or at the most two varieties. Each of these must be grown in fields separated not only from his own but from his neighbors' beans.

There seems to be no reason why the bean crop should not become a very important one in Maine. Most of the varieties of bush beans will easily mature in from 90 to 100 days. For the southern and central parts of the State it is a practically sure crop so far as frost is concerned. The return per acre compares very favorably with that of the cereals. Further the bean plant is a legume, belonging to the same general family to which the clover belong. The great benefit brought to soils by cropping with clovers lies in the ability of these plants to gather nitrogen from the air through the agency of the bacteria living in the nodules on the roots. The bean plant also collects nitrogen from the air by similar means. Thus at the same time that a profitable crop is being produced, the soil is being enriched by the addition of nitrogen. For a large portion of the State beans are an excellent crop to use in the rotation.

Yellow Eye Beans.

The most popular varieties of beans grown in the State are the so-called Yellow Eye. Of these there are two principal classes, the Improved Yellow Eye and the so-called Old Fashioned Yellow Eye. Conversations with growers within the State have revealed the fact that there is a great difference of opinion as to the distinction between these two types of beans. Some growers are inclined to make the distinction upon the shape of the bean without reference to the color pattern, while others distinguish between them by the color pattern alone. Still others distinguish them by both color pattern and shape. In the following description we shall make the *chief* distinction between these varieties on the color pattern alone. This difference is shown in Figs. 36 and 38. There is also a slight difference in shape between typical strains of these varieties (Figs. 37 and 39). However, the market takes no account of differences in the shape of these two kinds of beans.

As a matter of fact it appears that outside of Maine only one of these types, the Improved Yellow Eye, is grown to any extent. In his work on bean varieties Tracy[2] lists an Improved Yellow Eye but does not mention an Old Fashioned Yellow Eye. He does, however, refer to a Yellow Eye Field bean which in many respects corresponds with the Old Fashioned type.

Improved Yellow Eye.

In regard to the Improved Yellow Eye, Tracy says that it has been listed by seedsmen in this country since about 1880. "The beans are of medium size, proportionately short and roundish in cross section. The ends are either truncate or round. Often the beans are larger at one end than at the other. The eye is either straight or rounded. The color is solid white except brownish ochre around the eye covering about one-fourth the area of the beans."

This description corresponds very well with the type of bean desired in the Boston market under this name. In Figs. 36 and 37 we have illustrated the type of the Improved Yellow Eye which meets with most favor among the bean dealers in Boston. It is proposed to make this bean the standard type of the Improved Yellow Eye for Maine. It is urged that the growers in the State bend their efforts towards the production of beans of this type. We have the assurance of the Boston merchants that beans of this type which fulfill the requirements given in the following paragraphs will receive the highest market price for Yellow Eye beans.

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[2]Tracy, Jr., W. W. American Varieties of Garden Beans. U. S. Dept. of Agr., Bur. of Pl. Ind. Bul. 109, pp. 1-173, 1907.

THE STANDARD TYPE OF THE IMPROVED YELLOW EYE.

There are certain points in regard to these beans upon which the dealers lay great stress and other points to which they pay relatively little attention. In the next few paragraphs it is proposed to point out those characters which the Standard Improved Yellow Eye bean must possess. At the same time will be indicated those characters to which the buyers pay less attention.

Size and Shape. The Improved Yellow Eye bean should be of medium large to large size. Its length should be a little less than $\frac{5}{8}$ of an inch. It must be proportionately broad, giving a plump appearance. Its width should be a little more than half the total length. The typical bean should be rounded at each end. It should have the same thickness at each end, or in other words it should not taper (Cf. Fig. 36). It should be straight at the eye.

Of these characters the one to which the dealers pay most attention is size and plumpness. There is no market for a small bean of this type, nor for a long and narrow bean. Such types should not be grown. Other characters such as shape of the ends and at the eye, etc., are not usually discriminated against. Yet in the interest of uniformity breeders will do well to aim to produce the type given above.

Ground Color. Outside of the "eye" the color should be a clear opaque white without any tinge of yellow. This, next to size and plumpness is the most important character. Beans with a yellowish dirty tinge in the white portion invariably bring less in the market than beans with a good clear white. Such yellowish tinge may result either from the actual presence of creamy pigment in the seed coat, or from a too transparent seed coat which allows the color of the cotyledons to show through. Whatever the cause, anything but a pure opaque white is discriminated against in the market and should be by the grower.

Eye Pattern and Color. The "eye" (i. e., the pigmented portion about the hilum or true eye) should be large and should cover about one-fourth the area of the bean. A bean of the proper shape when viewed from on top should show a very narrow margin of white on all sides of the eye with the possible exception of the anterior end[8] where the color may extend a little farther towards the lower surface. (Fig. 40 top row). The outer border of the eye should be clear-cut and regular in outline, except that it may be slightly irregular at the posterior end (Fig. 36).

The color should be uniform throughout the eye except the narrow ridge surrounding the hilum and over the caruncle where the color is always darker than elsewhere. The color over the remainder of the eye should be of a medium dark shade as illustrated in Fig. 36.

These are the requirements in pattern and color for the standard Improved Yellow Eye. The two things besides size and plumpness upon which the dealers insist most are (1) that the background should be a clear opaque white and (2) that the eye should be large. It is much better for the eye to be larger than the standard rather than smaller. Considerable laxity is allowed in regard to the shape of the eye pattern and also in regard to spotting. At the present time no discrimination in price is made if the eye pattern is irregular in outline, or if there is a reasonable amount of spotting. There is indeed a certain class of trade in Boston, particularly Italian and Jewish, which prefers a densely spotted bean, like that shown at *a* in Fig. 41. Such a bean however is not an Improved Yellow Eye. This class of trade would no doubt be as well or better satisfied with a solid yellow bean.

In regard to the eye color itself considerable variation will be allowed without discrimination in price. However, the market distinctly prefers a medium dark eye color. Very light shades will not sell readily.

The color must always be clear and bright. In a letter of March 16, 1915, from Chas. H. Stone & Company, of Boston, this concern, which is one of the largest handlers of produce in Boston, says: "A medium dark eye is more desirable than the usual light shade. But the dark color must be clear and

[8]In this paper the following orientation of the bean will be used. The area by which the seed is attached to the pod is the hilum. This side of the bean is the *ventral* and the opposite side the *dorsal*. At one end of the hilum there is a very small depression, the *micropyle*. This end is the anterior. At the opposite end of the hilum is a small raised area, the *caruncle*. This end is the *posterior*.

bright, otherwise the lighter shade, if it is clear and bright, will be preferred. That is to say, the brightness of color is of more importance than the shade."

To sum up, the chief requirements of an Improved Yellow Eye bean are: that it must be relatively large and of sufficient depth of color to contrast strongly against the clear opaque white background.

In Fig. 40 are shown some of the variation from the standard type of Improved Yellow Eye against which there is at the present time no discrimination in the market. In Fig. 41 are shown a few of the types which the dealers do not want and which on the average will not bring the best prices.

One other point should be mentioned in connection with these beans. This is the uniformity of the product not only of each grower but of each community or better of the State as a whole. It is obvious that in order to secure fancy prices a man must not only have *some* beans of the standard type, but he must have them *all* of that type. The more nearly uniform and true to type the better price one can expect for his crop. When it becomes known that a community is producing a standard uniform type of bean, the dealers will be willing to pay a better price for the product.

Of the various types of Yellow Eye beans the Improved, or as it is sometimes called the Boston Yellow Eye, is by far the best seller in the Boston market. There is more demand for this bean than for any other type of Yellow Eye. Consequently growers of this variety are always assured of a ready market for their crop.

According to our experience the type of Improved Yellow Eye described above is of the short runner type of plant. Under ordinary conditions the runners are from 2 to 3 feet long. Where the beans are grown in a field by themselves this is an advantage in that it gives opportunity for a larger yield. Where beans are grown in with corn, however, this is a disadvantage, since in harvesting the beans the corn is likely to be injured. One of the objects of the Station's breeding work is to produce a good yielding standard Improved Yellow Eye of the bush type.

Old Fashioned Yellow Eye.

As mentioned above, Tracy[4] describes a "Yellow Eye Field" bean which corresponds very well with what is generally known in this State as the Old Fashioned Yellow Eye. Of this bean Tracy says that it is a very old variety listed by seedmen at least since 1874. It was formerly much more grown than now. It is distinct from and of about the same usefulness as the Improved Yellow Eye. It resembles this latter variety more than any other, but has narrower, flatter seeds with a smaller area of yellow. He further says that the eye is of "about the same color and shape as the Golden Eyed Wax" of which he gives a figure.

From the information gathered by us it appears that this Old Fashioned Yellow Eye was formerly grown much more extensively in this State than at present. On the other hand, one gains the idea throughout the State that the Old Fashioned type is again becoming more popular. Whether it is really more widely grown than a few years ago, it is difficult to say.

Boston bean merchants in general say that outside of Maine there is practically no demand for the Old Fashioned type of bean. They tell us that when they receive a lot of these beans (most of which are grown in Maine) they are largely sent to jobbers and retailers in Maine for sale within this State. Under such conditions there is not the same wide market for the Old Fashioned Yellow Eye that there is for the improved type.

The only exception to this statement which we have been able to learn of is contained in a letter from Chas. H. Stone & Company, Produce Commission Merchants, 9 Chatham Row, Boston. They say: "Our experience, however, is a little different from that which you found in that we have always been able to get a better price for the old fashioned Yellow Eye than we have for the improved type."

"You speak of the "improved" as by far the best seller in the Boston market. This, as we said before, has not been our experience, but possibly it may have been with other dealers. Also you speak of there being no demand for old fashioned Yellow Eyes outside of Maine. While there is always a demand for the old fashioned in Maine we have found a good

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[4] *Loc. cit.*

sale for them in Massachusetts and should certainly not discriminate against the old fashioned "Yellow Eye."

Regarding these statements our only comments would be, first, that they are not in accord with what other large dealers in Boston have told us, and, second, that under these circumstances, it would seem that the Maine grower who has some Old Fashioned Yellow Eyes to dispose of beyond what his local market will absorb would perhaps do well to send them to Chas. E. Stone & Company, as they, on their own statement, have a good market for them.

Maine consumes annually large quantities of beans. At the present time it would appear that our consumption must nearly if not quite equal our production of this crop. So long as the demand for Old Fashioned Yellow Eyes continues within the State there is not much danger of the supply exceeding the demand. However, it is believed that large growers will find it more advantageous to confine their attention to the Improved Yellow Eye. On account of its wider market the producer will on the average have a much better opportunity to dispose of his crop to advantage.

It is not at all difficult to find large numbers of people within the State who claim that the Old Fashioned Yellow Eye bakes much better and has a better flavor than other types of beans. No doubt an equal or greater number of people could be found to claim the same for the Improved Yellow Eye. It is extremely improbable that either baking quality or flavor is closely associated with the shape of the color spots on the bean. Different strains of each variety no doubt differ in quality but undoubtedly equally good strains exist in each. This market preference is in the same class with that for brown or white shelled eggs. So long as the consumer gets satisfaction from such differences, whether real or imaginary, it is the business of the growers to produce them in accordance with the demand.

THE STANDARD TYPE OF THE OLD FASHIONED YELLOW EYE.

In the following paragraphs we have attempted to describe the standard for Old Fashioned Yellow Eye beans which most nearly meets the demands of the dealers and growers within the State and which also is in agreement with the ideals of the Boston merchants. This standard type is illustrated in Figs.

38 and 39. In addition to the description of this type we shall indicate some of the variations in type, pointing out especially those for which there is no general market.

Size and Shape. To meet the present market conditions the Old Fashioned Yellow Eye like the Improved must be of medium large size and of plump appearance. It must be emphasized again that there is no market for a small or slender *colored* bean for baking purposes. The typical Old Fashioned Yellow Eye is slightly smaller than the typical Improved. This difference, however, is of little importance since both must give the appearance of large plump beans.

In shape the typical Old Fashioned Yellow Eye is slightly more flattened laterally than the Improved. Instead of being of equal thickness at each end the Old Fashioned tapers towards the anterior end.[6] The posterior end is round and full. The anterior end is slightly truncated giving the appearance of a diagonal cut. (Fig. 39). The ventral or eye side should be nearly straight. The dorsal side (opposite the eye) should be rounded and taper towards the anterior end as shown in Fig. 39.

While the above description is taken as typical of the variety, any commercial lot of Old Fashioned Yellow Eyes will contain many other shapes. Some of these variations in shape are shown in Fig. 44.

The market-men do not make distinctions between different shapes. Their only requirement is that the beans shall be large and plump. They distinguish between Old Fashioned and Improved Yellow Eyes entirely on the eye pattern.

Ground Color. The ground color of the Old Fashioned Yellow Eye bean must be a clear opaque white. A yellowish tinge means a lower price. All that was said regarding this character in the Improved Yellow Eye applies with equal force to the Old Fashioned type.

Eye Pattern and Color. A typical Old Fashioned Yellow Eye pattern is shown in Fig. 38. Some of the variations of this pattern are shown in Figs. 42 and 43. The typical pattern will be discussed first.

The Old Fashioned Yellow Eye pattern consists typically of three color areas or color centers. The first of these is a

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[6]For explanation of these terms see foot-note on p. 168.

rather narrow stripe of pigment extending anteriorly from just in front of the micropyle to the apex of the bean. The second color area is that surrounding the micropyle and extending in the form of a horse-shoe around the anterior end of the hilum. This color area may or may not unite with the anterior stripe (cf. Figs. 42 and 43). The third color area is much larger than either of the others and much more variable in form. It covers the caruncle at the posterior end of the hilum and extends at least part way around the posterior end of the hilum. This pigment area may or may not meet the horse-shoe band from the second pigment area. If it does there is formed a narrow band of dark pigment surrounding the hilum (hilum ring). This third pigment area extends posteriorly almost but not quite to the posterior edge of the bean. In some cases the posterior edge of this area is forked or slightly irregular. Starting immediately behind the caruncle two rather broad wings extend forward along the sides of the hilum. These wings should extend forward to the level of the micropyle. These wings should not unite with the color area surrounding the micropyle. The colored area should be sharply defined with few irregularities. The pattern should be symmetrical on the two sides and there should be no spots outside the pattern.

The color of the eye should be medium dark as shown in Fig. 38. The color should be of even intensity over the whole of the pattern except in a narrow band around the hilum and in the region of the micropyle and over the caruncle. These areas have a much darker and browner pigment than the remainder of the pattern. The market requirements in regard to color are not strict. Any shade of brownish yellow pigment will be accepted provided it is not too light. As in the case of the Improved Yellow Eye the color must be deep enough to contrast with the white background. Light and faded appearing colors will not bring the best prices. Brightness of color is, however, always more important than the exact shade (cf. p. 168).

In regard to the color pattern itself there is an almost infinite number of variations from the type described above.

A number of these are shown in Figs. 42 and 43.[6] With few exceptions any of the variations in Fig. 42 would be accepted on the market as Old Fashioned Yellow Eyes. Beans in which the colored area is too small, as some of those in rows 1 and 2 of Fig. 42, would not bring the best price. Against the remaining beans, there would probably be no discrimination in price. However, in the interests of uniformity of type, breeders will find it to their advantage to approach as nearly as possible to the standard described above.

As indicated in these paragraphs, the only points in regard to the color pattern to which the dealers seriously object are (1) too small an eye pattern, (2) too pale a color, and (3) dullness of color. If a bean is to be eyed at all, the eye must be large enough and distinct enough to form a good contrast. These points together with the whiteness of the background and the large plump appearance of the seed are the things to be clearly kept in mind.

One other point should be mentioned in connection with these beans. There has several times appeared upon the market and in the seed shows of the State a variety of beans similar to those shown in Fig. 44. These beans are entirely white except for a dot of color at each end of the hilum. These beans have been listed in the past under the name "Old Fashioned Yellow Eye." Now they are usually listed as "Imperial Yellow Eye." In our study of this matter we have been unable to find any justification for including these "dot eyes" or Imperials in the Old Fashioned Yellow Eye class. We are further informed that in the large markets there is absolutely no demand for such beans. We, therefore, strongly recommend that growers who expect to sell their crop outside of purely local communities should *not* grow this type.

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[6]These two figures are taken from an unpublished thesis in the University of Maine library entitled "Variation in the Seeds of the Old Fashioned Yellow Eye Bean" by Mr. C. W. Barber.

Comments of Leading Boston Dealers in Beans on the Standards here Proposed.

As has been pointed out earlier, the standards for yellow eye beans herein set forth have been submitted to leading market men in Boston.[1] Some of their comments follow:

Chas. H. Stone & Company, 8 Chatham Row, Boston, say: "We have been much interested in reading this report and with one or two minor exceptions we heartily agree with all you have said and believe it will be of great benefit to the bean growers here in Maine or any other state."

Mr. O. H. Dodds, the bean expert of the Thomas W. Emerson Company, 74-76 So. Market St., Boston, says under date of March 13, 1915: "Your treatise on Yellow Eye Bean breeding which was kindly left here for me to read, with request to offer what criticism I might see fit to make, I have carefully perused, and I fail to see where I can make any criticism. You seem to have covered the ground very thoroughly.

"Would say that there are only two kinds of Yellow Eye Beans which find a ready market here. One is the plump type of the Old-Fashioned Yellow Eye, and the large plump type of the Improved Yellow Eye. If the beans come anywhere near these two types they find a ready market here in Massachusetts, and also in Maine.

"Of course, it is plain to be seen that the sooner farmers come up to these ideals, they will have a better produce and receive a better price for same."

Mr. J. W. White, the bean expert of the Fowle, Hibbard Company, 173 State St., Boston, says: "We have been over the manuscript that was left with us and it will be presumptive on our part to add anything to the very clear and exhaustive treatise that you have made on the subject. The two types of Y. E. Beans we should consider almost perfect and if you can induce your farmers to use that kind of seed we believe we shall have a much better type of beans."

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[1]It is a great pleasure to acknowledge our indebtedness and to express our thanks to Mr. Robert H. Gardiner of Boston, formerly a member of the Council of the Maine Agricultural Experiment Station, for aiding us in getting in touch with the principal bean men in Boston.

Description of Figures.

Fig. 36. Standard type of Improved Yellow Eye Bean. Ventral view.

Fig. 37. Standard type of Improved Yellow Eye Bean. Side view.

Fig. 38. Standard type of Old Fashioned Yellow Eye Bean. Ventral view.

Fig. 39. Standard type of Old Fashioned Yellow Eye Bean. Side view.

Fig. 40. Showing some of the variations in typical Improved Yellow Eye beans. These beans are all of marketable types.

Fig. 41. Showing some of the undesirable types of Improved Yellow Eye beans. These beans are either too small or too slender or show too small and too irregular an eye pattern.

Fig. 42. Showing some of the variations in Old Fashioned Yellow Eye beans. Most of these beans are not of the ideal type but with few exceptions they would not be discriminated against in the market. (After Barber).

Fig. 43. Showing some of the variations in shape of the Old Fashioned Yellow Eye beans. (After Barber).

Fig. 44. Showing some variations in "Dot-eye" beans. These are not Old Fashioned Yellow Eye beans, and outside of a few purely local markets there is no sale for these beans. (After Barber).

FIG. 36. Standard type of Improved Yellow Eye Bean. Ventral view.

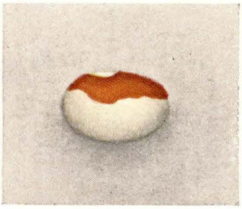

FIG 37. Standard type of Improved Yellow Eye Bean. Side view.

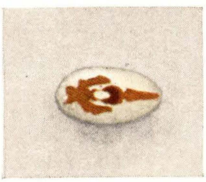

FIG. 38. Standard type of Old Fashioned Yellow Eye Bean. Ventral view.

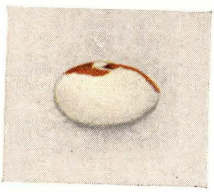

FIG 39. Standard type of Old Fashioned Yellow Eye Bean. Side view.

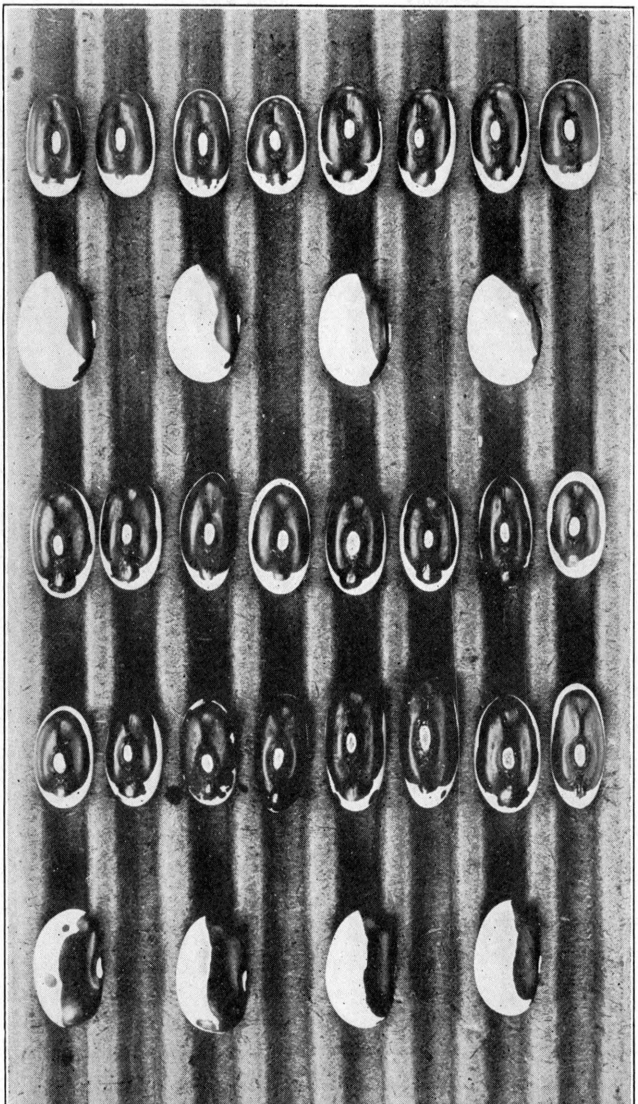

FIG. 40. Showing some of the variations in typical Improved Yellow Eye beans. These beans are all of marketable types.

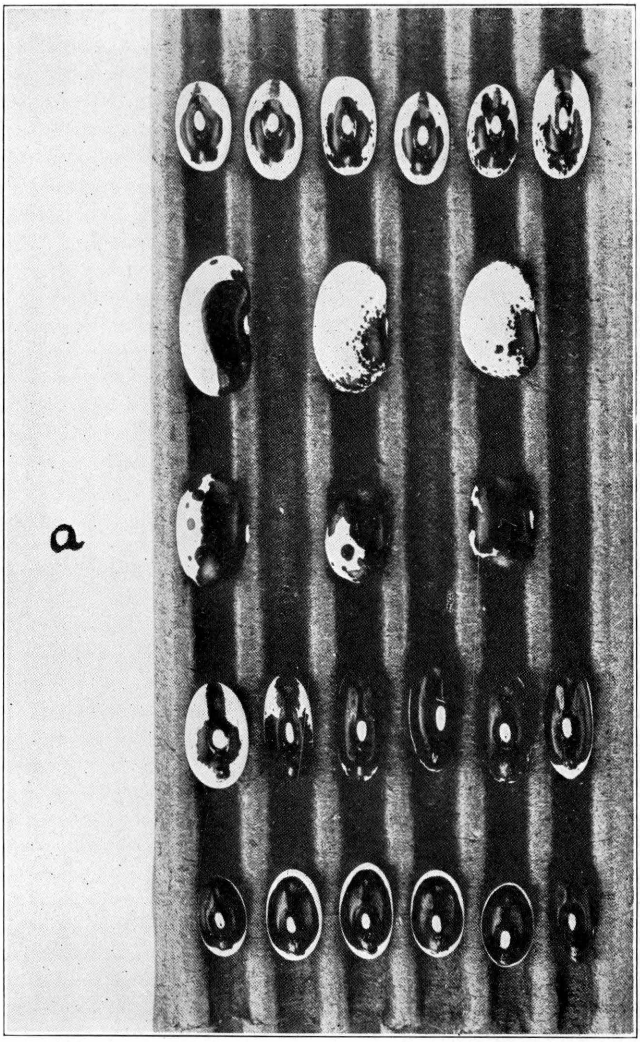

FIG. 41. Showing some of the undesirable types of Improved Yellow Eye beans. These beans are either too small or too slender or show too small and too irregular an eye pattern.

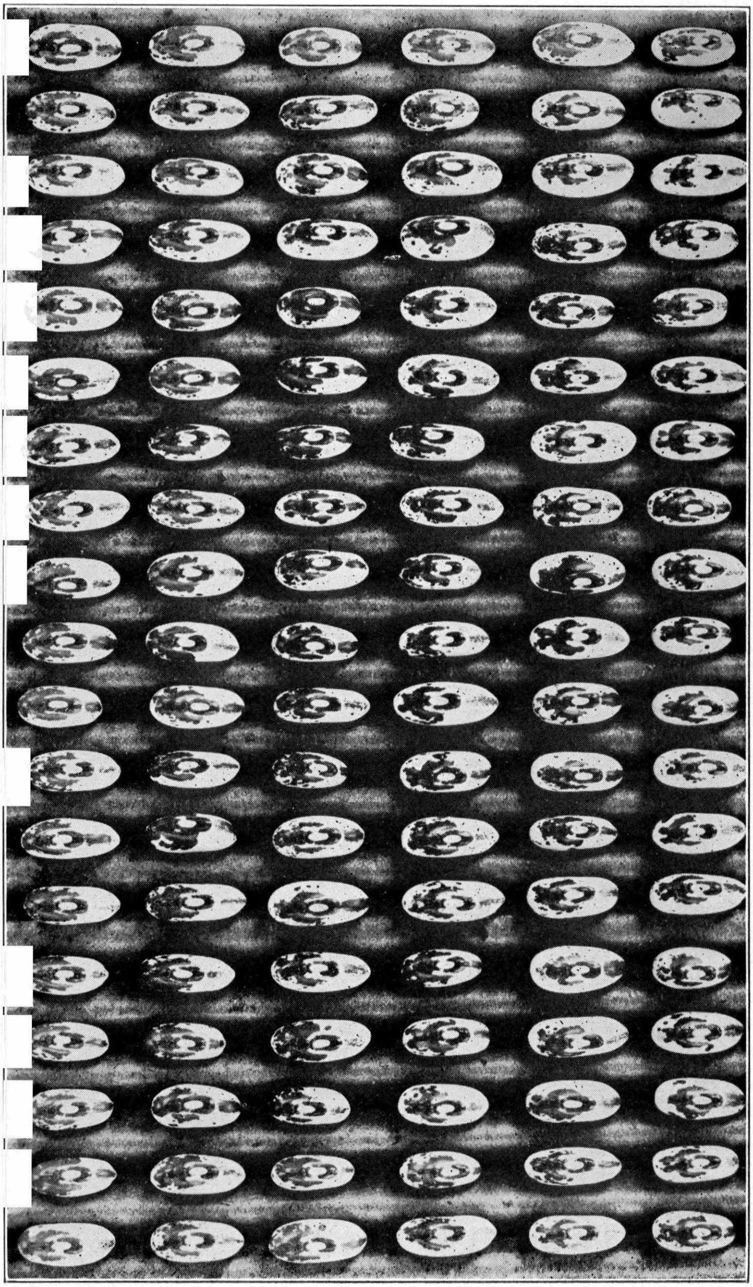

Fig. 42.

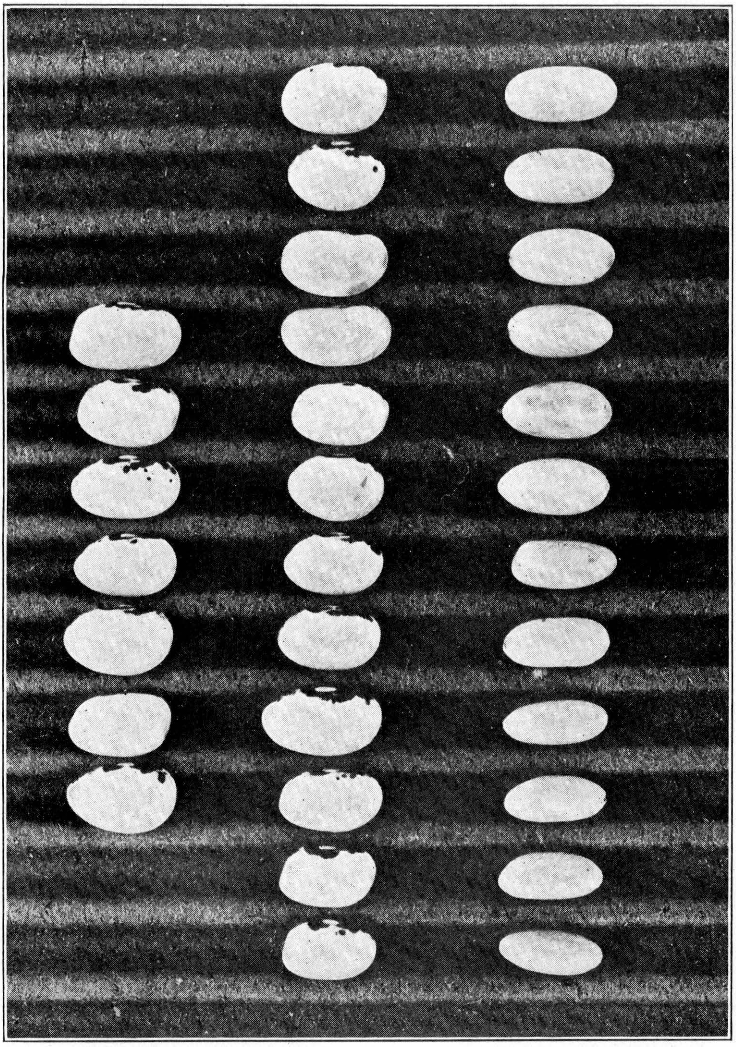

FIG. 43. Showing some of the variations in shape of the Old Fashioned Yellow Eye beans. (After Barber.)

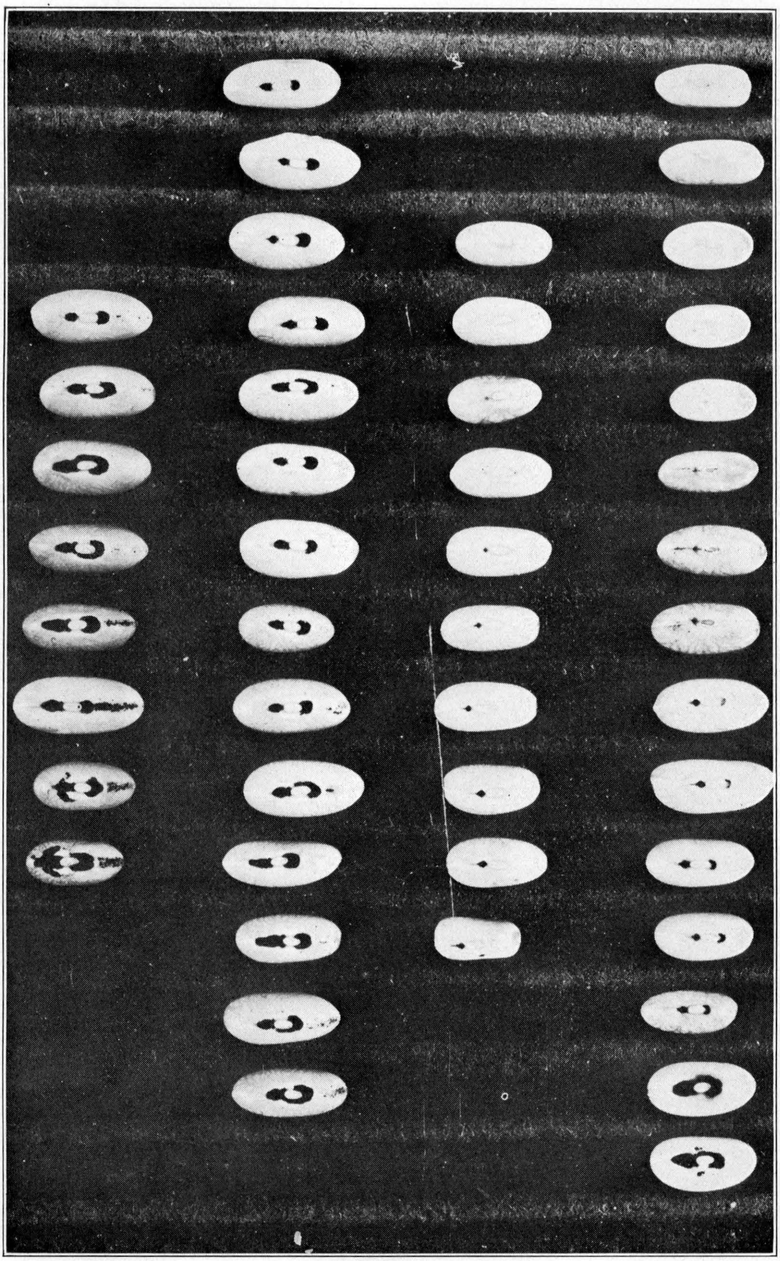

FIG. 44. Showing some variations in "Dot-eye" beans. These are not Old Fashioned Yellow Eye beans, and outside of a few purely local markets there is no sale for these beans. (After Barber.)

BULLETIN 240.

APPLE SPRAYING EXPERIMENTS IN 1914.

W. J. MORSE AND M. SHAPOVALOV.

While in many respects the problem of controlling apple scab by spraying has long since become merely a matter of demonstration, there are still certain phases of it, both from a scientific and a practical standpoint which require much additional study. In order to secure data applicable to Maine conditions this Station is conducting a series of apple spraying experiments at Highmoor Farm, Monmouth. That this is important and that it is not always safe to generalize too freely in adopting locally the conclusions derived from results obtained in widely separated parts of the country, under different climatic conditions, is shown later in this publication.

In carrying out work of this kind it is necessary to introduce certain experiments, in order to provide a base line upon which to draw conclusions, which if considered by themselves would be simply of the nature of a demonstration. It has also seemed important to those who have had the planning of these experiments in charge that they be outlined so as to cover an indefinite series of years, that is, continued for a sufficiently long period to secure accuracy of results, or in other words to eliminate as far as possible inaccuracies resulting from abnormalities in climatic conditions of individual seasons. The experiments in question have been carried out each year in the same part of the smaller of the two large Ben Davis orchards on the farm, although the number of trees involved has varied considerably from season to season.

THE 1914 EXPERIMENTS.

The number of trees involved in the 1914 experiments was 282, somewhat more than the previous year, all of the Ben Davis variety. In laying out the plots the trees were selected so as to make 47 rows of 6 trees to the row. With the exception of plot 1 which was made up of 3 rows or 18 trees, each plot consisted of 24 trees in 4 parallel rows.

The trees under experiment are now in a very thrifty condition, for they have received good care for the past 5 years. Some renovation work was done on them in 1909, but previous to that for several years they had been badly neglected. On account of increasing the number of plots it has been necessary to utilize some trees which were less thrifty than the average in this part of the orchard when the Station took charge of the farm and which are consequently still somewhat inferior to the others. In 1914 this more particularly applied to plots 11 and 12, and to a less extent to plots 8, 9 and 10.

TREATMENT OF THE PLOTS.

The following is the spraying treatment outlined for each separate plot. The dates of application are given on page 182.

Plot 1. Bordeaux mixture, 3-3-50 formula, plus one pound of dry arsenate of lead to 50 gallons.

Plot 2. First application like plot 1; later applications 2 pounds of dry arsenate of lead to 50 gallons of water.

Plot 3. First application lime-sulphur 20 per cent stronger than standard dilution* plus one pound of dry arsenate of lead in 50 gallons; later applications like plot 2.

Plot 4. Standard dilution lime-sulphur plus one pound of dry arsenate of lead in 50 gallons.

Plot 5. Like plot 4 with the first application omitted.

Plot 6. "Soluble sulphur" three-fourths pound and one pound of dry arsenate of lead in 50 gallons of water.

Plot 7. "Atomic sulphur" 7 pounds and one pound of dry arsenate of lead in 50 gallons of water.

Plot 8. Standard dilution lime-sulphur plus 2 pounds of copper sulphate and one pound of dry arsenate of lead in 50 gallons.

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*By standard dilution is meant the equivalent of a 1 to 40 dilution of a 33° Baumé lime-sulphur concentrate. For a 20 per cent stronger dilution, one-fifth more of the concentrate was used for making a given amount of spray than was used for making the standard dilution.

Plot 9. Extra fine sulphur 10 pounds plus one pound of dry arsenate of lead in 50 gallons of water.

Plot 10. Lime-sulphur 20 per cent stronger than standard dilution plus one pound of dry arsenate of lead in 50 gallons.

Plot 11. Two pounds of dry arsenate of lead alone in 50 gallons of water.

Plot 12. Unsprayed check.

Plots 1, 4, and 12, sprayed with bordeaux mixture, standard dilution lime-sulphur, and unsprayed, respectively, were introduced as checks upon which to make comparisons in judging the results obtained upon the other plots.

The spraying program laid out for plots 2, 3, and 11 was suggested by the results obtained with arsenate of lead as a fungicide during the two previous seasons.* The efficiency of this material in controlling apple scab, when used somewhat in excess of the usual amount employed as an insecticide, suggested a possible modification in spraying procedure which might still control both scab and insect enemies and at the same time simplify the work of orchard spraying. This plan was to use a strong fungicidal spray combined with the usual amount of arsenate of lead when the blossom buds are showing pink, but for later sprayings to depend entirely upon double strength arsenate of lead alone for controlling both scab and insect enemies. Plot 11, sprayed with arsenate of lead alone throughout the season, was introduced in order to obtain additional data upon the fungicidal value of this material.

Plots 5 and 10 were primarily for comparison with plot 4 which was sprayed 3 times with standard dilution lime-sulphur. It is generally conceded that the application of fungicides when the blossom buds are showing pink is a very important one from the standpoint of scab control. Partly through accident this was brought out quite forcibly in the 1912 experiments. On the other hand omitting this first application of lime-sulphur in 1913 resulted in but a slight increase of scab. Hence plot 5 was introduced into the 1914 experiments to test this matter again in

*Morse, W. J. and Yeaton, G. A. Orchard Spraying Experiments in 1912. Maine Agl. Exp. Sta. Bul. 212: 69-70. 1913.

Morse, W. J. Spraying Experiments and Studies on Certain Apple Diseases in 1913. Maine Agl. Exp. Sta. Bul. 223: 13-16. 1914.

comparison with plot 4. Plot 10 was also a continuation of the work of previous years, the object being to determine whether or not it is safe and profitable to add 20 per cent more of the lime-sulphur concentrate to a given amount of water, thus increasing the strength of the summer spray to that extent.

In 1913 a proprietary spraying material in powder form, known under the trade name of "Soluble Sulphur," was used at the rate of 2 pounds to 50 gallons of water in combination with one pound of dry arsenate of lead. While this material appeared to be quite effective in scab control that season very serious leaf injury resulted. Correspondence with orchardists in various parts of the State, who had used this material as a summer spray, showed that in the majority of cases they had experienced a like difficulty. Plot 6 was a repetition of the previous trial of this material, but the amount used to 50 gallons of water was reduced to three-fourths pound on the recommendation of the New England selling agents of Soluble Sulphur.

The "Atomic Sulphur" used on plot 7 is another proprietary spray material which was used in 1913.

The "copper-lime-sulphur" applied to plot 8 was a combination of spray materials used for the first time at this Station. Dr. Howard S. Reed and his associates at the Virginia Agricultural Experiment Station reported very successful results with this in their spraying experiments for cedar rust of apples in 1913.* Since no unfavorable effects with reference to foliage or fruit injury were recorded in their publication this spray combination appeared promising as a means of combatting apple scab. Therefore, it was included in the experimental series of 1914.

Plot 9, sprayed with the extra fine sulphur, was introduced at the request of a representative of the Union Sulphur Company of New York. This extra fine flour sulphur was prepared for application as a liquid spray material as per directions furnished by him as follows:

"For every seven or eight pounds of dry sulphur to be used prepare two gallons of glue solution containing one-half ounce

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*Reed, Howard S., Cooley, J. S., and Crabill, C. H. Experiments on the Control of Cedar Rust of Apples. Virginia Agl. Exp. Sta. Bul. 203, 1914.

of glue to the gallon. Place the sulphur in a pail or other convenient receptacle, and pour on half of glue solution called for above, i. e., one gallon of glue solution to seven or eight pounds of sulphur. Work the sulphur into the glue solution until it is thoroughly wetted and forms a smooth, creamy mass by stirring with a stick or kneading with the hands, breaking up all the lumps as thoroughly as practical."

For straining he recommended the construction of a special strainer of wire cloth, preferably of brass, 10 or 12 meshes to the inch, supported by a piece of one-fourth to one-half inch mesh galvanized wire cloth, and backed by a piece of cheese cloth attached to a removable wooden frame placed in the box. According to directions the remainder of the glue solution was to be used to wash the sulphur paste through the strainer, this process to be facilitated by brushing with a cheap paint brush.

Since the main object to be attained in this straining was simply to thoroughly break up all small masses of sulphur sticking together, as well as to remove foreign bodies which might clog the spray nozzles, a more simple method of straining was tried with fair success. In this the ordinary strainer used for straining other spray materials was employed. This strainer is a rectangular box, open at the top. One of two opposite sides of this box is several inches shorter than the other, so that the bottom of the strainer, which is covered with strong brass wire cloth, about 40 meshes to the inch, forms an acute angle with the sides. By rubbing with the hands or a piece of shingle most of the sulphur was worked through this strainer with the remaining glue solution, and what was left was readily washed through with ordinary water from a hose.

As a rule this sulphur and glue paste after straining and diluting was immediately placed in the spray tank and applied. If allowed to stand for a time after straining the sulphur would settle and form a rather stiff paste or semi-solid mass at the bottom of the container, but no difficulty was experienced in again bringing it into suspension in condition to be diluted for final application.

TIME AND MANNER OF APPLICATION.

Except as mentioned below the spray applications to the different plots were all made on the same day. Especial care was taken to make the method of application as nearly uniform as possible. A gasolene power sprayer was used, carrying 2 leads of hose with each extension rod equipped with 2 nozzles. Approximately 150 pounds of pressure per square inch was maintained. While this pressure is less than that frequently recommended a fine mist was obtained from the nozzles, which appeared to be entirely satisfactory. Care was taken to see that each tree was thoroughly and evenly sprayed at each application, but not enough to cause excessive dripping. After each plot was sprayed the spray tank, pump, hose and extension rods were thoroughly rinsed with clean water.

The first application was begun on Saturday, May 23 and finished on Monday, May 25. Conditions during the previous week seemed to indicate that spraying the entire plot might be delayed until the latter date, but toward the last of the week the flower buds began to develop quite rapidly. They were just beginning to show pink on some of the trees on the 22nd. Saturday morning, May 23, was cloudy with slight rain. The afternoon being clear it was decided to begin spraying, and applications were made to plots 3 and 4. As has already been stated the remaining plots were sprayed on Monday the 25th. The 24th was clear, but the 25th was more or less cloudy with a slight trace of rain in the evening following.

The second application was made on June 6, immediately after the petals had fallen, the third on June 22, slightly more than 2 weeks later.

EFFECT OF THE DIFFERENT SPRAYS ON FOLIAGE AND FRUIT DURING THE SUMMER.

The development of scab. No scab was observed on any of the plots until after June 23. Its first appearance on the foliage occurred between this and June 30, or in the week following the third spray application. On the latter date it was recorded as common on the unsprayed check plot and present to a slight extent on some of the others. The following is a brief summary of the weekly or semi-weekly notes on the development of scab on the foliage and fruit up to the end of the first week in August, along with certain other records made at more or less irregular intervals between this and harvest time.

On plot 1, sprayed with bordeaux mixture and arsenate of lead, no scab was recorded on either foliage or fruit previous to harvest time.

Plots 2 and 3, sprayed first with the strong fungicides and arsenate of lead and later with double strength arsenate of lead alone, showed a slight amount of scab on the foliage on June 30, and a similar record was made with reference to the fruit on July 21, but there was very little increase throughout the season.

The records for plot 4, sprayed with standard dilution lime-sulphur, plot 5, sprayed the same as plot 4 with the first application omitted, and plot 6, sprayed with Soluble Sulphur, were also nearly identical. A slight amount of scab was observed on the fruit on July 14 and the same thing was noted for the leaves on July 21, with no material increase as the season progressed.

On plot 7, where the Atomic Sulphur was used, scab was recorded as slight on the leaves on June 30, July 7 and 14; quite common on July 21, and abundant on July 28. On this plot it was first observed on the fruit to a slight extent on July 14 and did not increase materially during the season.

No scab was observed on either foliage or fruit on plot 8, sprayed with the copper-lime-sulphur mixture, during the season.

On plot 9 where the extra fine sulphur was applied the disease was first noted on the leaves as slight on June 30. Very little increase was observed up till July 28 when scab was recorded as plentiful, and also as occurring to some extent on the fruit.

Where the stronger lime-sulphur was used on plot 10 no scab was observed on the leaves till July 28 when a very slight amount was noted. A little had been previously recorded on the fruit on July 14.

On plot 11, sprayed with double strength arsenate of lead alone, it was very evident throughout the season that scab was more common on both leaves and fruit than on the plots sprayed with the regular fungicides. It was also more common than had been the case where the same treatment had been made in previous years. However, it was also equally evident that it was materially less than on the unsprayed check plot which stood beside it, although it was first recorded on both of these plots on the same date.

Scab was first recorded on the foliage on the unsprayed check plot on June 30, and abundant on both leaves and fruit on July 7. This condition prevailed throughout the season.

Spray injury during the summer. Where bordeaux mixture was used on plot 1 no spray injury was noted till July 7, or something over 2 weeks after the third application had been made. At this time russeting had begun to appear on the young fruit, but there was no spotting of the leaves. However, foliage injury developed quite rapidly during the next week, and by July 14 many of the leaves were badly spotted and a few were beginning to turn yellow and drop off. This defoliation increased during the month and on the 5th of August it was estimated that at least one-third of the leaves had fallen and that the total number of injured ones represented at least 50 per cent. At harvest time nearly all evidence of early leaf injury had disappeared. At this time while the foliage was noticeably less dense, and some of the older leaves showed some spotting, the general effect was such as to give the impression that the foliage on this plot was more strong and vigorous and of a richer green than on any other plot in the series.

With regard to spray injury some very interesting observations were made on plot 2, sprayed with a 3-3-50 bordeaux mixture when the blossom buds were showing pink and later with arsenate of lead alone, at the rate of 2 pounds of the dry powder to 50 gallons of water. The first evidence of any injury was noted on the same date, July 7, that it was observed on the adjoining plot sprayed 3 times with bordeaux mixture. At this time the record shows "Doubtful russeting of the fruit." A slight russeting was plainly evident on July 14, and this increased somewhat during the remainder of the season. Slight leaf injury was recorded on July 21, but this did not amount to much then or thereafter. The foliage was very vigorous and healthy at harvest time. Attention is called to the fact that, as is recorded below, no such injury was observed on plot 11 which was sprayed with double strength arsenate of lead for all 3 applications. Also, as is shown in the detailed record of the condition of the fruit at harvest time, relatively few russeted apples were produced on the last named plot. The possible significance of these observations is considered later in the discussion of results.

The most serious leaf injury of all was obtained on plot 6, although, as has already been stated, the amount of Soluble Sulphur in 1914 was reduced to three-fourths pound to 50 gallons of water. Not only was this leaf injury more severe, but this injury occurred much earlier where Soluble Sulphur was applied than anywhere else, being first observed on June 6 before the second application of the sprays. At this time a considerable number of the leaves had turned brown at the edges and brown circular spots had begun to appear on various parts of them.

This injury increased very rapidly, and was followed by partial defoliation of the trees. On June 18, 10 days after the second application, the ground under these trees was from one-third to one-half covered with fallen leaves. By the last of June it was estimated that at least one-third of all of the leaves on the trees sprayed with Soluble Sulphur had fallen. The more severely injured leaves continued to fall gradually through July, but defoliation had largely ceased by the first week in August. The total leaf-fall early in the season undoubtedly amounted to considerably over 50 per cent of the foliage present at the time of the last application, but growth later in the season made this somewhat less apparent.

No russeting of the fruit was observed on the Soluble Sulphur plot during the season.

Severe foliage injury also occurred on the plot sprayed with the copper-lime-sulphur. It did not begin quite so soon as where Soluble Sulphur was used but was nearly as severe. It differed from the injury produced by the latter in that it first appeared as more of a spotting and less of a burning of the margins of the leaves. Also rapid defoliation did not occur so early in the season but the final outcome in this last respect was nearly the same. The injury caused by the copper-lime-sulphur more closely resembled that produced by bordeaux mixture.

In another respect the effect of the copper-lime-sulphur spray was similar to that of bordeaux mixture. Injury to the fruit was noted when the latter was quite small, which developed into a marked russeting later in the season.

What was thought to be a slight burning of the margins of the leaves was noted on plot 10 after the first application of the stronger lime-sulphur, although nothing of the kind was recorded for plot 3 where the first spray application was identical with that on plot 10. No other evidence of spray injury on foliage or fruit was observed on plot 10 previous to harvest time.

No leaf injury could be detected on plots 3, 4, 5, 7 and 11 during the season and whatever fruit russeting was present on any of these plots was not sufficiently prominent to be noted in the field.

THE EFFECT OF THE DIFFERENT SPRAYS ON THE FRUIT.

The apples on the experimental plots were harvested on October 7 and 8 and were immediately sorted into 3 classes,—namely, the number of smooth or perfect apples, the number scabby and the number russeted.

Except in the case of plot 1, the sample from which to obtain this sorting record consisted of 20 barrels of fruit selected at random from the crop produced on the two central rows of trees on each plot. By rejecting the crop on the two outer rows it was felt that the effects of the sprays drifting with the wind from adjoining plots was largely eliminated. In the case of plot 1, sprayed with bordeaux mixture and consisting of but 3 rows, the 20 barrels used for sorting came from the central row and the inner half of each tree on the two outside rows.

The following is a tabulated summary of the results obtained from sorting and counting the number of fruits on each of the different plots. The percentages of smooth, scabby and russeted fruits do not always total 100 for in some instances apples were found which were both scabby and russeted and were therefore counted twice.

All apples which showed any traces of scab, however small, were classed as scabby. No attempt was made to separate these into classes showing different degrees of scabbiness, for it was felt that the fundamental question under consideration was the relative efficiency of the different spray materials in the prevention of disease under conditions as near alike as they could be made in an ordinary field experiment. Therefore, it would seem that the only basis upon which this could be judged, which would eliminate matters of personal judgment, is whether or not scab was present in any degree. On the other hand no apples were classed as russeted unless this was plainly evident,—that is, apples which showed minor scars and imperfections of the skin, not plainly suggestive of spray injury, were classed as smooth.

The senior writer has been interested in watching the development of these various injuries and imperfections which appear on the skin of growing apples and has followed individual cases through a number of different seasons. He is convinced that many of these minor imperfections are due to slight mechanical injuries or to insect attacks, often when the fruit is quite young and small, and particularly from the egg-laying punctures of the curculio. In the fall imperfections on the surfaces of apples resulting from injuries produced by this insect earlier in the season have been found in the orchard in question, varying from the typical crescent-like scars through various steps and graduations up to large blotches of russeting in which all evidence of the original puncture had disappeared and where the outline had become so modified as to practically obliterate the distinct crescent form of the original injury.

Summary of Results Obtained from Sorting Fruits.

Plot No.	TREATMENT.	Total number of apples.	Number smooth.	Number scabby.	Number russeted.	Per cent of perfect apples.	Per cent of scabby apples.	Per cent of russeted apples.	Difference in per cent of russeting as compared with check.
1	Bordeaux mixture, 3-3-50, plus 1 lb. dry arsenate of lead to 50 gallons. .	*8,070	833	24	7,217	10.32	0.3	89.43	89.24
2	First application like plot 1. Later applications 2 lbs. dry arsenate of lead to 50 gallons of water.	*8,078	6,611	305	1,218	81.84	3.78	15.08	14.88
3	First application lime-sulphur 20% stronger than standard, plus 1 lb. dry arsenate of lead to 50 gallons. Later applications like plot 2.	7,578	7,278	150	150	96.04	1.98	1.98	1.78
4	Standard dilution lime-sulphur plus 1 lb. dry arsenate of lead in 50 gallons	*7,250	6,808	109	336	93.9	1.5	4.63	4.43
5	Like plot 4 with first application omitted.	8,629	8,483	104	42	98.31	1.2	0.49	0.29
6	"Soluble Sulphur" ¾ lb. and dry arsenate of lead 1 lb. to 50 gallons of water.	*7,807	7,578	68	164	97.07	0.87	2.1	1.9
7	"Atomic Sulphur" 7 lbs. and dry arsenate of lead 1 lb. to 50 gallons of water.	7,582	7,506	67	9	99	0.88	0.12	-0.08
8	Standard dilution lime-sulphur plus copper sulphate 2 lbs. and dry arsenate of lead 1 lb. to 50 gallons. . . .	*7,795	3,193	154	4,484	40.96	1.98	57.52	57.32
9	Extra fine sulphur 10 lbs. plus dry arsenate of lead 1 lb. in 50 gallons of water.	*9,007	8,177	292	544	90.78	3.24	6.04	5.84
10	Lime sulphur 20% stronger than standard dilution plus 1 lb. dry arsenate of lead to 50 gallons.	*8,043	7,425	53	568	92.32	0.66	7.06	6.86
11	Dry arsenate of lead 2 lbs. alone to 50 gallons of water.	*8,814	8,266	443	107	93.78	5.03	1.21	1.01
12	Unsprayed check.	*8,579	7,478	1,085	17	87.17	12.65	0.2	

* Omitting those fruits counted twice—both scabby and russeted.

Discussion of Results.

Since the spraying experiments for 1914 were either planned largely as the result of tentative conclusions derived from data previously secured or are repetitions of those carried out in one or both of the two preceding years it is necessary to consider the latter in discussing the results of the work of the past season.

Efficiency of the first spray application: Some writers have laid great stress upon the importance of the spray application made when the flower buds are showing pink as well as upon the necessity of being ready to apply this within the limits of one or two days. This attitude is undoubtedly the correct one with reference to many seasons and for many localities. The writers do not wish to be understood as recommending that Maine orchardists be less vigilant or less prompt in applying the so-called "pink spray" but the results obtained for the past two seasons show that if circumstances arise which delay its application or cause it to be omitted altogether the apple grower need not necessarily feel that his spraying operations for the current year will result in a failure in scab control, provided the other, later applications are made in due time.

In 1913 and 1914 the unsprayed check plots produced 38.8 and 12.65 per cent of scabby apples respectively. The plots sprayed 3 times with standard dilution lime-sulphur gave 3.15 and 1.5 per cent of scabby fruit while on the adjoining plot in each case where the first application was omitted the per cents were 6.32 and 1.2 respectively. In other words omitting the pink spray entirely in 1913 resulted in some increase of scab when compared with the plot where it was not so omitted, but when compared with the unsprayed check plot it was shown that over five-sixths of the probable amount of scab development had been prevented—a condition far from a total failure. Moreover from the records obtained in 1914 it will be seen that no increased efficiency in scab control was obtained from the first application of the spray which was made on plot 4 sufficiently early to give ample protection. In fact the amount of scab was actually less where it was omitted, but the difference was slight and within the limits of experimental error.

In this connection it is only fair to call attention to the results obtained in 1912. Not only was apple scab more severe that season, but apparently weather conditions and other influencing factors were particularly favorable for scab infection at the blossoming period. Hence the results secured by omitting the first fungicidal spray were most striking. Three applications of standard dilution lime-sulphur gave almost perfect scab control, there being only 1.4 per cent of affected fruits at harvest time. Where the first of these applications was omitted 47.6 per cent of scabby apples were obtained. However, even here the amount of scab was materially reduced, but this can only be judged approximately, for the only available check plot was one sprayed with 2 pounds of arsenate of lead paste (approximately equivalent to one pound of the dry powder used during the past 2 seasons) in 50 gallons of water. Somewhat over 80 per cent of the fruit on this plot was scabby at harvest time. Our work during that season and the two following has shown that double this quantity of arsenate of lead is of material value as a fungicide for apple scab. Also the results obtained in 1913 indicated that even so small an amount of arsenate of lead as was used on this so-called check plot in 1912 might materially reduce the amount of scab and consequently make a plot sprayed in this way unreliable as a basis for comparison in judging the efficiency of a fungicide used on another plot.

Different dilutions of lime-sulphur. Last season was the third where different dilutions of lime-sulphur were tested, in which apple scab developed to a sufficient extent to judge their efficiency. Earlier work indicated that under Maine conditions it was not safe to use a weaker dilution than that commonly employed, or what is referred to throughout this publication as "standard dilution." From the work of the three seasons it would seem that on the Ben Davis, a variety well-known to be easily injured by bordeaux mixture, at least 20 per cent more of a lime-sulphur concentrate than is commonly employed may be used to make a given amount of spray and be used with comparative safety.

With this stronger dilution a slight amount of leaf injury has been observed occasionally and the amount of fruit russeting has been somewhat increased, particularly last season where it was increased from 4.63 to 7.06 per cent when compared with the plot sprayed with the weaker dilution. Therefore there might be some question about using the stronger spray for the later applications.

As might be expected the stronger lime-sulphur has invariably produced better scab control than the standard dilution. In 1912 when scab was more severe this increase in efficiency much more than paid the extra cost for spraying material.

Lime sulphur vs. bordeaux mixture. As has already been stated plots 1 and 4, particularly the former, were introduced chiefly for the purpose of comparison. Attention is called to the fact that again bordeaux mixture showed the greatest efficiency in scab control, but far outranked all of the other spraying materials in the amount of russeting produced. On account of russeting only a little over 10 per cent of perfect apples were obtained where bordeaux mixture was applied while nearly 94 per cent of the same grade of fruit was harvested where the standard dilution lime-sulphur was used.

"Soluble Sulphur." The results secured in 1914 with this material fully confirm the tentative conclusions derived from the experiments of the previous year and from letters received from orchardists who used Soluble Sulphur as a summer spray that season. Even when reduced to three-fourths pound and used with one pound of dry arsenate of lead in 50 gallons of water it again produced most serious defoliation. In view of these results it therefore cannot be recommended and cannot be used with safety with arsenate of lead as a summer spray for apple trees.

In justice attention should be called to the fact that during both seasons in which this material has been tested very efficient scab control has been secured and the amount of fruit russeting compared very favorably with that resulting from the use of standard dilution lime-sulphur.

"Atomic Sulphur." The condition of the fruit at harvest time on the plot sprayed with this material was, as in the case of the previous season, quite satisfactory. Scab control on the fruit was very efficient and the amount of russeting was actually less than on the unsprayed check plot. The control of scab on the leaves was by no means as good as the previous season.

Arsenate of lead as a fungicide. The results secured in 1912 and 1913 indicated that arsenate of lead for apple scab has considerable fungicidal value. Our attention was first called to this fact when it was found in 1912, a season in which scab development was particularly severe, that a plot sprayed with

4 pounds of arsenate of lead paste alone in 50 gallons of water showed as good scab control as where other plots were sprayed with half of this amount of arsenate of lead combined with recognized fungicides, exceeding that obtained from bordeaux mixture and standard dilution lime-sulphur and only being equalled by the stronger lime-sulphur.

In 1913 where 2 pounds of the dry arsenate of lead was used in 50 gallons of water scab was better controlled than on any of the other plots except where bordeaux mixture and the stronger lime-sulphur was used in combination with one pound of the insecticide.

Reference to the tabulated results shows at once that in 1914 arsenate of lead was less efficient in controlling scab than during the two preceding years. This fact was also apparent from the condition of the foliage and fruit on the trees all through the season. However, while these results are not so favorable they by no means contradicted those of previous years. This fact is also shown in the later discussion of the results secured on plots 2 and 3 where only double strength arsenate of lead was used after the first application. On account of freedom from russeting the per cent of perfect apples on plot 11 where the double strength arsenate of lead was used was fully equal to that obtained on plot 4, sprayed throughout the season with standard dilution lime-sulphur, combined with one pound of arsenate of lead in 50 gallons.

In connection with the discussion of arsenate of lead used alone as a fungicide it should be mentioned that some results reported from certain other parts of the country last season were less favorable than those previously secured at this Station. Jackson and Winston in Oregon make the following statement: "Double arsenate of lead, when used throughout the season uncombined with fungicide gave negative results as a remedy for scab."* However, Professor Winston in a letter to the senior writer under date of April 15, 1915, says: "In regard to arsenate of lead you might infer that it is of no value to us as a fungicide; our figures would indicate that, however, I have been told by certain orchardists that they received very

*Jackson, H. S. and Winston, J. R. Report of the Hood River Branch Experiment Station for 1913-1914: 17, Oregon Agl. Col. Exp. Sta. 1915.

nice control of scab by the use of double strength arsenate of lead in the calyx and subsequent applications where lime-sulphur or bordeaux had been used in the pink." He then goes on to state that certain factors, particularly of a local, climatic nature which influenced the results of the experimental trials should be taken into consideration in interpreting the figures obtained.

Dr. W. L. Howard of Missouri reported that in 1914 in the case of an acre of Jonathan trees sprayed with arsenate of lead alone the amount of cedar rust was reduced one-half.* There was, however, a large amount of russeting of the fruit on this plot which could not be accounted for except that it came from bordeaux mixture which had been previously used in the spray tank and not entirely removed. He suggests the possibility that the scab control might be attributed to the same material.

Professor Howard writing under date of April 20, 1915, says: "I have long felt that arsenate of lead possessed some fungicidal value, particularly against such apple diseases as scab and fly speck or sooty mold. Also, some of our fruit growers in the Missouri peach belt feel that arsenate of lead contributes materially toward the control of brown rot, aside from its value as an insecticide in poisoning the curculio."

In a previous publication the senior writer has called attention to the fact that other observers have also reported that arsenate of lead alone, or in combination with lime-sulphur, contributed either directly or indirectly to the control of certain fungous diseases of the apple and the peach.†

Arsenate of lead alone for calyx and later applications. The very favorable results secured with arsenate of lead as a fungicide for scab suggested a possible modification of spraying methods by which the work might be materially simplified without decreasing the efficiency. This plan was to use bordeaux mixture or the stronger dilution lime-sulphur when the blossom clusters were opening and the buds showing pink, but for later applications to depend entirely upon double strength

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*Howard, W. L. Profits from Spraying Twenty-five Missouri Apple Orchards in 1914. Mo. Agl. Exp. Sta. Bul. 124: 272. 1915.

†Morse, W. J. Spraying Experiments and Studies on Certain Apple Diseases in 1913. Maine Agl. Exp. Sta. Bul. 223: 14. 1914.

arsenate of lead for protection against both scab and insect enemies.

Plots 2 and 3 in 1914, conforming to this program, produced some very interesting results. It is of particular interest to compare the figures obtained on plot 3, sprayed first with the stronger lime-sulphur and later with double strength arsenate of lead alone, with those secured from plot 4 along side of it and sprayed throughout the season with a combined lime-sulphur and arsenate of lead of ordinary strength. While scab control is slightly better on plot 4 there was more russeting of the fruit. Consequently the net result in percentage of perfect apples is in favor of the arsenate of lead alone for the later applications. The same thing is found to be true when the number of perfect apples on plot 3, 96.04 per cent, is compared with that obtained on plot 10, 92.32 per cent, which latter was sprayed throughout the season with the stronger lime-sulphur and the smaller amount of arsenate of lead. In this connection attention is again called to the results obtained on plot 5, where the first application of lime-sulphur was omitted, as compared with plot 4. This comparison indicates that for the season of 1914 on this farm, undoubtedly largely on account of weather conditions in May, that the first fungicidal spray had little to do in the prevention of apple scab. This therefore, emphasizes the part played by the arsenate of lead in reducing the amount of scab on plot 3, adjoining plot 4 on the other side.

On the whole it cannot be denied that the results obtained from the use of lime-sulphur and arsenate of lead applied in this manner on plot 3 were very satisfactory. However it should be remembered that they represent only the work of a single season. At the same time these results possess added significance when considered in connection with those obtained in three successive years in testing arsenate of lead alone as a fungicide against apple scab.

As will be seen on reference to the table, the final results on plot 2 where bordeaux mixture was used for the first application were decidedly less favorable than those secured on plot 3, yet except for the first application, the spraying treatment of the two plots was identical. The amount of both scab and russeting was greater on the former than on the latter, resulting in somewhat less than 82 per cent of perfect apples in one case as compared with slightly over 96 per cent in the other.

It is rather difficult to account for the slight leaf injury and the rather large amount of fruit russeting which occurred on plot 2. At the time the single application of bordeaux mixture was made the first foliage leaves were very small and just beginning to unfold, while the flower buds were not fully open till some few days after. The fruit russeting which occurred on this plot had every appearance of bordeaux injury, yet at first thought it hardly seems within the range of possibility that a spray applied before the blossoms open could in any way injure the fruit which set later. While it does not seem probable the only possibility in this connection is that enough of the bordeaux mixture from the early spraying, which was quite thorough, adhered to the limbs and twigs and was washed off onto the fruits by rains, after the latter had set, in sufficient quantity to cause the injury observed. Another hypothesis which has suggested itself to the writers is that sufficient bordeaux mixture from the later sprayings of the adjoining plot drifted across and caused the injury referred to. This seems improbable also for care was taken to avoid this contingency as much as possible and no trouble of like nature has been experienced in the past with adjoining plots under like conditions. Moreover the apples used for sorting came from the two inner rows on plot 2 and none from the outer row of trees adjoining those sprayed with bordeaux mixture.

The amount of russeting on plot 2 was not fully appreciated until after the fruit was harvested and the sorting began. Therefore no critical observations were made to see whether or not the rows of trees or the sides of individual trees which were most exposed to the drifting of the spray from plot 1 showed the most russeting of the fruit. There was nothing of this nature which attracted attention in making the summer observations in the field. The same experiment will be repeated during the coming season and careful observations will be made to check up this point.

Copper-lime-sulphur. This spray combination did not give any better scab control than ordinary lime-sulphur and the large amount of leaf injury and fruit russeting, over 57 per cent of the crop in the case of the latter, was very unfavorable to it. The only conclusion which could be drawn from this single trial is that under Maine climatic conditions it is not likely to prove satisfactory when used on such tender foliage as that of the Ben Davis variety of apples.

After the first leaf injury was observed the fact was reported to Doctor Reed who replied that a statement to the effect that they did secure some spray injury on the Ben Davis in Virginia should have been inserted in their bulletin, but through an oversight this was omitted. With them the injury was less than in the case of bordeaux mixture and came largely from the earlier sprayings. The fact should not be lost sight of, however, that in different parts of the country, under different climatic conditions, the effects of a given spray on the foliage of fruit trees may be quite different.

Extra fine sulphur. While this material did not give as good results as most of the others used it showed considerable efficiency in scab control. The amount of russeting was, however, relatively high, being nearly as much as that produced by the stronger lime-sulphur when the latter was used throughout the season. In connection with the use of fine sulphur flour in suspension in water as a liquid spray mention should be made of the results obtained in New York by Blodgett and later by Reddick and Crosby with this material and with fine sulphur and arsenate of lead as a dust spray for apple orchards.* The figures presented by these writers show a material reduction of scab where fine sulphur and arsenate of lead were used alone, or combined with some inert substance used as a carrier or diluent.

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*Blodgett, F. M. Experiments in the Dusting and Spraying of Apples. Cornell Agl. Exp. Sta. Bul. 340. 1914.

Reddick, Donald and Crosby, C. R. Further Experiments in the Dusting and Spraying of Apples. Cornell Agl. Exp. Sta. Bul. 354. 1915.

BULLETIN 241.

WOOLLY APHID OF ELM AND JUNEBERRY.*

(*Schizoneura americana* in part, of authors.)

EDITH M. PATCH.

Each season considerable concern is expressed by residents of Maine relative to certain deformations of elm leaves due to the work of aphids. Indeed so unattractive do young elms appear when heavily infested that it sometimes seems desirable to the owners to remove them from the lawn.

Several species cause distortions of these leaves, one of which is treated in this paper in such a manner as to outline the chief points in its life cycle.

Familiar to all observers of the American Elm are leaves one edge of which is rolled under as is shown in Figure 45. Such a curl constitutes a protective habitation for a family of aphids during their spring residence there.

The mother of the colony is a large plump, somewhat powdery aphid which, if examined in the sunlight under a lens, is found to have a greenish complexion. She passes the winter in the egg stage hidden in the crevices of the elm bark. In the spring, hatching from the egg just as the leaves are unfolding, she seeks a suitable one, punctures it with her beak and by remaining and feeding causes it to curl into the protecting roll. Early in June she has attained her full growth and the leaf in which she has been dwelling looks like the left hand leaf of Figure 45. She now gives birth to a large number of young, which, unlike their mother are born alive, not undergoing any external egg stage.

Her progeny are all females which upon attaining their growth give birth in turn to living young,—also all females.

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*Papers from the Maine Agricultural Experiment Station: Entomology No. 79.

All the descendants of the original aphid or "stem-mother" as she is called, ordinarily remain in the same leaf and the curl becomes swollen and crowded with the numerous family. As each individual casts its skin several times in the process of its growth and as the discharge of honey dew is abundant, the curl after a time has a considerable amount of waste matter which causes it to look untidy within. Conditions are kept remarkably sanitary, however, by the aid of the waxy secretions of the aphids, particles of which cover the honey dew so that it rolls about in liquid pellets without drenching their bodies. These insects are further protected by the white waxy secretions which remain upon them rendering them impervious to moisture.

The earlier members of the family, including the stem-mother, are all wingless. Late in June, however, a generation matures with wings.

These winged individuals, or "spring migrants" as they are called, resemble the wingless generations previously mentioned in being all females, but they are smaller bodied and differ in various structures. Instead of remaining within the leaf with their wingless relatives these later forms take flight, seeking fresh vegetation for the establishment of the summer colonies. They are strong on the wing and fly to distances of at least three-fourths of a mile if they do not find a suitable location near at hand. When they desert the elm leaf which has furnished sap for their development they are "instinctively" led to an entirely different habitat, namely the Juneberry (*Amelanchier*) so common in Maine and variously known as Shad Bush, Service Berry, and locally as Sugar Plum.

When the migrant reaches one of these bushes it settles upon a leaf and soon afterward creeps to the underside where it remains quietly, ordinarily for the rest of its life. Before many hours it begins to give birth to young and continues this process for several days. The wee aphids, born on the underside of the Juneberry leaf, cling there for a little while without feeding and then walk down the stem of the plant. Sometimes a line of these can be seen trailing down "Indian file,"—little pellucid yellow specks so small that the observer almost requires a lens to detect them at all. The destination of these minute young is the underground stems of the Juneberry,, where they settle in groups at some tender spot.

This, then, is the destined summer residence of the insect;—the little thing whose mother, grandmother and great grandmother grew up in the curl of a high swinging elm leaf, creeps under ground and sips Juneberry sap in the dark.

There is, perhaps, no bird migration more remarkable than the flight of a migratory aphid and the histories of many species of this family of insects have the thrill of a dramatic tale of adventure.

The summer colonies of our aphid of elm and Juneberry, like their spring antecedents, are composed only of females, the first generation being wingless and the body whitened by the secretions of the wax glands.

In the fall a generation of winged females is developed among the underground forms. These are the fall migrants and in appearance they are practically like the spring migrants. These leave the Juneberry and take flight to some American Elm.

Alighting on the bark, they seek a convenient crevice and give birth to minute young, part of which are egg-laying females and part males,—this being the only time in the life cycle of this insect that either of these forms appear. These tiny "true sexes" have no functional mouth parts,—their chapter in the life history being concerned merely with mating and providing for the deposition of the overwintering egg. Each female lays but a single egg which nearly fills her small body.

The egg is the closing page of the life cycle for the fall, and the opening one for the spring; because it is from this overwintering egg that the stem-mother hatches at the time of the bursting leaf buds, in season to form the curl of the elm leaf for the spring habitation used by her and her numerous progeny.

Natural Enemies.

There are several predaceous insects which frequent the elm leaf curls of this aphid. In Maine the most common ones are a capsid (*Camptobrochis nitens*), the flocculent larva of a coccinellid, and syrphus maggots. Some years these greatly reduce the numbers of this elm pest.

Preventive and Remedial Measures.

In a state where both elms and Juneberries abound as they do in Maine, we must expect this aphid to occur both in the curl of the leaves of the former and on the underground stems of the latter.

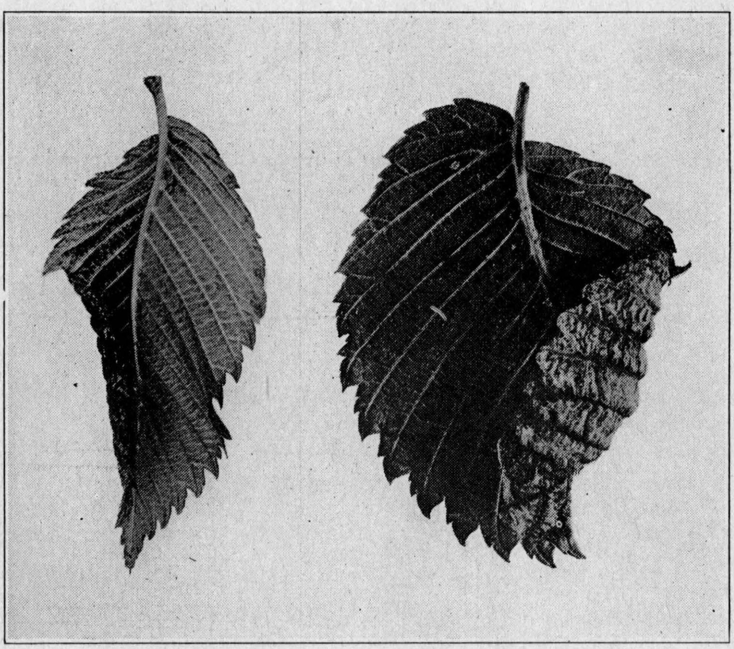

FIG. 45. Work of *S. americana* in part of authors: at left young roll containing stem female; at right, same species, old roll just deserted by migrants. Maine specimens.

Where the *Amelanchier* is planted for park or ornamental purposes within aphid flight of American Elm, it would seem desirable to try drenching the soil at the base of the shrub with Black Leaf 40 or other good tobacco decoction. Probably once about mid-July and again late in the month would be the most favorable time for this treatment as the colonies would be young and susceptible and likely to be nearer the surface than later in the season.

Young elms can be protected by spring sprays of tobacco decoction before the leaves become curled. Where large power sprayers are available old elms sprayed with drive nozzles could probably be cleaned of most of the infestation.

Dormant sprays of lime sulphur heavily coating the elm bark should be tested as to their efficiency in killing the over-wintering egg.

Notes.

The species discussed in this paper under the title "Woolly Aphid of Elm and Juneberry" is the same species which is listed as CCC in the Habitat Key on page 184 of Bulletin No. 217 of this Station, and recorded on pages 268-271 of Bulletin No. 220.

As the alternate or summer host of this species has not previously been published, it seems desirable to state here the data upon which this life cycle is recorded.

On June 28, 1911, a collection of winged forms of this species from *Amelanchier canadensis* (L.) Medic. was made by Mr. William Woods and mounted by my assistant under the number 15-11. As *Prociphilus corrugatans* is commonly taking flight from the leaves of Juneberry late in June, I took it for granted that 15-11 was probably that species and did not examine the material until 1914 when I was startled to find that all this collection was *Schizoneura americana* of the elm leaf curl.

No additional data were obtained last year but on June 25, 1915, Mr. Woods brought into the laboratory about 30 migrants stating that they were abundant and occurring singly on the underside of the Juneberry leaves. Upon examination, I found these to be *Schizoneura americana* and as they had been collected about three-fourths of a mile from the nearest known elm, the situation was given immediate attention. I visited the place in the college woods where Mr. Woods had made his collection (50-15) and found the migrants resting upon the underside of the leaves of almost all of the numerous Juneberries in that vicinity, and did not find them settling upon other vegetation there. Upon some of the Juneberry leaves the minute yellowish young of the migrants were found, and it was an easy matter to locate on the underground stems of these shrubs, the colonies of young, already grouped about some favorable spot and covered by a slight waxy secretion.

Three young Juneberries were potted and brought into the laboratory. Migrants were removed from elm curl and caged with these plants. They settled on the ventral side of the leaves and remained there several days giving birth to their young which sought the underground stem of the accepted plant. Of course, since these plants were taken from the open, there was every possibility that their roots might have been infested also in the field. But fortunately one of the three plants was kept moist under glass and upon this the progeny of the migrants colonized on the stem well above ground where there was no danger of their being confused with field material. Some of the colony were still alive 14 days later, but they did not thrive as did the underground settlements.

On Checkerberry Hill near Orono a solitary Juneberry not more than eighteen inches high was found with several migrants on the underside of its leaves. As this plant was about three-quarters of a mile from the nearest known elm, the record is interesting.

June 28, near Orono, 415 of these migrants were counted resting on the under surface of leaves of a single large Juneberry situated between two large elms. This number was only a part of the migrants present as those on the upper leaves could not be counted from the ground.

During the week of June 27, I spent parts of several days watching some small Juneberries on the river bank ledges near Orono. The migrants from elm were present and others alighted every now and then. I saw their young trailing down the stem toward the ground, and found colonies on the underground stems here as in the college woods.

For the most part but one migrant occurred on a leaf, but where leaf curls removed from elm were placed under caged Juneberries on the ledge, as many as 16 migrants were found on the ventral surface of a single leaf. Four other kinds of plants chanced to be under the same cage and it was interesting to record that not a single migrant was found on the under surface of the leaves of any of these. One was observed walking restlessly across the top of a goldenrod leaf, but it did not remain there.

As will be seen from the date of the publication, this paper goes to press before the fall migrants are collected from Juneberry; and the statement in the life history account that the fall migration to the elm is from Juneberry is based only upon what seems to be the inevitable sequel to the behavior of the spring migrants and their progeny on the Juneberry. Knowing the summer host and that migrants seek the elm in the fall, the circumstantial evidence seems logically sufficient.

The observation here recorded open up an interesting series of questions in regard to this widely distributed elm leaf species. Does this insect occur on the elm only where that tree is within aphid flight of *Amelanchier?* If not, what summer host is accepted for such localities? Are there circumstances where the elm, alone, is able to provide for a continuation of this species? Does it occur on the roots of trees or shrubs botanically related to the Juneberry and has it in such circumstances ever been confused with *lanigera?*

In connection with the last question it might be stated that the wax gland areas of the summer root forms are different from those of *lanigera* and would doubtless serve as a sufficient means of separating

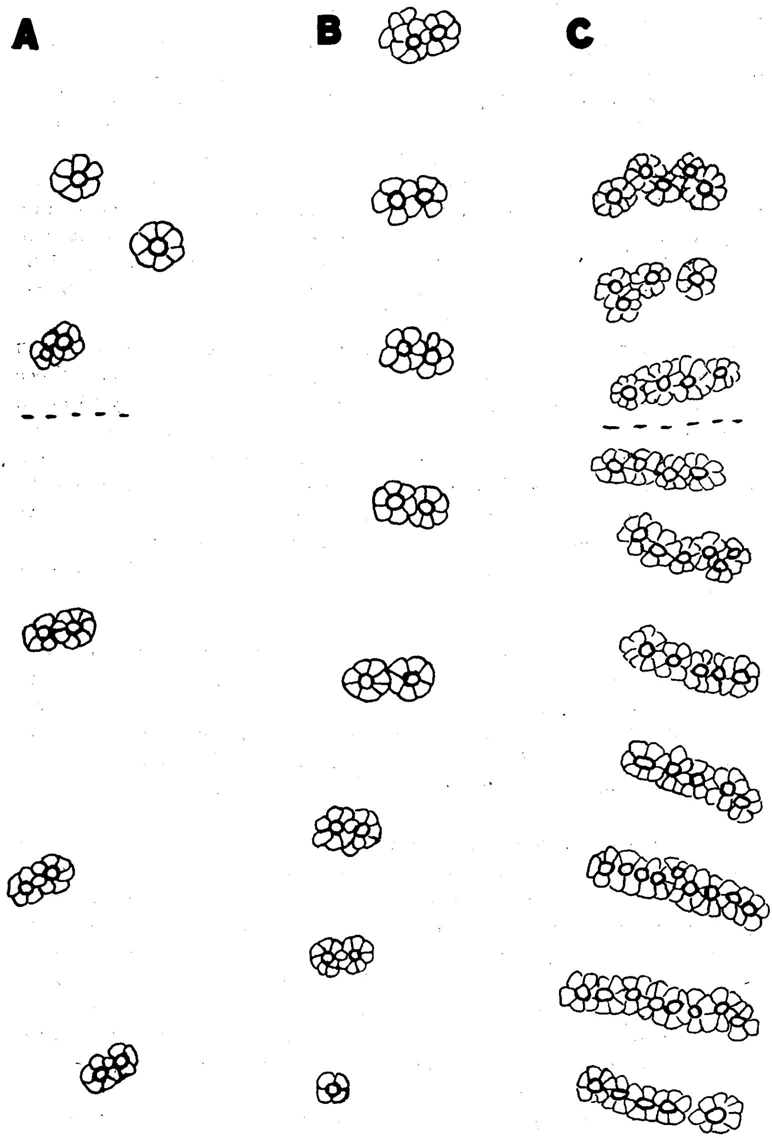

Fig. 46. Wax gland areas of nymphs of *S. americana* taken from underground stem of Juneberry, July 13, 1915. A. and B., those of one of the two dorsal lines. A, from head and thorax. B, from abdomen. C, lateral wax glands of thorax and abdomen.

these two species should they ever be found to occur upon the roots of the same trees.

Schizoneura americana is a name which until recently has been commonly applied to two distinct species by American entomologists.

One of these species inhabits the leaf cluster or aphid rosette of the American Elm.* This migrates to apple, several varieties of mountain ash (*Pyrus sp.*) and to hawthorn (*Crataeus*), where it was familiar as *lanigera* long before its identity with the aphid of the elm rosette was suspected. The life cycle of this species so far as personally ascertained by the writer is recorded in Bulletin No. 217 of this Station. The admirable publication by Mr. A. C. Baker should be consulted by everyone studying this insect. (1915. The Woolly Apple Aphis. Report No. 101, U. S. Dept. Agric. Office of the Secretary).

The other species to which the name *Schizoneura americana* has been commonly applied is the aphid discussed in this present paper. Since the name *lanigera* takes care of the rosette species on elm as well as on apple, *S. americana* seems to be left free for the aphid curling or rolling the leaf of the American Elm. Riley's description of the leaf deformations caused by *S. americana*† seem to indicate clearly enough that he originally applied this name to both these species as his successors have certainly done until recently; and the synonomy "*schizoneura lanigera* (*americana* in part, of authors)," correctly designates the "rosette aphid" of the elm.

* * * * * * * * *

The writer has observed and previously recorded migrants from leaf curl upon mountain ash (*Pyrus sp.*) in company with those from the rosette. The mountain ash concerned with that record was very near elms and whether the presence of leaf curl migrants upon that tree was accidental or whether their progeny will accept its roots as they do those of the Juneberry still remains to be ascertained.

The writer's first announcement of the migration of *lanigera* from elm to apple (Science Vol. 36, pp. 30-31) was a record of migrants from elm leaf curl establishing a successful colony upon apple seedlings. From the fact that subsequent successful migrations to apple have been from rosettes and not curls, there seems to be a possibility that rosette migrants may have been present accidentally in the curls which were collected in the South and sent to Maine, and that they were really the progenitors of the successful colony. Where curls and rosettes are present on the same tree such a mixture of the winged forms sometimes happens. Whether some southern elms support normally an elm curl form of *lanigera* or whether that initial record will stand as unique and without subsequent verification as to the type of the deformation concerned, remains to be seen.

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* Figs. 70 and 71, Bulletin 217. Maine Agric. Exp. Sta.

† "Curling and gnarling the leaves of the White Elm (*Ulmus americana*), forming thereby a sort of pseudo-gall. The curl made by a single stem-mother in the spring takes the pretty constant form of a rather wrinkled roll of one side of the young leaf, but, according as there is more than one stem-mother, or as several contiguous leaves are affected, the deformation assumes various distorted shapes, sometimes involving quite large masses of the leaves."

BULLETIN 242.

PINK AND GREEN APHID OF POTATO.*

(*Macrosiphum solanifolii* Ashmead).

Edith M. Patch.

The need for the study of the habits and life cycles of aphids, before a satisfactory basis can be obtained for remedial recommendations, is apparent to anyone familiar with the complexities of such a problem.

Those species that accept but one food plant, depositing their winter eggs upon it and passing their whole life cycle there, usually present no difficulties greater than those of other insect pests and are even easier to combat than many.

But those aphids that select one kind of plant upon which to pass the fall, winter and spring and a different kind for the summer generations, frequently so change their manner of life to suit the two environments that it behooves us to look sharply lest we miss a link here or there in their life cycles, but even here we need reckon with only two plants.

When, however, in addition to two favorite food plants, a species of aphid will accept others not botanically related, the problem is complicated by a new element for every different food plant.

This latter condition is the case with the pink and green aphid of potato. When work with this species was first undertaken at the Maine Agricultural Experiment Station, the only food plants recorded for it were two plants belonging to the night-shade family,—the "pepper vine" and the potato. A glance at the food plant list in this bulletin will show that the insect concerned has really a broad taste in botanical juices and will imbibe freely of the sap from numerous sources, each of which deserves consideration in economic work with this aphid.

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*Papers from the Maine Agricultural Experiment Station Entomology No. 81.

LIFE HISTORY.

The pink and green aphid of potato is found in the spring upon rose bushes, feeding on the succulent growth and especially abundant near the flower buds. Unlike many species of plant-lice, migration with this insect may occur through wingless as well as winged individuals. The winged ones take flight, and the others, if they are near enough, walk over to potato plants. This occurs in Maine ordinarily from the first to the middle of July, when a very few scattered individuals may be seen upon the potato. Upon this plant they seem to find conditions ideal for growth and increase enormously, often before the last of August covering the tender tips and blossom stalks thickly with their colonies. At this time a single female may produce more than 50 young in 2 weeks, and it takes, in warm weather, about 2 weeks after birth for a female of this species to attain maturity and begin to produce young. A glance at figure 48 will show the result of a heavy infestation of 14 days duration upon the potato plant.

By the middle of September the fall migration is over and the aphids have deserted the potato fields. The indoor studies with this insect indicate that when it leaves the potato it prefers the rose, but will colonize upon a variety of plants, part of which are common weeds. This seems more like a dispersal from the potato than a "return migration" in the sense this term is used with reference to those aphids which accept only two kinds of food plant—the first for the fall, the overwintering egg and the spring, and the second for the summer months. However, the rose seems to be the favorite and it is probable in Maine that this serves most commonly for the fall generations of the potato aphid. The last generation of the year consists in the wingless, egg-laying females and the winged males,—or the so-called "true sexes" which appear in Maine about September 20 and only at this one time, all the other generations consisting entirely of viviparous females. The insectary observations of 1907 showed that under indoor conditions, the true sexes may be produced and the overwintering eggs may be deposited on both potato and shepherd's purse. It is likely that this generation can be produced on other accepted food plants also. No evidence has been found in the field, however, that the true sexes or eggs occur normally upon the potato, for the aphids leave that food plant earlier in the season when out of doors. In the insectary the eggs were placed indiscriminately on leaves and stalks. These are pellucid green at first and later become glistening brownish black.

It is not known upon how great a range of food plants this aphid will develop in the spring. In Maine it has never yet been collected during this season upon anything but rose, which would indicate that this is the favorite overwintering host plant and the one ordinarily chosen for the deposition of the egg in the fall.

On October 9, 1908, great numbers of winged viviparous females and winged males and wingless oviparous females were found on Japanese rose bushes on the Maine Campus. They were for the most part on the ventral surface of the leaves. The winged viviparous females were presumably the fall migrants and mothers of the true sexes.

The stem mothers or females hatching from the overwintering eggs, were abundant upon these same bushes the next May and by the thirteenth of the month were nearly mature and were feeding at the half-opened leaf buds. On June 3 the progeny of the first generation, or the stem mothers, consisted of mature alate and apterous viviparous females as well as immature aphids of both the second and third generation. Usually by the first of July only scattered colonies remain upon the rose and by this time the summer generation may be found upon the potato.

ECONOMIC SIGNIFICANCE.

During certain summers enormous numbers of the pink and green potato aphid have appeared over wide areas in Aroostook County, the vines being attacked to an injurious extent in the vicinity of Houlton and elsewhere. The colonies cluster thick on stem, leaf and blossom stalk, blighting the stems and drying the terminal leaves as is shown in figures 47 and 48. The time of severest attack apparently varies somewhat, but the infestation in Maine has not been excessive before early August and is over with before the middle of September. Under conditions favorable to aphid growth, an attack of less than two weeks' duration suffices to kill the potato stalk for a distance of 4 to 6 inches from the tip, and the growth of the tubers on plants thus weakened must necessarily be affected. Aside from the direct weakening of the plant due to the loss of sap and the withering of the tissue, the danger to the health of a plant thus attacked by plantlice is considerable. Although exceedingly minute, the beak of the plantlouse makes a wound which becomes in a short time surrounded by a discolored area, readily detected by the unaided eye. As these wounds extend for some little distance into the plant, a favorable location for the entrance of bacterial or fungus disease is thus secured even where the infestation of plantlice is not excessive enough to wither the tips of the stalk. Moreover it is perfectly possible for insects to carry fungus spores from diseased to healthy plants. Where the plantlice are abundant the leaves are covered with honey dew which is soon attacked by a dark fungus, and which together with the molted skins adhering to the sticky substance, gives the leaves an unhealthy appearance and must interfere with their natural function.

DISTRIBUTION.

Macrosiphum solanifolii has been recorded from Canada, Florida, Maine and California, and from various intermediate localities. Apparently it might be expected to occur in any of our states.

DESCRIPTION.

Recognition characters: In general *Macrosiphum solanifolii* is a large species either green or pink. The apterous forms are somewhat inclined to drop from the plant when disturbed. The abdomen is not marked with dark, but is ordinarily clear in color either pink or green, though sometimes late in the season individuals may be found with a mottling part pink and part green. The mature forms are rather glistening, but in the stage previous to the last molt the insect usually has a mid-dorsal line of dark green or pink (according to the color of the individual) while the rest of the dorsum is paler by virtue of a very slight powdery deposit. This appearance is more noticeable in bright light. The beak is short, usually, not or barely reaching the second coxa, though certain collections have been taken with beaks a little longer. The cornicles are characterized by reticulations at the tip. This reticulation holds true for all the mature individuals,—alate and apterous viviparous females, oviparous females, and males,—whether of the green or pink variety, and regardless of the food plant upon which they have developed. The cornicles of the immature individuals are not so marked. The antennae of the apterous females are a little swollen at the proximal part of III, where a few sensoria are placed; those of the alate females have the sensoria in a single row not extending to the distal tip of III. The wing veins are clear cut and well defined though slender.

The foregoing are the general recognition marks. There is no structural difference between the spring and the fall individuals great enough to lead one to think they might be different species; though there is a range in size, influenced by food plant or other conditions, great enough to cause hesitation in determining certain collections unless the progenitors are known. The measurements, therefore, in the following descriptions can only be taken as approximate.

Macrosiphum solanifolii. Winged viviparous female, green variety.—Head yellowish green. Beak typically barely reaching second coxa, though in some collections a little longer. Antennae, proximal segments pale green, distal segments dark; length of segments: III, .88 to .96 mm.; IV, .76 to .9 mm.; V, .64 to .72 mm.; VI, base .16 to .2 mm.; VI, spur .96 to 1.12 mm.; total length I to VI, 3.6 to 4.05 mm. III with single row of sensoria somewhat irregular in size numbering 18 or a few more or less, not extending to distal end. Prothorax and thorax light yellowish green, lobes brownish. Wings hyaline, veins dark brown, very slender and clear cut, stigma pale brown. Total wing expansion 8.1 mm. Legs with proximal part of femora and tibiae pale, tarsi and distal part of femora and tibiae dark. Tarsi .16 to .2 mm. Abdomen light green unmarked dorsally or ventrally. Cornicles, with proximal portion green and distal portion dark brown, imbricated for more than three-fourths its length but strongly reticulated at tip, cylindrical, length .95 mm. or about five times length of tarsus. Cauda light green, ensiform, length .48 mm. or about one-half length of cornicles. Total length of body to distal tip of cauda and exclusive of antennae 2.9 to 3.37 mm.

Winged viviparous female, pink variety.—Head light yellowish. Antennae with I and II light yellowish, rest dark. Sensoria as with the green variety. Porthorax and thorax light yellowish pink. Abdomen pale pink. Cornicles light yellow with tips dusky and strongly reticulated. Cauda pink. Measurements the same as with the green variety.

Apterous viviparous female.—Color either pink or green as with the winged viviparous form. Antennae, length of segments: III, .8 to .96 mm.; IV, .72 to .88 mm.; V, .56 to .72 mm.; VI, base .16 to .2 mm.; VI spur .96 to 1.2 mm.; total length of segments I to VI, average about 4.05 mm. III slightly swollen at basal third where 1 to 5 sensoria occur. Cornicles .96 to 1.04 mm. in length, and strongly reticulated at tip about one-fifth tne distance. Cauda .56 mm. Total length of body to distal tip of cauda and exclusive of antennae, 4.05 mm.

Apterous oviparous female.—Head pale, nearly white. Antennae with proximal joints pale, distal half dark. Length of segments: III, .68 tc .88 mm.; IV, .56 to .68 mm.; V, .52 to .64 mm.; VI, base .16 mm.; VI, spur .96 to 1.04 mm.; total antennal length I to VI average about 3.6 mm. III with about 3 to 6 sensoria. Prothorax and thorax pale like head. Legs with femora and tibiae, proximal portion pale, distal portion dusky. Tarsi dark, .16 mm. long. Hind tibiae conspicuously darker and much swollen and thickly set with sensoria. Abdomen light salmon pink. Cornicles pale at base, distal half dark and reticulated at tip; length .6 to .8 mm. Cauda salmon pink, ensiform, length .32 to .4 mm. Total body length to tip of cauda, antennae excluded, 2.13 to 2.15 mm. The size of the hind tibiae of this form makes it readily distinguished from the apterous viviparous form and young, even to the unaided eye.

The pink variety has been described because these predominate among the oviparous females. The color scheme of the green and yellow forms can be determined merely by substituting these colors for the salmon pink of the individual described, the dark coloration being the same for all three.

Winged male.—Head and antennae dark brown. Length of antennal segments: III, .72 to .8 mm.; IV, .48 to .64 mm.; V, .48 to .6 mm.; VI, base .16 mm.; VI, spur 1.04 to 1.28 mm.; total antennal length I to VI, 2.93 to 3.60 mm. Sensoria numerous on III, usually none on IV, and an irregular row of them nearly the whole length of V. Prothorax and thorax dark brown. Wings hyaline, veins dark and very slender, stigma pale brown. Legs brown, darker at tips. Abdomen greenish or brown. Cornicles pale brown, dark distally and reticulated, cylindrical, .48 to .56 mm. long. Total body length exclusive of antennae and cornicles, 1.12 to 1.57 mm. The thorax is large and strong, the abdomen much shrunken, making the cornicles seem conspicuously long. The male is described from individuals taken in copulation, in order that no mistake as to the identity of the species might occur.

INDOOR STUDIES.

This potato aphid is amenable to laboratory or greenhouse conditions, being very easy to rear indoors. In 1907 successful colonies were reared by the writer on garden peas and shepherd's purse in the insectary, the insects being originally collected from potato. The notes concerning these follow:

July-October, 1907. By starting potatoes in the insectary often, the aphids were supplied with fresh plants which were colonized by the individuals deserting the leaves and stalks they had rendered sickly.

Buckwheat was sown among the potato plants in the insectary and about 200 young and clean plants of shepherd's purse were put into trays. Peas were also sown at the same time. By the time the buckwheat and peas were well up about 100 fresh potato plants were available, and the *M. solanifolii,* deserting the older potato stalks, colonized thoroughly the fresh potato vines, pea vines, and the shepherd's purse apparently with no preference. Both winged and wingless forms were found for the rest of the season rearing contented progeny upon potato, and shepherd's purse, and also upon the young pea vines. Except for stray individuals which, of course, would be found upon everything in the crowded insectary, the buckwheat remained apparently untouched for feeding purposes. Whether *M. solanifolii* would have accepted the blossom tips of the older buckwheat or not was not demonstrated, as the buckwheat, although it lived, did not make much growth. (On vigorous succulent buckwheat in the field a collection of apparently *solanifolii* was taken at Houlton, Me., Aug. 31, 1907.)

October 11, 1907. Insectary search showed the *Macrosiphum* eggs near some of the oviparous forms both upon potato and shepherd's purse (*Capsella Bursa-pastoris.*) Many of the eggs were the glistening brownish black of well hardened eggs but some were pellucid green, showing that they had very recently been deposited. They were upon the plants indiscriminately on leaves and stalks. Males and oviparous females were present upon both these plants.

The appearance of the oviparous females and the deposition of eggs with the uncaged material at practically the same time as that of the forms that had been prisoners for 2 months would indicate that these dates are about normal. In the insectary the dispersion from overcrowded potato stalks to fresh plants seemed to take place irregularly and not at any stated times, the condition of the infested plant apparently influencing these movements. The fact that they seemed to accept the fresh potato plants almost as readily as the peas or the shepherd's purse might seem to indicate that if a similar succession of new potatoes were supplied them in the field they might not seek another host even there. As it is a wholesale migration has taken place each of the seasons these plantlice have been under observation.

July 7, 1915. Specimens of *Macrosiphum solanifolii* were collected from about the flower buds of Japanese rose on the campus (72-15).

72-15 (a) July 7, mature apterous viviparous females collected from Japanese rose were placed on potato in the laboratory. Both the pink and the green varieties were used. These settled at once. July 13,—pink and green individuals both still feeding, and a vigorous colony of green nymphs present. July 20. Progeny of 72-15 (a) present in colonies of pink and green young.

72-15 (b) July 7,—a few alate viviparous females collected from Japanese rose were placed on potato plants in the laboratory. Both the pink and the green variety used. July 9,—one pink female with 4 pink young, one green female with several green young. July 13,—pink and green females still feeding, and pink and green nymphs numerous. July 19,—plant sickly but aphid colonies thriving. Nine mature apterous pink females (progeny of the alate forms of July 7 (72-15 (b)) removed to fresh potato plant under number of 72-15 (b) (b).

72-15 (b) (b) July 19,—9 mature apterous pink daughters of alates (collection 72-15 (b)) placed on fresh potato plant. August 2,—the progeny of aforesaid 9 individuals now number approximately 500. All are pink, 35 of these have attained their growth, 20 being winged and 15 apterous.

*   *   *   *   *

The descendants unto several generations, of 72-15 which had been collected from Japanese rose, were kept on a succession of fresh potato plants in the laboratory until about the middle of August, when both the winged and wingless aphids began to get restless. The infested plants were taken down to the insect greenhouse and left uncovered. Stems of cut Japanese rose were kept near them in jars of water.

On September 15, these potato plants still had numerous aphids upon them but many had left and established thriving colonies of progeny upon the rose cuttings; goosefoot, *Chenopodium album;* redroot pigweed, *Amaranthus retroflexus;* shepherd's purse, *Capsella Bursa-pastoris;* several varieties of cultivated asters; and sow thistle, *Sonchus oleraceous.*

Both winged and wingless viviparous mature females of both the green and pink color varieties were found feeding upon all the plants listed in the foregoing paragraph and good colonies of young both pink and green, were also feeding readily upon all these plants. They were along the tender terminal stems, on fresh leaves or in the case of the asters particularly abundant upon the blossom petals.

Whether this aphid would accept so varied a diet immediately upon leaving the rose in the spring or not we do not know. After a summer upon potato it is apparently ready to play the role of a general feeder, judging from the wide range of food plants just recorded.

Maine collection data for eight seasons indicate that *solanifolii* prefers decidedly the rose in the spring and the potato in the summer, for it is commonly abundant upon these two and has not yet been conspicuous upon other vegetation here. There is however, no reason to suppose that any aphid will accept indoors a plant which it would not feed upon out of doors if conditions were favorable, and it might easily be present in small colonies without being detected.

FOOD PLANTS.

GRAMINEAE. Grass Family.

Zea mays L. Britton, W. E. 1913. 12th Rept. St. Ent. of Conn.

IRIDACEAE. Iris Family.

Iris sp. cultivated. Patch, Edith M., 1912. Me. Agr Expt. Sta. Bul. 202.
Gladiolus sp. Patch, Edith M. 1912. Me. Agr. Expt. Sta. Bul. 202.

POLYGONACEAE.

Fagopyrum esculentum Moench. Buckwheat. Patch, Edith M. 1907, field collection, (16-07).

CHENOPODIACEAE. Goosefoot Family.

Chenopodium album L. Patch, Edith M. 1915. Notebook record for Sept. 15. Greenhouse material.

AMARANTHACEAE. Amaranth Family.

Amaranthus retroflexus L. Redroot pigweed. Patch, Edith M. 1915. Notebook record for Sept. 15. Greenhouse material.

CRUCIFERAE. Mustard Family.

Brassica Rapa L. Turnip. Patch, Edith M. 1905, field collection (62-05).
Capsella Bursa-pastoris (L) Patch, Edith M. 1907. Me. Agr. Expt. Sta. Bul. No. 147, p. 244.

ROSACEAE. Rose Family.

Pyrus malus (Hill). Apple. Baker, A. C. 1915. Letter of May 4: "Last season we found the green variety feeding on apple. . . . I had noted the species previously on apple in the pink form, as well as the pink one on potatoes."

Rosa species. Patch, Edith M. 1914 (1915). Bul. 233. Me Agr. Expt. Sta. Japanese rose; 1915, Notebook record for July 13, apterous viviparous form on wild rose.

LEGUMINOSAE. Pulse Family.

Phaseolus vulgaris L. Bean. Patch, Edith M. 1905, field collection (53-05).

Pisum sativum L. Garden pea. Patch, Edith M. 1907. Me. Agr. Expt. Sta. Bul. No. 147, p. 244. Greenhouse test with progeny from potato colonies.

SOLANACEAE. Nightshade Family.

Physalis species. Ground cherry. Webster, R. L. 1915. Iowa Bulletin 155.

Solanum jasminoides Paxt. Pepper vine. Ashmead, Wm. 1882. Canadian Entomologist.

Solanum melongena L. Egg plant. Chittenden, F. H. 1915. In letter of June 22 "Collected at Washington between June 17 and 21, 1915."

Solanum tuberosum L. Potato. Fletcher, James. 1905. Ann. Rept. on Expt. Farms for 1904: Patch, Edith M. 1907-1915. Bulletins of Me. Agr. Expt. Sta.: Davis, J. J. 1911, Jour. Ec. Ent.; Britton, W. E. 1913 12th Rept. St. Ent. of Conn. Webster, R. L. 1915. Iowa Bul. 155.

COMPOSITAE. Composite Family.

Aster cultivated. Patch, Edith M. 1915 Notebook record for Sept. 15. Greenhouse material.

Cineraria sp. Ross, William A. 1914. In letter of Feb. 26, greenhouse material, "taken from flower stalks and foliage."

Lactuca sp. Davidson, W. M. 1912. Jour. Ec. Ent.

Sonchus oleraceous. Patch, Edith M. 1915. Notebook record for Sept. 15. Greenhouse material.

NOTES.

The type specimens of *solanifolii* are presumably lost. The writer once called at the Smithsonian Museum to consult Dr. Wm. Ashmead as to the possibility of referring to these and received the information that "the type is knocking around in a vial somewhere, probably dry by this time.' Then he continued with cordial interest: "If you have a large green *Macrosiphum* on *Solanum* you have *solanifolii* all right."

Upon this evidence the potato pest of Maine fields was identified with the "pepper vine" aphid of Florida, after comparing it with specimens which were being determined by Mr. Pergande as *solanifolii.*

The original description of the wingless female accords with the species generally known as *solanifolii* except that "style short, conical," is hardly applicable to any mature representative of the genus concerned. For this reason it seems likely that the specimen recorded may have been in the last nymphal stage, at which time the style or cauda would be short and conical. As was customary at that time, the spur of the sixth antennal joint is designated as the seventh.

The so-called male of the original description is the winged form of some other species of aphid.

It is an interesting fact that this species, though widely known in this country as a rose aphid and existing in various collections under a commonly recognized manuscript name, has not been described from the rose, although its identity with *solanifolii* remained unsuspected and it has for some years been supposed to be an undescribed rose species.

Considering the range of food plants this aphid accepts it would be surprising if the synonomy when it is finally worked out did not contain a long list of names. It is certain that it has been recorded for *pisi* at times and it is possible that some of the food plants accredited to *pisi* really belong to the dietary of *solanifolii.*

The present paper is not concerned with the question as to whether *solanifolii* should fall as a synonym of some well known European species. It seems safer to confine the problem to America, at least until we learn to recognize this species on our own territory regardless of the foodplant from which it is collected.

LITERATURE.

1882. Ashmead, Wm. *Siphonophora solanifolii.* On the Aphididae of Florida with descriptions of new species. (Paper No. 3.). Can. Ent. Vol. 14, p. 92. Original description of apterous viviparous form. The so-called "male" is a winged form of some other species.

1905. Fletcher, James. *Nectarophora solanifolii.* Ann. Rept. on Expt. Farms for 1904, p. 228.

1907. Patch, Edith M. *Nectarophora solanifolii.* In Insect Notes for 1906. Me. Agr. Expt. Sta., Bulletin 134, p. 215.

1907. Fletcher, James. *Nectarophora solanifolii.* Ann. Rept. on Expt. Farms for 1906, p. 210.

1907. Patch, Edith M. *Nectarophora solanifolii.* The Potato Plant Louse. Me. Agr. Expt. Sta., Bulletin 147, pp. 235-257. Figs. 25-33.

1911. Patch, Edith M. *Macrosiphum solanifolii.* Two species of Macrosiphum. Me. Agr. Expt. Sta., Bulletin 190, pp. 81-92. Figs. 59-66. Compared with *M. destructor.*

1911. Davis, J. J. *Macrosiphum solanifolii.* List of Aphididae of Illinois. Journal of Economic Entomology, Vol. 4, p. 330.

1912. Davidson, W. M. *Macrosiphum solanifolii.* Aphid notes from California. Journal of Economic Entomology. Vol. 5, p. 411. Recorded from wild lettuce.

1912. Patch, Edith M. *Macrosiphum solanifolii.* Aphid Pests ot Maine. Me. Agr. Expt. Sta. Bulletin 202, p. 178. Apparently this species collected from *Gladiolus* and cultivated *Iris.*

1913. Britton, W. E. *Macrosiphum solanifolii,* 12th Rept. of the State Entomologist of Connecticut for 1912, p. 294. Reported from leaves of corn and potatoes.

1914. Patch, Edith M. *Macrosiphum solanifolii.* Maine Aphids of the Rose Family. Me. Agr. Expt. Sta., Bulletin 233, p. Recorded from Japanese rose.

1915. Webster, R. L. *Macrosiphum solanifolii.* Potato Insects. Agr. Expt. Sta., Iowa St. Col. of Agric. and Mech. Arts. Bul. 155, pp. 400-406. Recorded from two species of wild ground cherry. (*Physalis*).

NATURAL CONTROLS.

It is always well to bear in mind concerning the injury inflicted by any plantlouse that so many elements of uncertainty enter into the career of these insects that it is quite impossible to predict whether such a pest is likely to trouble us for two or many consecutive years, or succumb to some adverse condition and practically disappear for a long time.

The weather, for instance, plays an important part in the welfare of aphids, heavy rains washing the tender forms from the plants, and cold days retarding the rate of their increase.

Certain climatic conditions are favorable to fungus parasitism which may sweep out the plantlice from a large area in a few days' time.

Then, too, in some seasons, predaceous and parasitic insects appear in numbers sufficient to render any artificial remedial measures superfluous.

REMEDIAL MEASURES.

Clean culture. Since the pink and green potato aphid passes the winter in the egg stage presumably upon a great variety of weeds near infested potato fields, the practice of fall plowing commends itself, and also the burning over of weedy places in the vicinity of potato fields in the fall or early spring. As it seems not impossible, although it has not been observed in the field, that belated individuals might under certain conditions remain upon the potato vines and deposit overwintering eggs there, the custom common through Aroostook County of burning the old stalks is commendable in this connection.

As the aphid feeds upon a wide range of plants, the foregoing measures should be observed relative to other crops grown in rotation on the same ground.

Sprays. Cultivated roses should be sprayed with some good tobacco decoction if found to be infested with these plantlice in the spring. This is both for the health of the rose bushes as a direct measure and for the potato crop indirectly, because none of the aphids which are killed on the rose can migrate to the potato fields later on.

If the infestation upon the potato is excessive a tobacco spray for aphids might be given.

When the trouble is confined to greenhouse plants either tobacco sprays or fumigation can be resorted to according to the experience and preference of the operator.

Formula—Tobacco Decoction.

Tobacco stems or tobacco dust*......	2 pounds.
Water	4 gallons.

Put the tobacco in the water, enough to cover, which may be either cold or hot. Place over the fire and when the water has reached the boiling point, remove some of the fire and allow the water to simply *simmer* for fully one hour, when the liquid is ready to be drained off, diluted to the above proportions and appled. Boiling violently drives off the nicotine. If whole-leaf tobacco is used prepare as above, using one pound of tobacco to each four gallons of water. No lime or other alkaline substance should be added to the tobacco *while cooking*. Apply at once or within a few days after making, if possible.

Certain reliable extracts such as "*Black Leaf*," "*Black Leaf 40*," and "*Nikoteen*" can be secured through local druggists. The Black Leaf preparations are manufactured by *The Kentucky Tobacco Product Company*, Louisville, Ky., and are carried by the Collins Hardware Company, 97 Friend St., Boston, Mass. *Nikoteen* is manufactured by *The Nikotine Manufacturing Company*, St. Louis, Mo., and can be secured from Joseph Brick & Sons, 47-54 N. Market St., Boston, Mass.

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*Refuse from cigar factories.

There is nothing to do in the preparation of these extracts except to stir the contents of the can before pouring out any quantity for dilution. In most cases one gallon of the *Black Leaf* will be found sufficient for each 70 gallons of water. But if in the treatment of any louse this does not seem sufficient it may be used in proportion of one gallon to 60 or 65 gallons of water. Careful sprayers have usually succeeded in killing plant-lice with this preparation in the proportion of one gallon to each 100 gallons of water. Thoroughness of application is of as much importance as the strength of the material.

Nikoteen is a more concentrated abstract, 1 part being used with from 400 to 600 parts of water.

Black Leaf 40 is a concentrated solution of nicotine-sulphate and is widely and successfully used in large western orchards, at the rate of 1 part to 700 or 800 parts of water. Some have been successful with 1 part to 1000 parts of water.

It is the common practice to add soap,—whale oil soap or good laundry soap at the rate of 2 bars to 50 gallons. This is to lessen the formation of drops, causing the spray to cover surfaces more in the form of a thin film.

Better success is obtained by some by using a little lime instead of soap, the inert solid in suspension aiding the extract to "wet" and "stick" to the bodies of the aphids. For the purpose 1 pound of stone lime, slaked and strained into 50 gallons of tobacco extract as prepared for application, is sufficient.

When other plant enemies besides aphids are present "Combination sprays" are frequently successfully applied. Self-boiled lime-sulphur (8-8-50 cold) may be used adding 1-70 of its volume of *Black Leaf*. On the same basis *Black Leaf* may be combined with Bordeaux (5-5-50) or with lead arsenate or with both together when foes combine against one kind of plant.

Even when the spraying is thoroughly done some of the aphids are likely to escape. Watch should therefore be kept and if the first application seems unsatisfactory, a second treatment in the course of a week is desirable.

When a small quantity of spray is required one teaspoonful of *Black Leaf 40* in one gallon of water is a convenient amount to mix.

Fig. 47. Pink and green aphid on potato stalk. Leaves covered with honey dew, honey dew fungus, and cast skins.

Fig. 48. Potato plant showing the result of 14 days infestation of plantlice on stalks which were previously healthy.

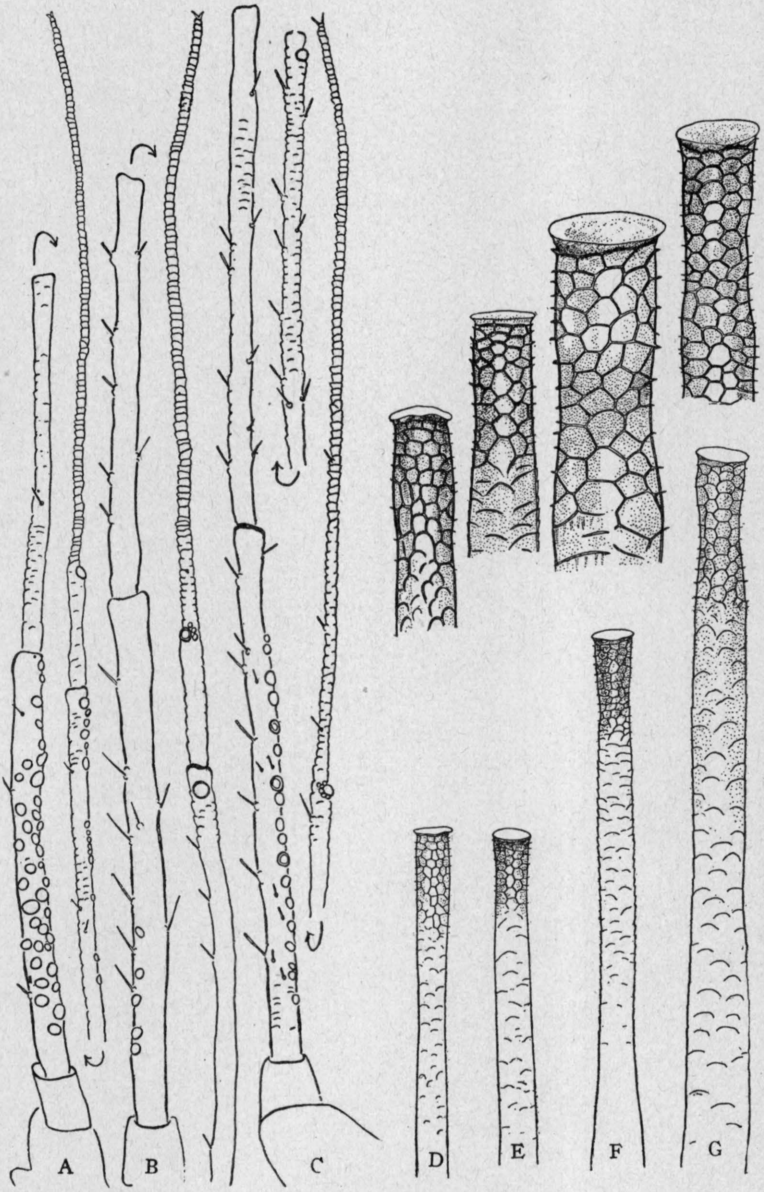

Fig. 49. *Macrosiphum solanifolii,* antennae and cornicles. A, alate male; B, apterous viviparous female; C, alate viviparous female; D, male; E, apterous oviparous female; F, alate viviparous female, pink variety; G, apterous viviparous female, green variety.

BULLETIN 243.

FURTHER DATA ON THE MEASUREMENT OF INBREEDING.[1]

By Raymond Pearl.

The purpose of the present bulletin is to continue the discussion of the measurement of inbreeding beyond the point where it was left in Bulletin 215 of this Station.[2] In that bulletin,

[1]This bulletin is based on certain technical studies on the theory of inbreeding which have appeared since the publication of Bulletin 215 of this Station. These technical papers have appeared under the general title "Studies on Inbreeding." The following list gives the bibliographical data regarding this series.

Studies on Inbreeding. I. A Contribution towards an Analysis of the Problem of Inbreeding. By R. Pearl, Amer. Nat. Vol. XLVII, pp. 577-615, 1913.

II. Tables for Calculating Coefficients of Inbreeding. By R. Pearl and John Rice Miner, Ann. Rept. Me. Agr. Expt. Stat. for 1913, pp. 191-202, (Bulletin 218), 1913.

III. On the Results of Inbreeding a Mendelian Population: A Correction and Extension of Previous Conclusions. By R. Pearl, Amer. Nat. Vol. XLVIII, pp. 57-62, 1914.

IV. On a General Formula for the Constitution of the *n*th Generation of a Mendelian Population in which all Matings are of Brother and Sister. By R. Pearl. *Ibid.* Vol. XLVIII, pp. 490-494, 1914.

V. Inbreeding and Relationship Coefficients. By R. Pearl. *Ibid.* Vol. XLVIII, pp. 513-523, 1914.

VI. Some Further Considerations regarding Cousin and Related Kinds of Mating. By R. Pearl. *Ibid.* Vol. XLIX, pp. 570-575, 1915.

It should be said that the above papers (with the exception of II) are not available for distribution by the Maine Agricultural Experiment Station. It is, however, the aim of the present bulletin, in conjunction with Bulletin 215 of this Station, to present the essential features of this series of studies likely to be of interest to the practical stock breeder in condensed form. A general review of the whole subject in detail will be found in the present writer's book entitled "Modes of Research in Genetics," New York (The Macmillan Co.) 1915.

[2]Pearl, R. The Measurement of the Intensity of Inbreeding. Me. Agr. Expt. Stat. Bulletin 215, pp. 123-138. 1913.

besides the general theory of the inbreeding coefficients and the practical means for their calculation, the consequences of continued brother × sister and parent × offspring breeding were discussed. Along the same line we shall now consider the theoretical consequences of

(a) Continued mating of first cousins, and

(b) Continued breeding of individuals exhibiting the avuncular type of relationship, that is, uncle × niece or nephew × aunt.

Another matter which will be discussed, as it was not considered at all in Bulletin 215, is the measurement of the proportionate part played in the total observed inbreeding by the fact that sire and dam are related to each other, as compared with inbreeding in the ancestry of either sire or dam alone.

Cousin Mating.

There are two possible sorts of first cousins, single and double. In the first case one of the parents of any individual is a brother (or sister) to the one of the parents of the other individual in the mating. In the second case, both the parents occupy this relation to the parents of the other individual in the mating.

These two sorts of first cousinship are shown in Pedigree Tables I and II.

PEDIGREE TABLE I (HYPOTHETICAL).

To Illustrate the Continued Breeding of First Cousin × First Cousin — Single Cousins.

λ	*a*	*c*	*g*	*m*	1
					2
				n	3
					4
			h	*o*	1
					2
				p	5
					6
		e	*i*	*m*	1
					2
				n	3
					4
			j	*q*	1
					2
				r	9
					10
	b	*d*	*g*	*m*	1
					2
				n	3
					4
			h	*o*	1
					2
				p	5
					6
		f	*k*	*m*	1
					2
				n	3
					4
			l	*u*	1
					2
				v	7
					8
Generation number	1	2	3	4	5

PEDIGREE TABLE II (HYPOTHETICAL).

To Illustrate the Continued Breeding of First Cousin × First Cousin — Double Cousins.

				k	*o*
			g		*p*
				l	*q*
		c			*r*
				m	*o*
			h		*p*
				n	*q*
	a				*r*
				k	*o*
			i		*p*
				l	*q*
		d			*r*
				m	*o*
			j		*p*
				n	*q*
Δ_2					*r*
				k	*o*
			g		*p*
				l	*q*
		e			*r*
				m	*o*
			h		*p*
				n	*q*
	b				*r*
				k	*o*
			i		*p*
				l	*q*
		f			*r*
				m	*o*
			j		*p*
				n	*q*
					r
Generation number	1	2	3	4	5

TABLE I.

Values of the Successive Coefficients of Inbreeding in the Case of Continued Cousin Mating.

Coefficient of Inbreeding	Ancestral Generation Included	Coefficient for Single Cousins	Coefficient for Double Cousins	Coefficient for Brother × Sister
Z_0	1	0	0	0
Z_1	2	0	0	50.00
Z_2	3	25.00	50.00	75.00
Z_3	4	50.00	75.00	87.50
Z_4	5	68.75	87.50	93.75
Z_5	6	81.25	93.75	96.98
Z_6	7	89.06	96.98	98.44
Z_7	8	93.75	98.44	99.22
Z_8	9	96.48	99.22	99.61
Z_9	10	98.05	99.61	99.80
Z_{10}	11	98.93	99.80	99.90
Z_{11}	12	99.41	99.90	99.95
Z_{12}	13	99.68	99.95	99.98
Z_{13}	14	99.83	99.98	99.99
Z_{14}	15	99.91	99.99	99.994
Z_{15}	16	99.95	99.994	99.997

The values of the coefficients of inbreeding (Z_0 to Z_{15}) for continued single and double cousin matings are shown in Table I. These coefficients are calculated from the usual formula,

$$Z_n = \frac{100\,(p_{n+1} - q_{n+1})}{p_{n+1}} \qquad \text{(i)}$$

where p_{n+1} denotes the maximum possible number of different individuals involved in the matings of the $n+1$ generation, q_{n+1} the *actual* number of different individuals involved in these matings. The method of using this formula on a pedigree has been fully explained[8] and need not be repeated here.

The data of Table I are given graphically in Fig. 50, together with the curve for brother × sister and parent × offspring.

From the table and figure it is seen that with continued inbreeding according to any one of these four types the coefficient approaches the value 100. The rate of approach is different, however, in the different cases. The curves fall into two pairs. The brother × sister and the double cousin curves are precisely alike so far as concerns their curvature or shape at any given point. Similarly, the parent × offspring and single cousin curves

[8]Me. Agr. Expt. Stat. Bulletin 215, pp. 127-135.

are of the same shape. *The essential point of difference is that the cousin curves lag a generation behind the others.*

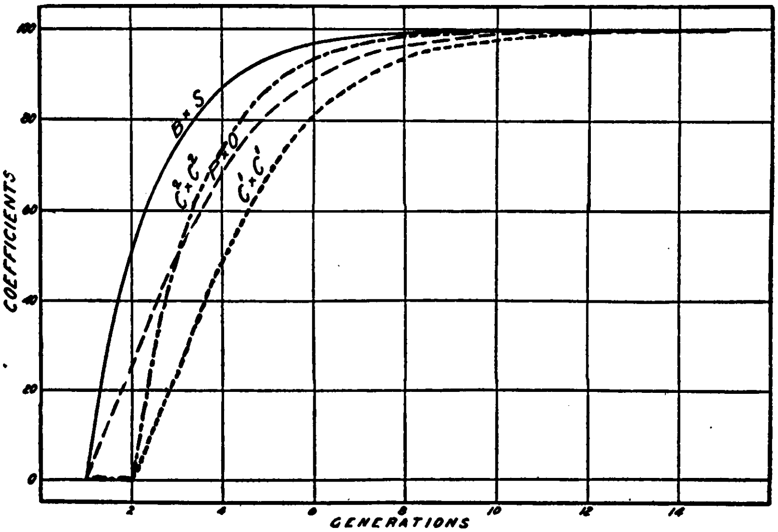

FIG. 50. Curves of inbreeding, showing (*a*) the limiting case of continued brother × sister breeding, wherein the successive coefficients of inbreeding have the maximum values; (*b*) continued parent × offspring mating; (*c*) continued first-cousin × first-cousin mating where the cousinship is double ($C^2 \times C^2$), and (*d*) continued first-cousin × first-cousin mating where the cousinship is single ($C^1 \times C^1$). The continued mating of uncle × niece gives the same curve as $C^1 \times C^1$.

AVUNCULAR MATINGS.

We may next consider the degree of inbreeding which follows continued mating of the type uncle × niece. Pedigree Table III gives a pedigree which is of this sort. In this, as in all the other pedigrees in this paper, the upper of two bracketed individuals is regarded always as the male, and the lower as the female. Thus in Pedigree Table III individual *b* is a female. the niece of individual *a* with whom she is mated; her father *e* having been a full brother of *a*.

PEDIGREE TABLE III (HYPOTHETICAL).

To Illustrate the Mating of Uncle × Niece.

X	*a* *b*	*a* *d* *e* *f*	*g* *h* *i* *j* *c* *d* *k* *l*	*m* *n* *o* *p* *g* *h* *q* *r* *g* *h* *i* *j* *c* *d* *s* *t*	*u* *v* *w* *y* *m* *n* *z* *l* *m* *n* *o* *p* *g* *h* 2 3 *m* *n* *o* *p* *g* *h* *q* *r* *g* *h* *i* *j* *c* *d* 4 5
Generation number	1	2	3	4	5

The values of the coefficients of inbreeding for uncle × niece mating are given in Table 2.

TABLE 2.

Values of Coefficients of Inbreeding for Continued Uncle × Niece Mating.

Coefficient	Number of Ancestral Generations	Value of Coefficient
Z_0	1	0
Z_1	2	0
Z_2	3	25.00
Z_3	4	50.00
Z_4	5	68.75
Z_5	6	81.25
etc.	etc.	etc. as in Table I

From this table it appears that the values of the coefficients of inbreeding will be exactly the same for this type of mating as in the case of single cousin mating. In other words the inbreeding is of the same degree of intensity if uncle is bred with niece, or nephew with aunt, as if single first cousins are mated together.

From the data presented in this and former papers it is clear that inbreeding continued for about ten generations, quite regardless of the type of mating, provided only it be continuously followed, leads to within one or two per cent. of complete "concentration of blood." The bearing of this result upon the general question of the degree of inbreeding which exists in the ancestry of our domestic animals today is obvious. To consider but a single case: In 1789[4] a law was passed prohibiting the importation of cattle into the Island of Jersey. Hence it follows that all pure-bred Jersey cattle of the present time must be of the descendants of the relatively few animals on the Island in 1790. Taking three years as about the average generation interval in cattle, this means about forty generations since the Island was closed to importation. The concentration of lines of descent which must have occurred in this time merely by the dropping of lines and quite regardless of the type of mating is obvious. This is not the place to go in detail into the discussion of inbreeding in Jerseys, especially as the writer hopes shortly to publish the results of an extensive study of this matter, but it seems desirable to emphasize the bearing of such hypothetical pedigrees for particular types of mating as are given in this and earlier papers, on the general problem of inbreeding.

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[4]Teste Rees's Encyclopedia and H. S. Redfield, Natl. Stockman and Farmer, December 15, 1892.

INBREEDING AND RELATIONSHIP COEFFICIENTS.

The pedigree of an individual consists of two halves. One of these halves is made up of the sire and his ancestors; the other of the dam and her ancestors. Following the conception of inbreeding set forth in detail in the earlier papers of this series it is plain that the values of the coefficients of inbreeding for a particular pedigree are composed of the following elements.

1. The occurrence of the same individual animals more than once on the sire's side of the pedigree only.
2. The occurrence of the same individual animals more than once on the dam's side of the pedigree only.
3. The reappearance of animals which appear first on one side of the pedigree (either the sire's or the dam's) on the other side.

If only 1 and 2 are to be found in the pedigree it means that the sire and the dam are totally unrelated (within the limits covered by the pedigree in the particular case). On the other hand, the occurrence of 3 means that sire and dam are in some degree related, and that a portion of the observed inbreeding arises because of that fact. Now the coefficients of inbreeding, in and of themselves, tell nothing about what proportionate part has been played by these three elements in reaching the final result. It is a matter of great importance to have information on this point because of its genetic significance. It is the purpose of the present discussion to describe a general method for obtaining this desired information.

The first step in the method, stated briefly, is to break up the pedigree elimination table formed to get the successive values of $p_{n+1} - q_{n+1}$, in our former notation, into four different parts. One of these parts will include the primary reappearance on the sire's side of the pedigree of such animals as appear first on the same side This may be called the "male only" table. The second part will include the primary reappearance on the dam's side of such animals as first appear on the same side. This is the "female only" table. The third part will include the primary reappearance on the dam's side of such animals as first appear on the sire's side. The fourth part is the reverse of the third. These last two may be called the "cross tables." The sums of the totals of these partial tables will give the total $p_{n+1}-q_{n+1}$ values for the successive generations.

The formation of the tables on this plan may be illustrated with some examples. These examples will also show the skeleton method of writing pedigree elimination tables, which saves much labor. This was referred to, but not significantly illustrated, in the earlier bulletin. It consists simply in doubling the total of the column for each generation rather than the separate items.

TABLE 3.

Partial Pedigree Elimination Table for King Melia Rioter 14th Showing the Primary Reappearances on the Sire's Side of the Pedigree of Animals which first Appear on that Side.

Generation	2	3	4	5	6	7	8	9	10	11	12
Melia Ann's Son			1	(2)[5]							
Melia Ann 3d				1	(6)[5]						
Lucy's Stoke Pogis					3						
Melia Ann					2						
St. Lambert Boy					1						
Letty Rioter					1						
Allie of St. Lambert					1						
Lord Aylmer					1						
Amelia 2d					1	(32)[5]					
Victor Hugo						1					
Oakland's Nora						1					
Stoke Pogis 3d						1					
Bachelor of St. Lambert						1					
Sir George of St. Lambert						1					
Diana's Rioter						1					
Orloff						1					
Lorne						1					
Hugo's Victoria						1	(82)[5]				
Victor Hugo							1				
Pauline							1				
Canada's John Bull							1				
Oakland's Nora							1				
Stoke Pogis 3d							7				
Kathleen of St. Lambert							1				
Lord Lisgar							4				
Lucy of St. Lambert							2				
Diana of St. Lambert							1				
Pet of St. Lambert							1				
Orloff							1				
Bachelor of St. Lambert							1				
Ida of St. Lambert							1	(210)			
Victor Hugo								2			
Stoke Pogis 3d								2			
Lord Lisgar								3			
Lorne								1			
Amelia								1	(438)[5]		
Lord Lisgar									1		
Pride of Windsor									2		
Laval									1		
Amelia									2		
Victor Hugo									3	(894)[5]	
Laval										1	
Amelia										1	
Lisette										1	
Berthe										1	
Totals			1	3	16	41	105	219	447	898	1,796

[5] In this and the following table the numbers in brackets are in each case twice the sum of the numbers in the preceding column. They represent the accumulated ancestral reduplication up to the generation in question.

The pedigree for 12 ancestral generations of the Jersey bull King Melia Rioter 14th (103901) may be taken as the first illustration.

TABLE 4.

Partial Pedigree Elimination Table for King Melia Rioter 14th Showing the Primary Reappearances on the Dam's Side of the Pedigree of Animals which first Appear on that Side.

Generation	2	3	4	5	6	7	8	9	10	11	12
King's Rioter Lad	—	—	—	1	2	4	8	16	32	64	128

Table 5 is clearly the one which demands special attention. As will shortly appear, it is the most important for the theory of inbreeding. Let us attempt its analysis. Just what does the first entry mean genetically? It states that King Melia Rioter, an animal which first appeared on the sire's side of the pedigree, reappeared in the second ancestral generation on the dam's

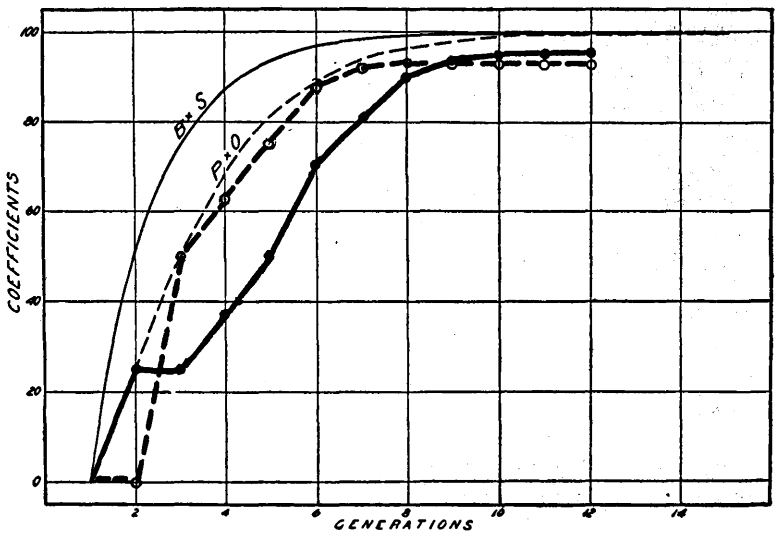

FIG. 51. Diagram showing (*a*) the total inbreeding (heavy solid line) and (*b*) the relationship (heavy broken line) curves for the Jersey bull, King Melia Rioter 14th. The high order of the inbreeding and relationship between the sire and dam in this case is evident by comparison with the lighter lines, which give the maximum values for continued brother $\times$ sister, and parent $\times$ offspring.

side. What this clearly means is that at least one-half of all the dam's ancestors, in the third and higher ancestral generations, *are identically the same animals as are ancestors of the sire.* The next entry in Table 5 indicates that in the fourth and higher ancestral generations at least $\frac{5}{8}$ of all the dam's ancestors were the same individual animals as were also ancestors of the sire. One-half of them were the same before the reappearance of St. Lambert's Rioter King. He makes up the additional $\frac{1}{8}$ of the dam's ancestry.

TABLE 5.

Partial Pedigree Elimination Table for King Melia Rioter 14th Showing the Primary Reappearances on the Dam's Side of the Pedigree of Animals which first Appear on the Sire's Side.

Generation	2	3	4	5	6	7	8	9	10	11	12
King Melia Rioter	1	(2)	(4)								
St. Lambert's Rioter King			1	(10)							
King of St. Lambert				1							
St. Lambert Boy				1	(24)						
St. Lambert Boy					2						
Oakland's Nora					1						
St. Lambert's Rioter King					1	(56)					
St. Lambert Boy						1					
King of St. Lambert						1					
St. Lambert's Letty						1	(118)				
Letty Coles 2d							1	(238)			
King of St. Lambert								1			
Louise's Grace								1			
Totals	1	2	5	12	28	59	119	240	480	960	1,920

From these tables it is obvious that a very considerable portion of the inbreeding shown in the pedigree of King Melia Rioter 14th arises from the fact that his sire and dam were closely related. Furthermore, both sire and dam are closely inbred in their own lines. The curve of total inbreeding in this case is shown in Fig. 51, along with the curves for continued brother × sister, and parent by offspring.

TABLE 6.

Summarized Pedigree Elimination Table for King Melia Rioter 14th.

Generation	2	3	4	5	6	7	8	9	10	11	12
♂ only			1	3	16	41	105	219	447	898	1,796
♀ only				1	2	4	8	16	32	64	128
Cross-over	1	2	5	12	28	59	119	240	480	960	1,920
Together	1	2	6	16	46	104	232	475	959	1,922	3,844

From this we have, for the inbreeding coefficients,

$$
\begin{aligned}
Z_0 &= 0\\
Z_1 &= 25.00\\
Z_2 &= 25.00\\
Z_3 &= 37.50\\
Z_4 &= 50.00\\
Z_5 &= 71.88\\
Z_6 &= 81.25\\
Z_7 &= 90.63\\
Z_8 &= 92.77\\
Z_9 &= 93.65\\
Z_{10} &= 93.85\\
Z_{11} &= 93.85
\end{aligned}
$$

PEDIGREE TABLE IV.

Pedigree for Four Ancestral Generations of King Melia Rioter 14th.

No. 103901 King Melia Rioter 14th. Sex ♂	♂ No. 73104 King Melia Rioter	No. 63200 ♂ Marjorie Melia Ann's Son.	No. 56581 ♂ Melia Ann's King.	No. 22041 ♂ Melia Ann's Son.
				No. 100775 ♀ Lottie Melia Ann.
			No. 157263 ♀ Marjorie Melia Ann.	No. 22041 ♂ ● Melia Ann's Son.
				No. 905883 ♀ Mary Melia Ann.
		No. 181544 ♀ Letty Silver Hair.	No. 58169 ♂ King of All Kings.	No. 54896 ♂ St. Lambert's Rioter King.
				No. 114804 ♀ St. Lambert's Letty.
			No. 148456 ♀ Exile's Silver Hair.	No. 32559 ♂ Exile of St. Anne's.
				No. 60449 ♀ Silver Hair 4th.
	♀ No. 262926 Larissa Marie.	No. 73104 ♂ ● King Melia Rioter.	No. 63200 ♂ ⊕ Marjorie Melia Ann's Son.	No. 56581 ♂ ⊗ Melia Ann's King.
				No. 157263 ♀ Marjorie Melia Ann.
			No. 181544 ♀ ⊕ Letty Silver Hair.	No. 58169 ♂ ⊗ King of All Kings.
				No. 148456 ♀ ⊗ Exile's Silver Hair.
		No. 219360 Z Dula Riotress Maid.	No. 62098 ♂ King Rioter's Lad.	No. 54896 ♂ ● St. Lambert's Rioter King.
				No. 142296 ♀ King's Riotress Nora.
			No. 218796 ♀ St. Lambert's Dula Riotress.	No. 57778 ♂ St. Lambert's Boy.
				No. 174761 ♀ Rioter Lad's First Daughter.

These facts will possibly be made clearer to those not actually working much with pedigrees by Pedigree Table IV, which gives the first four ancestral generations[6] of the pedigree of King Melia Rioter 14th.

Generalizing the above reasoning we get the following result.

In A_3, and higher ancestral generations, 2-4 = 50.00 per cent. of the dam's ancestors are animals which are also ancestors of the sire.

In A_4, and higher ancestral generations, 5-8 = 62.50 per cent. of the dam's ancestors are animals which are also ancestors of the sire.

In A_5, and higher ancestral generations, 12-16 = 75.00 per cent. of the dam's ancestors are animals which are also ancestors of the sire.

In A_6, and higher ancestral generations, 28-32 = 87.50 per cent. of the dam's ancestors are animals which are also ancestors of the sire.

In A_7, and higher ancestral generations, 59-64 = 92.19 per cent. of the dam's ancestors are animals which are also ancestors of the sire, and so on.

These percentages are quantities of a good deal of interest. They measure the degree in which King Melia Rioter 14th's sire and dam were related to each other. Community of ancestry is the basis of kinship.

Percentages derived in the way shown above, from cross pedigree elimination tables, I have proposed to call *coefficients* of relationship, and to designate by the letter K, with appropriate sub-numbers referring to the generation. These relationship coefficients are, with some limitations, independent of the inbreeding coefficients in the values they may take, though the two will usually be correlated to some degree. It is, however, possible to have a high value of Z with $K = 0$.

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[6]In the study of pedigrees stress is naturally laid on the ancestral generations, rather than on the filial, as in breeding experiments. It becomes very convenient to have a brief designation for ancestral generations, in the same way that F_1, F_2, etc., are used to denote filial generations. I would suggest the use of the letter A with sub-numbers for this purpose. We then have A_1 denoting the parental generation, A_2 the grandparental, A_3 the great-grandparental, etc.

TABLE 7.

Comparing the Maximum Possible Values of the Coefficients of Inbreeding (Z) when the Coefficient of Relationship K Equals (a) Zero, and (b) 100.

Generation	Maximum Possible Value of Z when $K = 0$	Maximum Possible Value of Z when $K = 100$
A_1	0	0
A_2	0	50.00
A_3	50.00	75.00
A_4	75.00	87.50
A_5	87.50	93.75
A_6	93.75	96.88
A_7	96.88	98.44
A_8	98.44	99.22
A_9	99.22	99.61
A_{10}	99.61	99.80

The most important feature of the relationship coefficients is found in their genetic implications. This can be indicated best by an illustration. Let us consider the case of the maximum possible degree of inbreeding with $K = 0$. This will be found when the sire and the dam are each inbred to the highest possible degree (continued brother $\times$ sister mating) but are in no way related to each other. Such a case would be afforded. for example, if a Jersey bull, the product of continued brother $\times$ sister mating, was bred to a Holstein cow, which was also the product of a continued brother by sister breeding. Clearly K would be 0, since no animal on one half of the pedigree could even appear on the other. The values of the successive coefficients of inbreeding (Z's) in such a case are shown in Table 7, where they are compared with the coefficients of inbreeding in complete continued brother $\times$ sister mating, where $K = 100$.[1]

From this it appears that an individual may be inbred in 10 generations to within two-tenths of one per cent. as intensely, measured by the coefficients of inbreeding, if his sire and dam are in no way related, as he would be if his sire and dam were brother and sister. But clearly the germinal constitution of the individual produced would, except by the most remote chance, be quite different in the two cases.

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[1]Since, of course, *all* of a sister's ancestors are identical with her brother's.

It is suggested that the two constants be written together for each generation, the coefficient of inbreeding being followed by the coefficient of relationship in brackets. Thus we have

INBREEDING AND RELATIONSHIP COEFFICIENTS OF KING MELIA RIOTER 14TH.

$$
\begin{aligned}
Z_0\,(K_1) &= 0 & (0)\\
Z_1\,(K_2) &= 25 & (0)\\
Z_2\,(K_3) &= 25.00 & (50.00)\\
Z_3\,(K_4) &= 37.50 & (62.50)\\
Z_4\,(K_5) &= 50.00 & (75.00)\\
Z_5\,(K_6) &= 71.88 & (87.50)\\
Z_6\,(K_7) &= 81.25 & (92.19)\\
Z_7\,(K_8) &= 90.63 & (92.97)\\
Z_8\,(K_9) &= 92.77 & (93.75)\\
Z_9\,(K_{10}) &= 93.65 & (93.75)\\
Z_{10}(K_{11}) &= 93.85 & (93.75)\\
Z_{11}(K_{12}) &= 93.85 & (93.75)
\end{aligned}
$$

The physical meaning of these expressions is simple and straightforward. Z_4 (K_5) tells us that in the 5th ancestral generation of King Melia Rioter 14th he had only one-half as many different ancestors as was possible for that generation, and of his ancestors three-fourths were common to his sire and his dam. However one looks at the matter there can be no denial that King Melia Rioter 14th is a closely inbred animal.

In Fig. 51 the heavy broken line gives the relationship coefficients for King Melia Rioter 14th. It will be instructive now to consider another example by way of contrast. Again a Jersey bull, Blossom's Glorene (102701), will be taken. Only the final result need be given.

INBREEDING AND RELATIONSHIP COEFFFICIENTS OF BLOSSOM'S GLORENE.

$$
\begin{aligned}
Z_0(K_1) &= 0 & (0)\\
Z_1(K_2) &= 0 & (0)\\
Z_2(K_3) &= 12.50 & (0)\\
Z_3(K_4) &= 12.50 & (0)\\
Z_4(K_5) &= 25.00 & (0)\\
Z_5(K_6) &= 29.69 & (0)\\
Z_6(K_7) &= 35.94 & (0)\\
Z_7(K_8) &= 40.23 & (0)
\end{aligned}
$$

The total inbreeding and the relationship curves are given in Fig. 52.

The difference in the breeding of this bull and the one considered in the former example is striking. In the 8th ancestral generation Blossom's Glorene has but 60 per cent. of the num-

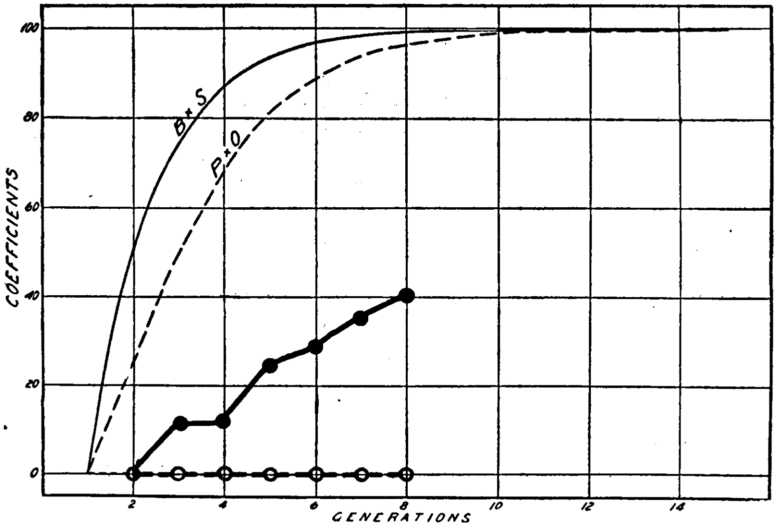

FIG. 52. Diagram showing the total inbreeding (heavy solid line) and the relationship (heavy broken line) curves for the Jersey bull Blossom's Glorene, over a period of eight ancestral generations. Compare with Fig. 51.

ber of different ancestors possible in that generation, but not one single animal in the ancestry of his sire occurs in the ancestry of his dam (within the limits A_1 to A_8). The probability is that Blossom's Glorene is heterozygous in respect of many of his characters, while King Melia Rioter 14th is homozygous.

The pedigree of Blossom's Glorene is shown in Pedigree Table V.

PEDIGREE TABLE V.

Pedigree for Four Ancestral Generations of Blossom's Glorene.

Sex ♂ No. 102701 Blossom's Glorene	♂ No. 86163 Dan of Peach Hill Farm.	No. 66900 ♂ Golden Lad's Double Grandson.	No. 53960 ♂ Golden Lad's Successor.	No. P. S. 2153 J. H. B. ♂ Great Scot. (Imp.)
				No. 127228 ♀ Golden Ora.
			No. 149149 ♀ Golden May of St. Peter.	No. P. S. 1242 J. H. B. ♂ Golden Lad.
				No. F. S. 7983 J. H. B. ♀ Cornflower.
		No. 99742 ♀ Oxorilletta 2d.	No. 23472 ♂ Glorene's Prince.	No. 10401 ♂ King Eric.
				No. 4785. ♀ Glorene.
			No. 50983 ♀ Oxorilletta.	No. 17417 ♂ Oxori.
				No. 26838. ♀ Orinoque's Riletta.
	♀ No. 235288 Blossom of Peach Hill Farm.	No. 84318. ♂ Oyama of Peach Hill Farm.	No. 55317. ♂ Pedro of Valley Home 2d.	No. 48886. ♂ Pedro of Valley Home.
				No. 97523. ♀ Madeline Pollard.
			No. 132053. ♀ Bessie of Highland.	No. 31111. ♂ Essie W's. Ricter.
				No. 113949 ♀ Lena of High Land.
		No. 230006 ♀ Lillie of Peach Hill Farm.	No. 55317 ♂ ● Pedro of Valley Home 2d.	No. 48886. ♂ ⊗ Pedro of Valley Home.
				No. 97523. ♀ ⊗ Madeline Pollard.
			No. 179056. ♀ Spotty Bouquet.	No. 46717. ♂ Silver Spray Pogis.
				No. 114910. ♀ Charm of Bouquet.

From this table it will be seen that this bull Blossom's Glorene essentially represents a cross of Island stock on St. Lambert. His sire is strong in Island blood particularly that of the famous bull Golden Lad P. S. 1242. The American blood on the sire's side is *not* St. Lambert. These facts make plain why it is that we get the values for inbreeding and relationship coefficients which have been shown above.

In view of the very marked difference between the two Jersey bulls which have been used as examples in the above discussion, King Melia Rioter 14th (103901) and Blossom's Glorene (102701), it becomes of interest to learn something, if possible, about the animals themselves. An attempt has been made to do this, by correspondence with the American Jersey Cattle Club, and the breeders and various owners of the animals under consideration.[8]

Let us first consider the registered progeny of these bulls. These are shown in Table 8.

TABLE 8.

Registered Progeny of King Melia Rioter 14th and Blossom's Glorene.

KING MELIA RIOTER 14TH (103901)			BLOSSOM'S GLORENE (102701)		
Sex.	Name.	Number	Sex.	Name.	Number
Male	Mary's Jolly Raven...	131203	Female	Sadie Glorence..........	296356
			Female	Maggie Lambert Blossom	318687
			Female	Glorene's Damsel.......	335348
			Female	Rose Glorene...........	335349
			Female	Freda Glorene..........	335351
			Female	Edith Glorene..........	335352
			Female	Glorene's Loretta D....	335353
			Female	Golden Lad's Miss Glorene..............	335354
			Female	Queen Ola Bloss........	335355
			Female	Glorene's Burletta......	335358

From the table it might appear that Blossom's Glorene was a much surer breeder than King Melia Rioter 14th. This, however, was not in fact the case. The difference in the two halves of the table only means that more of the progeny of the former bull than of the latter *were registered*. I am informed by Mr. S. B. McCague, who was the owner of King Melia Rioter 14th during the major portion of his breeding life, that he was a sure calf getter. Mr. McCague now has a good deal of stock from him eligible to registration, but not registered.

Regarding the characteristics of the two animals, it appears from the available evidence that both were excellent bulls, of fine conformation and high constitutional vigor. Unfortunately it is not now possible to get a photograph of either animal. Figures 53 and 54 give illustrations of certain of the progeny of

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[8]For aid in this inquiry we are particularly indebted to Mr. R. M. Gow, Secretary of the American Jersey Cattle Club, who in this as in other matters has always been most kind in furnishing data from the records of the Club; to Mr. W. J. Hussey, of Mt. Pleasant, Ohio, Mr. S. B. McCague, of Coraopolis, Pa., Mr. J. T. Ward, of Rogers, Ohio, and Mr. John K. Kelly, of Kensington, Ohio.

King Melia Rioter 14th. This is the most interesting, because he was such an extremely inbred animal. The photographs were furnished by Mr. McCague. They leave something to be desired so far as posing is concerned, but still give a very fair idea regarding these calves.

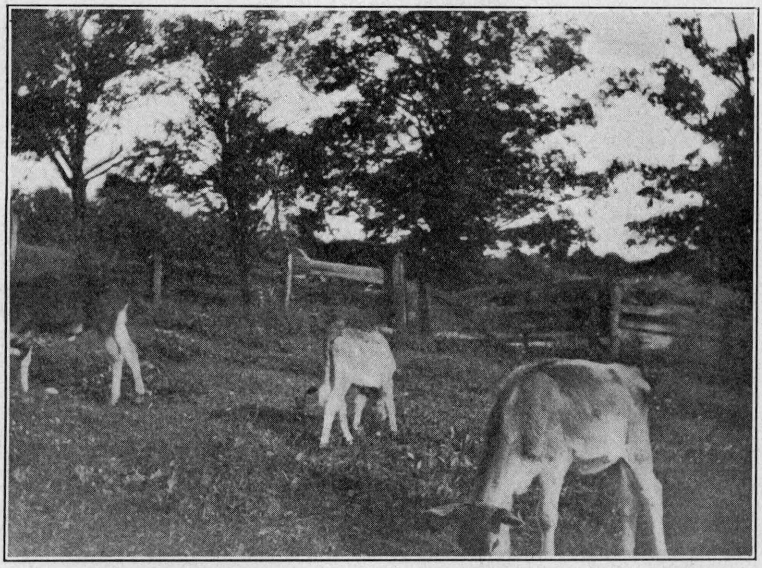

FIG. 53. Showing two daughters and a grand-daughter of King Melia Rioter 14th.

It is clear from these photographs, and the statements of the owners, that in spite of the excessive inbreeding these animals are not degenerate weaklings. King Melia Rioter 14th was as a calf a very superior animal, according to the statement of W. G. Hussey, a Jersey breeder of long experience. Mr. McCague, who owned him as an adult, says that he "was a splendid animal of fine conformation." He was sold about a year ago. Mr. McCague states that "the party who bought him, through improper handling made him cross, and he killed him."

Regarding Blossom's Glorene, the breeder, Mr. J. T. Ward, of Rogers, Ohio, writes as follows: "I sold the bull which you are interested about when he was a calf. Have not seen him since but he was a dandy when a calf . . . Enclosed you will find a picture of his sire. The young bull should have proven as good or better than his sire." The photograph referred to is reproduced here as Fig. 55.

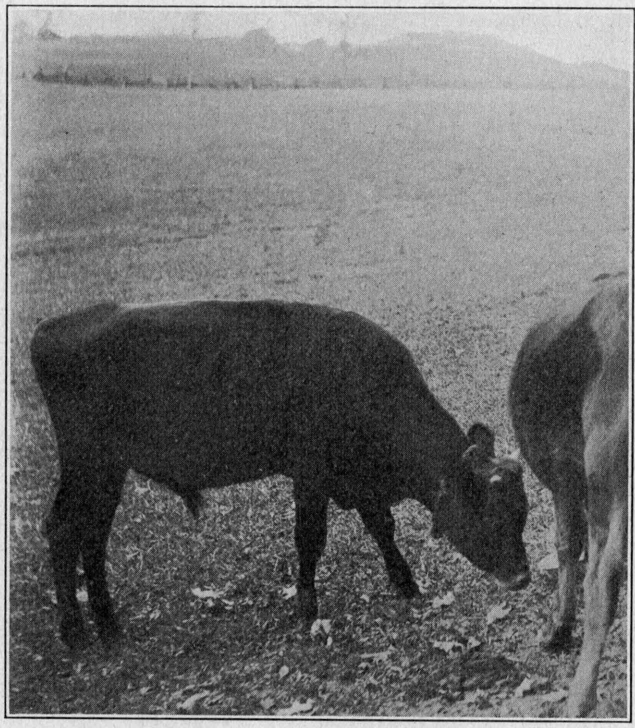

FIG. 54. King's King Melia, *aet.* 7 months, a son of King Melia Rioter 14th, out of Meadow Brook Edna (283141).

The last owner of this animal, Mr. J. J. Kelley of Kensington, Ohio, states that as an adult he fulfilled the promise he made as a calf and was a first-class bull. He was a sure breeder, getting stock of good quality. He was disposed of "owing to his vicious disposition."

It may fairly be said in conclusion that there does not appear to be any outstanding or marked difference between the two bulls, King Melia Rioter 14th, and Blossom's Glorene, in respect of either (a) constitutional vigor, (b) breeding ability, (c) conformation, or (d) quality of get. So far as these qualities, at least, are concerned there are no differences between these animals in any way corresponding in either degree or kind to the differences which we have seen to exist in their pedigrees in respect of the degree and nature of the inbreeding there existing. These facts constitute a definite, though small, bit of evi-

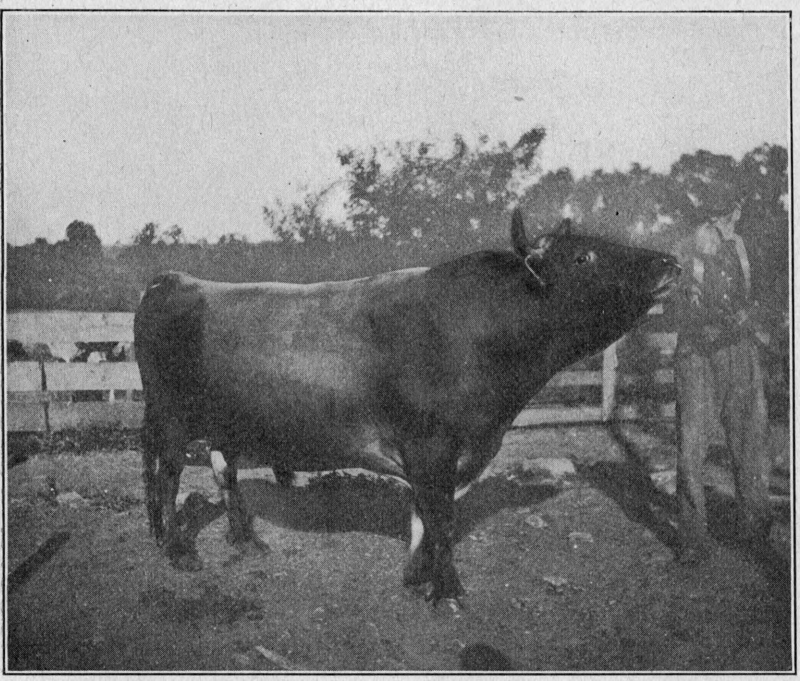

FIG. 55. Photograph of the sire of Blossom's Glorene, Don of Peach Hill Farm (86163).

dence in favor of the view, which finds much support in the literature of both practical stock breeding and experimental genetics, that the degree of inbreeding, *in and of itself alone,* has very little directly to do with the qualities of the offspring.

SUMMARY.

This bulletin is a continuation of Bulletin 215 of this Station. In it the subject of continued cousin mating and continued mating of the avuncular type are first discussed. It is shown that all types of cousin and avuncular matings if continued lead to values of the coefficient of inbreeding approaching 100 per cent.

Relationship coefficients and the method of calculating them are described. As illustrations of method the pedigrees of two Jersey bulls, King Melia Rioter 14th and Blossom's Glorene, are discussed. Following this the available data regarding these animals and their progeny are presented.

BULLETIN 244.

BLUEBERRY INSECTS IN MAINE.*

William Colcord Woods.

Perhaps as unique and interesting an ecological community as may be encountered in the state of Maine is presented by the blueberry barrens of Washington County which comprise some two hundred and fifty thousand acres of unforested wild land in the eastern part of the state, extending roughly from Cherryfield in the west to Machias in the east and comprising more especially Deblois and the townships numbered 16, 17, 18, 19, 24 and 25. How the barrens originated is a matter of dispute and there are several theories as to their beginning, but at any rate this fact is clear: in this section of the country wherever the forests are removed and more especially when they are destroyed by fire, blueberry bushes tend to spring up in large numbers. The barrens or "plains" consist of great stretches of mostly level or slightly rolling land more or less broken up by lakes and swamps. Climatic conditions such as characterize the whole coast of Maine prevail here: short summers, which on the barrens are very hot, and very long cold winters during which, however, the plants are usually well protected by a thick covering of snow. The average annual rainfall is 45 inches; typically there is a heavy rainfall in the spring followed by a dry period in June, a condition which seems to be favorable to the growth of blueberry bushes. When tested the soil, which is a mixture of sand, gravel and loam, is found to give an acid reaction.

The Blueberry in Maine.

In Maine the blueberry blossoms about the middle of May, and on the barrens the berries begin to ripen quite generally by

*Papers from the Maine Agricultural Experiment Station: Entomology No 83.

the end of July. There, the picking season lasts from the tenth of August until mid-September. The greater part of the barrens is owned by comparatively few individuals but for a moderate rental they lease the land to farmers and others living in the vicinity who, as will be explained shortly, take charge of the burning and picking and in general care for the property. The berries are picked with a rake somewhat similar to that used for gathering cranberries, consisting of a flat tray one end of which is prolonged into a row of 25 or 30 small steel teeth while to the opposite end a short handle is attached. When in use, it is swung with a forward-directed lifting movement More or less foreign material such as leaves and stems is gathered in this way together with the fruit, but usually the berries are given a preliminary winnowing in the field, and this removes the coarser dirt. With the rake, one man can pick on the average about 3 bushels a day and it is estimated that one acre yields about 60 bushels of berries. The land is valued at about 50 dollars per acre. After the berries have been winnowed, they are packed in half bushel boxes and driven to the canneries. During the picking season the pickers move out to the barrens with their families and live in tents, so that the plains appear not unlike an army encampment, for at this time there are some 1,200 or more people finding their employment there.

Although the blueberry stands transportation well, comparatively little of the fruit is shipped fresh on account of the high rates charged, and most of the berries are sold directly to the canneries and to the local markets. Washington County is the home of the blueberry industry in this state and 12 canneries are located in various towns in this county, as well as one in Amherst in Hancock County. Each cannery has a capacity of several hundred bushels per day and employs from 20 to 30 people. In 1886 when the first attempt was made to can the berries, 5,000 bushels were put up; whereas in 1912 some 90,000 bushels were canned and the industry valued at $2,000,000.

Every third year the barrens are burned over, although occasionally the land is allowed to lie unburned for as many as 5 years or even longer. As a rule, each owner divides his land into 3 approximately equal lots which are burned in rotation, one each year. No berries are produced on the "new burn" (by which is meant the first year's growth of bushes) but the second year the bushes bear very heavily, and somewhat less heavily in succeeding years, the reason being that the fruit is produced on the new wood developed during the preceding year. All the stems and leaves are destroyed in the burning and only the tangled mass of roots remains, so that there is a very vigorous growth during the first year, but decidedly less the second year as so much energy must be expended in developing the berries. The fires are set on a clear morning in the spring and sweep across the barrens all day but are checked by the heavy dews in the evening. Mr. Bird and Mr. Cobb in their thesis on the blueberry presented to the faculty of the University of Maine in 1913 state that no free element except carbon is left when the bushes are burned, for the vegetable oils are converted into carbonates, sulphates, and phosphates, or into metallic oxides, all of which are soluble in the soil water. Nitrogen is lost, but is supposed to be returned by a symbiotic fungus which lives on the roots.

Not only does the burning restore the fertility but it tends to keep in check the trees and bushes which would otherwise spring up on the plains. Three species of blueberries occur on the barrens, *Vaccinium pennsylvanicum* Lam. (including var. *nigrum* Wood), *V. canadense* Kalm, and *V. vacillans* Kalm, but the first two very decidedly predominate. As *V. canadense* ripens about 10 days later than *V. pennsylvanicum,* the berry season is fairly long. Locally the mountain-cranberry *Vaccinium Vitis-Idaea* L. var *minus* Lodd forms a dense cover over the ground, especially along the sides of little ravines. Huckleberries *Gaylussacia baccata* (Wang.) C. Koch and chokeberries, *Pyrus melanocarpa* (Michx.) Willd. are in places very plentiful, while the other more characteristic plants associated with the blueberries are the sheep-laurel, *Kalmia angustifolia* L., sweet-fern, *Myrica asplenifolia* L, and young gray birches, *Betula populifolia* Marsh. Less characteristic but common on some parts of the barrens are the alder, *Alnus incana* (L.) Moench, meadow-sweet, *Spiraea latifolia* Borkh, and several species of *Aster* and *Solidago.*

Blueberries are widely distributed elsewhere throughout the state but they grow only in pastures and waste land, and there is no real blueberry industry outside of Washington County (save for the one cannery already referred to in Hancock County), for the fruit is used only locally while fresh. As on the barrens the low bush blueberries and more especially *V. pennsylvanicum* and *V. canadense* are the ones most generally gathered. Two species of high bush blueberries, *V. corymbosum* L. and *V. atrococcum* (Gray) Heller occur in the state, usually in moister localities, but they are little used in any section of the state with which I am familiar.

Besides the low and high bush blueberries several other species of *Vaccinium* occur in the state. These are the bilberries *V. caespitosum* Michx. and *V. uliginosum* L. and the cranberries, *V. Vitis-Idaea* L. var. *minus* Lodd, *V. Oxycoccus* L. and *V. macrocarpon* Ait.

Insects Attacking the Fruit Directly.

The Apple Maggot *Rhagoletis romonella* Walsh.

Distribution. Most important of the insects affecting the blueberry and the one around which the chief economic interest centers is the ordinary apple maggot or railroad worm, *Rhagoletis pomonella* Walsh (Diptera, Trypetidae). In Maine this fly in so far as the blueberry is concerned apparently is restricted to the barrens of Washington County although as an apple pest this species is widespread and troublesome throughout the state. Mid-July is the time during which the adults begin to appear on the plains. Eggs deposited in the berries during August hatch into white maggots which become full grown in about two weeks and enter the soil to pupate, spending the winter as puparia and emerging as adult flies in the course of the succeeding summer.

Seasonal history and life history in the blueberry. The adult. Rhagoletis pomonella in the adult form is a beautiful little black fly with banded wings. Although the total number of individuals on the whole extent of the barrens must be very large they are nowhere very abundant and the writer has never captured more than 22 in any one day even when he has spent 8 or 9 continuous hours on the plains, while usually one sees but 12 or 15 or even fewer.

All of the writer's observations were made in the vicinity of Cherryfield, Maine, as this town offered the easiest access to the barrens. In 1913 two trips were made to the plains, the first on July 30 and the second on August 14. Adults were present on both dates. Rather more data are available for 1914. On July 2 the writer made his first visit to the plains for that year. No flies had yet emerged. An attempt to dig out puparia was partially successful for a few were obtained, but this is an impracticable procedure partly because, as the puparia are so scattered, much soil must be sifted to reveal only a few, and partly because the tangled mass of roots and underground stems renders digging very difficult. No flies emerged from any of these puparia and subsequent examination showed that all were dead, probably, as will be made clearer later, because they were dug on "new burn." On July 20 a few adults were captured and it seems fair to assume that they began to emerge about the middle of the month. On July 30 and August 12 the flies were fairly common, but they were decidedly more numerous on August 18-20. Imagos were still fairly common but noticeably fewer on August 25 and but one fly was observed on September 10. Adults were fairly common on August 26, 1915.

Under artificial conditions emergence covers a considerable period of time. Pupae obtained from material collected during the summer of 1913 were kept at room temperature through the following winter and spring. February 11, 1914 and May 8, 1914 were the extreme dates of the emergence of adults from puparia kept under exactly the same conditions in the laboratory. None emerged however between February 11 when a single female developed and April 3. 35 out of the total 54 emerged between April 14 and April 27.

As the puparia which were dug in the field failed to produce adults the writer was unable to determine the preoviposition period. No maggots were found on July 30, 1914 but on August 12 larvae at least a week old were fairly common. This would indicate a preoviposition period of at least 15 days and probably longer. Doctor Illingworth (Cornell Exp. Sta. Bul. 324, p. 143) records it as 24 days for specimens bred from apple. In this bulletin is published also a detailed account, with figures, of the development of the eggs in the female.

Presumably the habits of the fly in relation to the blueberry are in general similar to its habits on the apple. There is however one very striking difference. Whereas on the apple the flies are rather sluggish and very tame, so that it is easy to watch oviposition in the field, on the blueberry they are very alert and shy, and the writer has never seen oviposition in the field. The adults suddenly appear on the berries seemingly as if they had just sprung into existence, and are so suspicious that it is no easy task to take them captive, a decided contrast to the larger, less active, and easily taken apple flies.

The Egg. The writer observed copulation in the laboratory several times in early August, 1914. The male grasped the female with his prothoracic and mesothoracic legs, the metathoracic trailing unused behind. The female meanwhile wandered nervously and uneasily about. They may remain in copulation at least half an hour but from 15 to 20 minutes seemed to be the usual time.

The adults are restless in confinement and it is hard to keep them alive. The writer has never succeeded in keeping them much over 3 weeks although they were supplied with food daily and with water many times daily. They refused to oviposit in captivity and I have witnessed the process once only. Then it took place just as has been described for the apple maggot. The fly walked over the surface of the berry and finally stopped, head downward. Lifting her abdomen, she thrust out her ovipositor and made a slit at an angle of 45 degrees in which she deposited a single egg just below the surface. This occupied about 2 minutes. Unfortunately this egg did not develop. The writer has found eggs in the field half a dozen times, though without knowing when they had been deposited. All of these hatched within 24 hours and the egg period in the blueberry probably does not exceed 2 or 3 days.

At all events these data are sufficient to show that in the case of the blueberry maggot as with the apple maggot, the egg is deposited directly in the berry and not in the blossom as is the prevailing idea on the barrens, for the adults do not emerge until fully 6 weeks after the bushes have flowered.

The Larva. Maggots were fairly common on August 12, 1914, including some about a week old, but the writer failed to find any indication of them on July 30. On August 18 and 25 larvae were common in all stages from those just hatched to some ready to leave the berries. On September 10 they were decidedly less numerous and there were but few small maggots. About 30 puparia were obtained from material collected on July 30, 1913, and on September 5 of that year maggots were still common in all stages. The season 1913 was more normal than 1914, which was decidedly backward, and this doubtless explains the discrepancy in the records. In 1915 larvae in all stages were found to be common on August 25 and 26.

Judging from measurements of the chitinous rasping hooks there are three larval instars. About one-fifth caudad there is a pronounced articulation, and measurements were made from the base of this angle to the tip of the terminal portion. In a recently hatched maggot this measurement was .035 mm., and in the succeeding instars .0625 mm. and .11[illegible] mm. (although in the two latter cases there was variation from .055 to .070 and from .090 to .120). The size of the larva offers absolutely no criterion as to the size of the hooks.

The writer has reared only a few larvae under such conditions that he was sure as to the exact number of days passed in the berry. One maggot which hatched August 18, 1914, was in the third instar on August 24, and formed its puparium on September 2. Two which hatched August 26, 1914, were in the last instar on September 2, were apparently full grown September 7, left their berries Sepember 8, and formed puparia September 9. One which hatched August 28, 1914, was in the second instar on September 2, and in the last instar on September 8; the puparium was formed on September 14. One which was in the second instar on August 26, 1914, was in the last instar on September 2 and formed its puparium on September 7.

These records indicate that the larva spends on the average about 14 days in the berry and that the period spent during the last instar is nearly as long as the time of the two preceding instars together.

Although when the maggots are small, an infested berry cannot be distinguished by sight from a sound one, in any case, even when the larvae are very small, fruit which has been attacked can easily be determined by the touch, for it feels soft and mushy, and this is the surest external indication of attack from *Rhagoletis*. The pulp becomes red and stringy and by the time the larva is half grown, the fruit becomes much shriveled and shrunken. This condition is illustrated in figure 60 A. In every case which the writer has observed at all closely the larva has attained its full growth in one berry, which it leaves by an irregular and jagged exit-hole. Nor has he ever found more than one larva per berry under natural conditions. Usually the fruit falls off shortly before the larva becomes full-fed, but at times it may remain on the bush after the maggot has entered the soil. In such cases the larva doubtless works its way to the surface of the berry and then drops to the ground.

The Pupa. When ready to form their puparia, the larvae enter the soil which is of a sandy character on the barrens, but probably do not penetrate to a depth of much more than an inch. Under laboratory conditions they barely bury themselves beneath the surface in most cases. As is characteristic of this group of flies, pupation takes place within the last larval skin which is not molted but shrinks up and hardens, turning a light yellowish brown. Invariably the puparia are formed within 2 days after leaving the berry and usually within one. Transformation to the pupa takes place within 7 days after the puparia have been formed, usually about the fifth day.

The earliest date on which the writer obtained puparia in 1914 was on August 21, which would indicate that the first eggs were deposited about August 5. As has been stated previously, 29 puparia were found on August 22, 1913, in material collected on July 30, but, as has been explained, the difference in the climatic conditions easily accounts for the apparent discrepancy of the records.

Below is given in tabulated form the dates on which the writer removed full grown maggots which had left the berries, and puparia from the breeding cages, in 1913, 1914 and 1915. All material was collected in Cherryfield, Maine.

(1) MATERIAL COLLECTED AUGUST 18, 1913.

1913	Aug. 22	Aug. 23	Aug. 25	Aug. 27	Aug. 28	Aug. 30	Sept. 2	Sept. 4
Larvae	4	6	20	3	7	2	7	2
Puparia	7	4	4	33	7	22	38	10

1913	Sept. 8	Sept. 9	Sept. 13	Sept. 15	Sept. 22	Sept. 24	Sept. 26
Larvae	0	9	14	26	5	1	0
Puparia	50	20	16	12	15	18	4

(2) MATERIAL COLLECTED AUGUST 18, 1914.

1914	Aug. 21	Aug. 24	Aug. 27	Aug. 31	Sept. 14
Larvae	2	16	3	0	0
Puparia	2	20	11	2	3

(3) MATERIAL COLLECTED AUGUST 25 AND 26, 1914.

1914	Aug. 27	Aug. 28	Aug. 31	Sept. 4	Sept. 8	Sept. 14
Larvae	8	0	19	44	22	0
Puparia	0	1	16	104	30	4

(4) MATERIAL COLLECTED AUGUST 25 AND 26, 1915.

1915	Aug. 27	Aug. 28	Aug. 30	Aug. 31	Sept. 1	Sept. 2	Sept. 4	Sept. 5	Sept. 7	Sept. 9	Sept. 14	Sept. 18
Larvae ..	18	3	2	3	13	16	0	0	11	5	0	0
Puparia .	0	0	11	3	6	11	1	4	73	19	23	19

Generations. There is but one generation a year and the writer has not observed the slightest evidence of even a partial second generation.

DESCRIPTION.

No technical description of the stages of *Rhagoletis pomonella* Walsh is included in this bulletin because careful and accurate descriptions have already been published, especially by Doctor Illingworth in Bulletin 324 of the Cornell Experiment Station. (Egg, page 154; larva, page 154; puparium, page 155;

pupa, page 156; adult, male and female, page 151). The writer has compared his material with these descriptions and finds that larva, puparium, pupa and adult obtained from the blueberry exactly correspond down to microscopic detail, except that they fall much below the normal size of individuals bred from apples. The writer has also compared pinned specimens of adults bred from apple with individuals bred from blueberries, under the binocular, but can find no essential differences. The gray thoracic stripes are much lighter in the blueberry flies, even in fresh specimens, and the average difference in size between male and female is greater, but otherwise they are exactly like the apple flies except in size.

Specimens of the flies bred from blueberries were submitted to Mr. C. W. Johnson of the Boston Museum of Natural History, who very kindly determined them as undoubtedly *Rhagoletis pomonella* Walsh. It is interesting to note in this connection that the adults bred from huckleberries in Connecticut by Doctor Britton which Mr. Johnson showed the writer were of about the same size as those bred from blueberry, and Professor O'Kane states in his recent bulletin on the apple maggot that the flies which he bred from blueberries in New Hampshire were under the normal size of this species.

Below is printed a table showing the comparative size of a series bred from apples in Maine, and of a series bred from blueberries; measurements mere made from 10 males and 10 females of each race in the case of the adults, and of 10 larvae and of 10 puparia of each race for the rest. All measurements are expressed in millimeters.

	Apple Maggot		Blueberry Maggot	
	♂	♀	♂	♀
Average wing	4.80	5.20	3.55	4.25
Shortest wing	4.55	4.75	3.25	4.00
Longest wing	5.25	5.80	4.00	4.60
Average length adult	4.60	5.80	3.60	4.20
Minimum length adult	4.25	5.00	3.10	4.10
Maximum length adult	5.50	6.50	4.00	4.45
Average tibia mesothoracic leg	1.55	1.60	1.10	1.30
Minimum tibia	1.45	1.50	0.90	1.20
Maximum tibia	1.70	1.85	1.30	1.45

Average length larva	7.75*	4.75
Minimum length larva	7.00*	4.50
Maximum length larva	8.50*	5.50
Average length puparium	4.25	3.35
Minimum length puparium	4.00	2.80
Maximum length puparium	5.25	4.00

The measurements of the adults were made by means of a compound microscope and camera lucida under a magnification of 20 diameters. The larvae and puparia were measured by means of a simple dissecting microscope under a magnification of 12 diameters. The length of the wings was measured along a hypothetical line drawn from the angle formed by the union of R and C at the basal portion to the costal margin of R_{4+5} at the apical. The length of the adult was measured along a hypothetical line from the convergent bristles slightly in front of the ocelli to the tip of the abdomen. Only specimens in which the abdomen was straight and in which the ovipositor was withdrawn into its sheath were used in this last measurement. It will be noted that the largest female bred from the blueberry is but .2 mm. longer than the smallest male bred from the apple.

METHODS.

Infested berries were placed under breeding cages on cheese-cloth spread several layers thick over moist dirt, and the full grown larvae as they left the berries and the puparia removed daily. The writer found the most satisfactory way to keep the puparia through the winter was in jelly tumblers on cheese cloth over sand which was moistened approximately once a month. However, in one tumbler which was inadvertently overlooked and not watered between October and April the adults developed normally. The writer experienced no difficulty in carrying his 1913 material through the winter at room temperature but unfortunately all of his 1914 material—not only of *Rhagoletis* but of other blueberry insects as well—become overheated and completely failed to develop. For this reason it has not yet been possible to determine the exact preoviposition of *Rhago-*

*From Illingworth, Cornell Exp. Sta. Bul. 324, p. 155. No Maine material measured.

letis in connection with the blueberry, nor does the writer know whether as a general rule adults emerge earlier from the puparia that are formed first. Further collections were made during the past summer (1915) and it is hoped that these points may be ascertained later.

In the laboratory the adult flies were treated in accordance with the suggestions given the writer by Dr. H. H. P. Severin engaged in special work for this Experiment Station. They were kept in glass jars about five inches high and five inches in diameter in which a layer of moist sand was placed on the bottom. Absorbent cheesecloth was fastened over the top, and moistened with water every few hours. The adults were fed with banana once a day, inserted through a hole in the cheesecloth which at other times was filled with a cotton plug. Through this same hole flies could be removed or introduced at will. They were supplied with a fresh blueberry twig daily.

HOST-PLANTS.

The writer has bred *Rhagoletis pomonella* Walsh from the three species of low blueberries, *Vaccinium pennsylvanicum*, *V. canadense* and *V. vacillans*. Professor O'Kane has recorded it from *V. corymbosum* (N. H. Exp. Sta. Bul. 171, p. 18). This species has not been found at work in the mountain cranberry, *V. Vitis-Idaea* var. *minus*, locally common on the plains. The huckleberry, *Gaylussacia baccata* is also common on the barrens and is subject to attack later in the season. The writer has never found maggots in huckleberries in August but when the blueberries are becoming scarce in early September, then the huckleberries are quite generally infested. Twice before the apple maggot has been reared from huckleberries (*Gaylussacia* sp.): once in Connecticut by Doctor Britton (Rpt. Conn. Sta. 1905, p. 200); and once in New Jersey by Doctor Smith (Insects of N. J., 1909, p. 802). Chokeberry, *Pyrus melanocarpa*, is locally abundant on the plains but a careful search has failed to reveal any larvae in them. The writer did succeed in making successful transfers and very small larvae removed from huckleberries and blueberries attained their growth and formed puparia when placed in chokeberries. Puparia were also obtained in limited numbers from haws, *Crataegus* sp., collected in the vicinity of Orono.

For one very peculiar fact of distribution the writer can offer no very satisfactory explanation. In Maine, although as an apple pest *Rhagoletis pomonella* is widely distributed throughout the state, and although blueberries are found commonly everywhere in the state, as an enemy of the blueberry *Rhagoletis pomonella* seems to be entirely restricted to the blueberry barrens of Washington County. The writer has made a great many careful collections of blueberries around Orono during the past 3 summers without finding so much as a trace of the work of this insect. In the orchard in the rear of his home in Orono are 2 sweet apple trees which for years have served as a trap for the apple maggot, the fruit being so badly infested as to be worthless, and two pastures full of blueberries lie within an eighth of a mile of these trees, yet the blueberries are entirely free from any attack by *Rhagoletis,* nor has the writer seen any indication that *Rhagoletis* was at work on the blue berry elsewhere in Penobscot County. Careful collections at Auburn, and in the Katahdin region, and more hasty ones at Kineo, Searsport, Mount Desert, and elsewhere, bear out the conclusion stated in the first part of this paragraph. Moreover, the same would appear applicable to the huckleberries; it is true that they are not common in the State, yet they seem to be infested by *Rhagoletis* only on the blueberry plains.

Owing to the frequent burning of the barrens, the soil does not become exhausted and the berries there are much larger and juicier than elsewhere in the state. It is not impossible that only in these larger berries does the maggot find sufficient food for its growth and thus is restricted to this region. The writer's observations have been entirely confined to the low bush blueberries, and he has not had an opportunity to examine the high bush blueberries which are naturally somewhat larger; it is not improbable that when the high bush berries in different parts of the state are examined they will be found more or less abundantly infested with *Rhagoletis* elsewhere than in Washington County.

It will be recalled that the flies bred from blueberries were so much smaller than those bred from apples that at a glance they could be distinguished readily. Although the apple maggot was very troublesome in the orchards of Cherryfield in 1914 neither there nor elsewhere did the writer observe any flies on the apples that were subnormal in size. These observations are in perfect accord with those made by Professor O'Kane in New Hampshire.

The writer has not succeeded in inducing the fly of the apple maggot to lay eggs in blueberries. This experiment has been tried a number of times both in the laboratory and in the field. A large cage was placed over a healthy blueberry plant, and about 20 adult *Rhagoletis* just captured on apple introduced, but they refused to oviposit. This was done twice in the field and on a smaller scale several times in the laboratory and insectary, always with negative results. At various times during the past summer the writer introduced some 20 or more half-grown blueberry maggots into apples of various kinds, inserting them beneath the skin in such a way that they could burrow into the pulp before drying up, but not a single one developed sufficiently to form a puparium. Likewise flies taken on blueberries refused to oviposit in apples, but as they also showed so much reluctance in the laboratory to oviposit at all one should not lay too much stress on this point.

At any rate the writer is inclined very strongly to believe that biologically at least there are two distinct strains or races of *Rhagoletis pomonella* Walsh, the one breeding in the apple and related fruits and the other in smaller fruits such as the blueberry and huckleberry. There does not seem to the writer to be any other conclusion which will explain the data given above. Certainly in so far as *Rhagoletis* occurs in Maine the form on the apple and the form on the blueberry are entirely independent. The "oldest inhabitant" of the barrens cannot remember a time when there were not maggots in the blueberries, while the introduction and spread of the apple maggot in the state is a matter of record and is discussed by Professor Harvey in the Annual Report of this Experiment Station for 1889 and subsequent years. In Maine the blueberry maggot apparently did not migrate to the apple nor vice versa and the two races have lived on independently side by side.

The original host plant of this insect is as much a matter of theory as ever. Professor O'Kane has shown that it must have been some species of haw, or else the blueberry or huckleberry

(Bul. 171, N. H. Exp. Sta.). Since the blueberry and huckleberry flies are so much below what must be considered the normal size of this species, and since apparently they are decidedly restricted in their breeding habits, it does not seem probable to the writer that any species of either *Vaccinium* or *Gaylussacia* was the original host of the insect in question. This would seem to leave the haw as the only remaining possibility. Professor O'Kane has suggested four species (l. c. pp. 16-17) whose range and fruiting habits would be suitable in this connection. These are *Crataegus coccinea, C. punctata, C. macracantha* and *C. mollis*. Since *Rhagoletis pomonella* Walsh has now been bred quite extensively from haws and since adults so bred are about normal in size, the writer would suggest that some one of the four species of *Crataegus* listed above was the original host, and that the species has spread on the one hand to the apple and related fruits, and on the other to the huckleberry and blueberry, in which an independent and quite different strain has arisen.

It is tempting to try to include the chokeberry in the above scheme since it belongs to the genus *Pyrus,* especially after it has been demonstrated that successful larval transfers may be made to this fruit; but if the chokeberry were really an acceptable home to *Rhagoletis pomonella,* occurring abundantly as it does on the plains, it would certainly be heavily infested.

NATURAL ENEMIES.

A hymenopterous parasite, *Biosteres rhagoletis* Richmond, (Braconidae) was bred in considerable numbers from puparia obtained from blueberries in 1913. Under laboratory conditions the adults emerged at various times between February 25, 1914, and April 21, 1914, from the pupae of *Rhagoletis pomonella.* Specimens of this species were swept on the blueberry barrens of Washington County during the summer of 1914. Apparently they had considerably reduced the number of maggots as compared with the preceding season, and certainly must render very efficient aid in holding the maggot in check.

Adults were observed quite commonly on the barrens hovering about the blueberry bushes on August 26, 1915. They were rather slow moving and not very shy. In one case the writer was fortunate enough to witness oviposition. The long ovipositor was thrust its full length into the berry. The larva selected formed its puparium on September 11, 1915, so it could not have been more than a day or two old when the egg of the parasite was deposited in it. It is, therefore, a larval parasite although the parasitized larva grows normally and forms its puparium. In the field the parasite doubtless passes the winter protected within the puparium of the host and does not emerge until mid-summer or later.

These parasites belong to the family Braconidae and to the subfamily Opiinae. Specimens were submitted to Mr. E. A. Richmond of Cornell University, who determined it as a new species and named it *Biosteres rhagoletis*. The original description which appeared in the Canadian Entomologist for September, 1915, v. 47: 293-295, pl. 12, is here reprinted with Mr. Richmond's permission:

Biosteres rhagoletis (description of adult by Mr. Richmond)

"Fulvous (xanthine orange); antennae, except scape in ♂ (partly in ♀), terminal joints of pro- and mesothoracic tarsi, entire metathoracic tarsi and tips of mandibles, brown; eyes and ocelli black; wings with membrane colorless, nervures and stigma brown; sheath of ovipositor brown; inner stylets fulvous. Length 3 mm.; ovipositor 3 mm. Habitat—Cherryfield, Maine.

"*Head* shining, closely tessellate, punctulate, pilose (including mouthparts); ocellar elevation impunctate and not pilose; face with a median longitudinal elevation, almost a keel; *clypeus* with sparser punctures in center; *flagellum* 36-41-jointed; scape a little longer than first joint of flagellum, pedicellum globular. *Thorax* shining, sparsely punctulate and pilose; parapsidal furrows converging and ending in a median V-shaped, impunctate impression, which lies in the posterior third of the mesonotum; mesonotum (including scutellum) margined; propodeum not flat but rounded, more pilose and punctulate than the rest of thorax, irregularly rugulose and tending to have poorly-defined areoles, which are more especially prominent in ♀ ♀; r (first abscissa of the radius), a little more than 1-6 as long as r-m; shorter than the petiole of M_4; M_4 petiolate, petiole about 1-5 as long as m-cu. *Abdomen* finely punctulate, shining, very sparsely pilose; 1st segment margined laterally, finely and closely striated with some of the elevations often more prominent at basal half; 2nd segment with a little more than its basal half finely and closely striated (or sometimes almost entirely striated,) except at sides; ♂ and ♀ similar, except as noted above." The female is illustrated in figure 62, A, B and C.

METHODS OF CONTROL.

While the actual number of maggots in 250,000 acres literally blue with berries when they are ripe must be very large, ordinarily only an insignificant proportion of the fruit is infested. This was the case in 1913, when the crop was fairly large, and though the maggots were abundant only from 1 to 2 per cent of the crop had been attacked. But in 1914, though the larvae were far less numerous so small was the yield that from 8 to 10 per cent of the fruit was maggoty. Conditions were much the same in 1915, owing to a short berry crop, although as *Rhagoletis* is more or less locally distributed on the plains, it is very hard to make even an approximate estimate.

No measures aimed at a complete control of this pest would prove really practicable and in an ordinary yield no elaborate system of control is needed. The maggot could never be exterminated in so vast an area of wild land, most of it remote from any town and broken up by swamps, lakes and occasional forest tracts, even if concerted efforts were made, for of necessity there would always remain many places in which the flies would breed uninterruptedly and from which they would spread again over the rest of the barrens. Nor does it seem practicable to advocate poison spray and volatile oils for an area of 400 square miles, even if there were no doubt as to the efficiency of these agents.

Burning the plains as is commonly done is a practice highly to be commended. Besides restoring the fertility of the land, it undoubtedly destroys the puparia in the soil for they lie near the surface, and it must be a very material help in keeping down the numbers of the fly. It also serves to kill many other insects for wherever there is "new burn" the bushes are conspicuously free from leaf-feeding insects of all kinds. As approximately only one-third of the plains is burned yearly, the fly is not exterminated, and this probably could not be accomplished even if an attempt were made to burn over the whole extent of the barrens at one time.

When the berries are winnowed in the field the maggots can be found abundantly. A great many of the larvae are blown out with the lighter dirt and can be caught in one of the trays in which the berries are packed. Frequently a good many larvae remain in the trays after the berries have been poured out. The writer has never seen any attempt to kill the maggots at the time of winnowing but if this were done it should help not a little in reducing the numbers of this pest. The older larvae doubtless pupate *in situ* and because of the many berries necessarily scattered about in the process of winnowing probably many of the smaller larvae are able to work their way to a new berry and complete their growth.

As the maggots usually are not troublesome until the end of the season when the berries are scarce, and as the parasite *Biosteres* seems to be doing excellent work fortunately none of the more elaborate control measures are necessary for it would be impracticable to apply them on such a large scale on wild land so far from any centre of supply; and the common practice of burning together with the destruction of such maggots as can be caught and killed conveniently after winnowing will doubtless serve to hold *Rhagoletis pomonella* in check so far as Maine blueberries are concerned.

Bibliography.

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1914. *O'Kane, W. C.* The apple-maggot. N. H. Agr. Exp. Sta. Bul. 171, pp. 1-120, pl. 1-8.

1914. *Woods, William C.* A note on *Rhagoletis pomonella* in blueberries. Journal of economic entomology, v. 7:398-399.

These are the most recent publications dealing with the apple maggot and both contain a full bibliography of earlier articles.

A Blueberry Cecid *Lasioptera fructuaria*, Felt n. sp.

Distribution and Host-Plants.

Rhagoletis is not the only dipterous insect which has adopted the blueberry as its habitation. A tiny Cecidomyid, *Lasioptera fructuaria* Felt was found in the fruit in considerable numbers. It is not of economic importance, however, because it infests only decayed or decaying berries. It seems to be generally distributed through the state, for the writer has found it wherever he has collected berries at Orono, Cherryfield, Auburn and Searsport. The writer has bred it from *Vaccinium pennsylvanicum* and *V. canadense.*

SEASONAL HISTORY AND LIFE HISTORY IN THE BLUEBERRY.

Apparently the delicate little midge hibernates as an adult, emerging from her winter quarters at least by June. She is unable to puncture the skin of the berry and deposits her eggs in cavities which already exist in the fruit from other sources. Quite frequently she seems to make use of the egg puncture of a weevil, *Pseudanthonomus validus* Dietz; certainly this would be a natural inference, for one may frequently find cecid larvae in the same fruit as weevil larvae. Usually but 3 or 4 eggs are deposited in a berry, but the writer has found as many as 6 larvae in a single one.

The exact duration of the egg-stage was not determined. Eggs collected on June 18, 1915, hatched on June 21. Probably not more than 4 or 5 days is required. Recently hatched cecids are quite common after June 20. When the larva leaves the egg it is whitish and nearly transparent; the older larvae are pinkish orange. It is impossible to keep one individual under continuous observation for the larvae are very delicate; they cannot be transferred from one berry to another and dry up if left in an opened berry.

In an ordinary season most of the larvae are full grown about July 20 and begin to leave the berries to pupate. In a late season, such as 1915, the majority do not leave the fruit until about July 30. However, a few individuals are full fed even as early as the first of July. The dates on which the berries were picked and the dates on which the larvae left the fruit were recorded in 1913 and 1914. In the majority of instances the larvae have been ready to leave 8 or 9 days after the collection. From July 12 until August 4, 1914, 23 days, was the extreme length; and from 15 to 20 days would probably be a fair estimate of the larva life.

As was stated above, the larvae leave the berries before pupating. The writer does not know where they pupate in nature; Doctor Felt has suggested that they may seek grass stems. In the laboratory a part pupated on the cheesecloth in the berry dishes but the majority entered the sand or dirt. On the cheesecloth they spun cocoons before transforming to pupae, while in dirt no cocoon seems to be spun, but a little cavity is hollowed out by contorting the body. The silk appears to be secreted from glands opening on either side of the penultimate segment, but no detailed study was made of this point. From 12 to 14 days are required after leaving the berry before the adult midge appears. About half the time is spent as a pupa and half as a prepupa.

Only a very small proportion of the larvae that left the fruit ever emerged as adults. The pupae are extremely delicate and die unless conditions are exactly suitable. July 18, 1914, is the earliest record for the emergence of an adult.

There is probably a partial second generation as the writer has found eggs in early August and small larvae at various times through the month.

Technical Description.

Adults were submitted to Dr. Ephraim Porter Felt of the State Museum, Albany, N. Y., who determined them as a new species, *Lasioptera fructuaria.* In the key which he has prepared it runs near *L. michellae* Felt from which he states that it can be easily separated by colorational characters and by the presence of well developed hooks upon the ovipositor.

Doctor Felt described the adults of both sexes as well as the larva and has very kindly given me permission to publish his descriptions which are printed here for the first time.

Adult male. (Description by Doctor Felt). Length 1.5 mm. Antennae yellowish brown, the two basal segments yellowish; 15 or 16 segments, the fifth with a length one-half greater than the diameter, the terminal segment roundly conical, with a length one-fourth greater than its diameter. Palpi: the first segment narrowly oval, with a length three times its diameter, the second a little longer than the first, slender, the third two-thirds the length of the second, more slender, the fourth about as long as the third. Mesonotum shining dark brown. Scutellum yellowish brown, postscutellum fuscous yellowish. Abdomen: basal segment yellowish or whitish, the other segments dark brown, narrowly margined apically with yellowish or whitish. Genitalia fuscous yellowish. Wings hyaline, the third vein uniting with the costa just beyond the basal half. Legs a nearly uniform fuscous yellowish; claws slender, strongly curved, the pulvilli as long as the claws. Genitalia: dorsal plate deeply and triangularly emarginate, the lobes obtusely and irregularly rounded; ventral plate indistinct in the preparation. Harpes long, slender, the apices slightly divergent, subtruncate.

Adult female. (Description by Doctor Felt). Length 1.75 mm. Antennae dark brown, the 2 basal segments yellowish; 16-20 segments, the fifth with a length about three-fourths its diameter, the terminal segment globose. Palpi: yellowish, the first segment short, sub-quadrate, the second with a length twice the first, the third one-half longer, more slender, the fourth about as long as the third, more slender. Mesonotum dark brown. Scutellum, postscutellum and abdomen dark brown, the segments of the latter narrowly margined posteriorly with yellowish white, the ovipositor nearly as long as the body, fuscous yellowish, the terminal lobes with a length 4 times the width and with a group of heavy, chitinous hooks. Halteres and legs fuscous yellowish, otherwise nearly as in male. Type Cecid a 2641 in the New York State Museum, Albany, N. Y.

Egg. Shining white, oval, comparatively long and slender, slightly more pointed at one end. Length 0.20 mm. See figure 56 B.

Larva. (Description by Doctor Felt). Length 2.1-2.5 mm., orange pink, moderately stout, tapering at both extremities, the skin coarsely shagreened; head moderately stout, broad apically, the antennae divergent, with a length 3 times the diameter and apparently uniarticulate; breast-bone distinct, the shaft stout, the apex broadly bidentate; terminal segment broadly rounded, almost subtruncate and with 4 sublateral pairs of stout, tapering, spinose processes. See figure 56 A.

Pupa. Thorax and abdomen pink; head, eye and appendages colorless and transparent. Thoracic segments closely fused together; wings appressed to body, folded over to ventral side and partly covering the legs; the base of the antenna forms a projection on the anterior end; antenna extends back over the eyes bordering the lower margin of the wing; legs closely appressed to body, with the tips free. A dark brown spine on the suture between head and thorax. A brown spiracular opening above the eye from which a long flexuous seta projects. See figure 56 C.

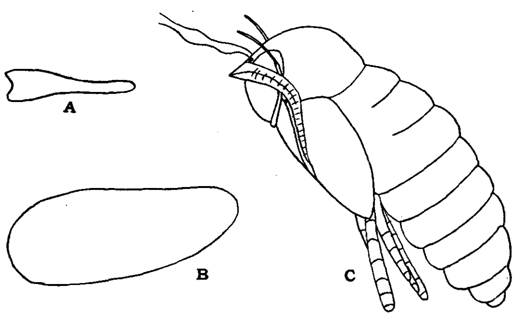

Fig. 56. *Lasioptera fructuaria* Felt sp. n. A. breast bone of larva about 100 times natural size; B. egg about 100 times natural size; C. pupa about 20 times natural size.

A Pomace Fly *Drosophila ampelophila* Loew. *et al.*

Pomace flies of various species were bred in great numbers from blueberries placed in cages in the insectary, as soon as the fruit became a trifle old and had lost its firmness. Unless stored berries were packed securely and guarded against the attack of these flies they might prove to be a very serious pest.

In two cases in fresh berries brought in from the field the writer has found white dipterous larvae which he believes were *Drosophila* sp., but it is seldom, if ever, that *Drosophila* attacks the fresh fruit.

Care should be taken not to confuse this insect with *Rhagoletis*. Fortunately larva, puparium and adults are all very much unlike. This species is figured in Bulletin 3 of this Experiment Station.

The Currant Fruit-Weevil *Pseudanthonomus validus* Dietz.

DISTRIBUTION AND HOST PLANTS.

The currant fruit weevil (Coleoptera, Curculionidae) is quite widely distributed in Maine as a blueberry pest for it occurs both in Orono and Cherryfield, the only places in which extensive collections of berries have been made for the study of their insect enemies. Mr. R. A. Cooley of the Montana Experiment Station has bred this species from the currant and reports it as a serious currant pest in that state. Dr. H. H. P. Severin, who has been engaged in a special investigation for this Station on the currant fruit fly during the past 2 seasons, states that he has seen no indication of the work of this species on the currant in Maine. So far as the writer knows, in Maine this species is confined to the low blueberries, *Vaccinium pennsylvanicum* and *V. canadense*.

SEASONAL HISTORY AND LIFE HISTORY IN THE BLUEBERRY.

The Egg. Hibernation takes place in the adult stage. Egg deposition begins about the middle of June, while the berries are still small and green. Usually the female chooses one of the calyx lobes in which to lay her egg. The sepals are hollow with just enough space between the two walls to receive the egg, and in the majority of cases it is simply deposited within one of the sepals. In other cases the puncture is longer and the egg lies in the berry itself near the surface, at the end of a short curved passage leading from one of the calyx lobes. The opening left after the puncture has been made is rather irregularly circular; the edges soon become dry and turn brownish. Frequently punctures of a similar nature are to be found continuing straight through both walls of the sepal. To make exactly the right puncture must be a rather delicate operation and presumably these represent unsuccessful attempts, for the writer has never found any eggs in connection with them. Occasionally an egg is deposited just beneath the skin at the stem end of the fruit, the puncture appearing as before. In a short time the surrounding skin becomes purplish and later hard and brownish.

The earliest date on which the writer has found the egg of this species is June 15, 1915; and they are to be found quite generally by June 18. The duration of the egg stage was not exactly determined for the overwintering adults are scarce and none were swept in the field until after the egg laying period was passed. Of 3 eggs found June 18, 1915, 2 hatched on June 21 and 1 on June 22. The egg stage probably does not last longer than 4 or 5 days. The latest date recorded for a first instar larva is July 9, 1914, so for the most part oviposition is probably over in early July. The writer has no data as to the number of eggs which one individual may deposit.

The larva. The newly emerged grub appears slightly larger than the egg and is pure white except for the proportionately large head which is very light yellow brown. Recently hatched larvae were common on June 22, 1915, and as the writer found one on June 16 eggs are evidently deposited at least as early as June 12.

As soon as the larva hatches it tunnels to the center of the berry, typically leaving behind it a hardened reddish trail which is very conspicuous in the green pulp. This seems to be the case no matter where the egg has been deposited. But from this point on the fruit is eaten irregularly. All through its larval life the weevil lives in a little cavity which is just the size of its strongly arcuate body. The grub is sluggish, moving but little and very slowly and filling up the trail behind it with frass. One berry furnishes sufficient nourishment for one weevil with little or none to spare. All parts of the fruit are eaten except the outer coat of the seeds, and the berry is left just a shell around a mass of fine brown frass. Where the weevil has burrowed near the surface, the skin often appears discolored.

The writer has not found it possible to keep one larva under continuous observation for they are unable to enter the uninjured fruit when once removed, and a green berry when punctured dries up very rapidly. Not infrequently larvae may be found which have been crushed by the growth of the berry.

There are 4 larval instars. The head of the newly hatched weevil measures .095 mm. and the succeeding instars measure approximately .11, .13 and .15 with slight variation, especially in the fourth instar. The ratio is 1.16 and the theoretical measurements .110, .1275, and .148 agree very closely with the actual. All measurements were made under a magnification of 20 diameters by means of a camera lucida.

All larvae found in the berries were preserved in alcohol with a record of the date of collection and the date of removal, and their instar determined by head measurements. A part of this data is given below in tabulated form.

		1st	2nd	3rd	4th
1914	June 30			1	
	July 6	1	1	3	2
	July 7		1	1	
	July 9	1			2
	July 10			2	5

		1st	2nd	3rd	4th
1915.	June 21	1			
	June 22	7			
	June 25	1			
	June 26	1			
	June 30		3		
	July 11			1	4
	July 13			1	6
	July 17				3
	July 18			1	3
	July 20			1	1
	July 23				1
	July 24				3
	July 29				1

Very few first instar larvae are to be found after the last of June. Second instar larvae occur mostly in early July before the seventh of that month. Third instar larvae were found on quite scattered dates but mostly between July 6 and 11. Fourth instar larvae are occasionally met with as early as July 6 but they are most abundant from July 13 until about July 24, occurring, however, through the rest of the month.

From his data and observations the writer would infer that each instar lasts about a week, except the fourth which (including the prepupal period) extends over 10 days, and that consequently 30 or 31 days is a fair estimate of the average length of the larval life. The majority hatch about June 22 and pupate from July 23 to July 30.

The pupa. This insect does not leave the berry in order to pupate, but the pupa is formed in the same little cavity in which the larva lived. The young pupa is pure white, with transparent legs and wings. It is able to move rather freely when disturbed. The cast larval skin usually adheres to the tip of the abdomen. Two days before emerging the beak, coxae, and femoro-tibial joints are brownish. About 24 hours before emergence, these parts are darker brown and the tips of the elytra appear dark; 12 hours before, in addition the dorsal part of the prothorax is brownish, and the eyes are black. The beak, head and prothorax of the newly emerged beetle are dark brown, the eyes deep black, the legs white except for the dark brown femoro-tibial joints and the black tarsi; the abdomen is practically white, the elytra are soft and colorless, and the wings are not yet folded beneath them. The legs are at first closely appressed to the body. The pupa lies with the ventral side uppermost and the adult remains on its back for several hours. The weevil stays in its cavity within the berry until the cuticula becomes fully hardened and colored, a matter of some 24 hours. Often the pupal skin is caught on the end of the beak which is used in pushing off the old cuticula.

Only once was the writer able to determine the pupal period exactly. From a pupa formed on July 20, 1914, the adult beetle emerged on July 29 and was fully colored on July 30. Less definite observations would indicate that 9 days might safely be considered the normal time spent as a pupa. Reckoning the duration of the egg stage as 5 days, the period of larval life as 31, and the pupal instar as 9, gives 45 days as the average length of the period of development.

Adults. The adults began to emerge in mid-July and emergence continued a month or more. Below is given in tabulated form the emergence of adults in 1913 and 1914.

1913		1914	
10 on August	1	1 on July	18
3	2	2	23
11	4	2	24
1	5	3	25
22	9	5	27
17	11	3	28
6	16	7 August	3
8	22	1	4
		3	5
		7	10
		4	17
		1	21
		1	28

The majority emerge in early August which further bears out the conclusion that the greater number pupate in late July and that the pupal period is about 9 days.

The adults feed very greedily on the berries, eating off the skin and sucking up the juices. This condition is illustrated in figure 60 C. They refuse to eat the leaves even when there is no fruit available. These weevils enter into hibernation shortly after they emerge. In the spring the over-wintering beetles will eat the leaves quite readily leaving them punctured with small dots.

Generations. There is probably but one generation in Maine for the writer has found no tendency to pairing and no tendency to lay eggs in weevils reared from the berries and confined in the laboratory. On the other hand, the writer occasionally has found larvae even in August as shown in the table printed below.

	1st instar.	2nd instar.	3rd instar.	4th instar.	Pupae
1914. August 10		1			1
14	1	1	1		3
15			1		
17		1			1
21				1	1

The writer is inclined to believe that these individuals hatched from eggs deposited much later in the season than is usual by the overwintering weevils of the preceding summer. It is possible, however, that they represent a partial second generation.

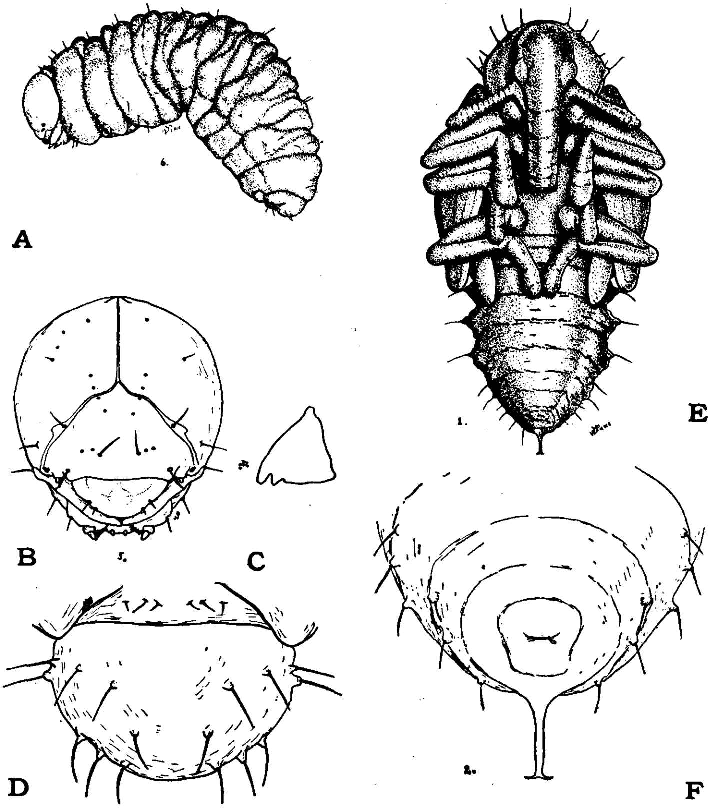

Fig. 57. *Pseudanthonomus validus* Dietz. From drawings by W. Dwight Pierce. A. larva; B. head of larva; C. mandible of larva; D. pronotum of pupa; E. pupa, ventral aspect; F. caudal portion of pupa, ventral aspect. All enlarged.

Description of the Stages.

Specimens were submitted to Mr. W. Dwight Pierce of the United States Bureau of Entomology, who determined them as *Pseudanthonomus validus* Dietz. He has very kindly supplied me with a description of the larva and pupa, which is published in the next section. All of the drawings for figure 57 were made by Mr. Pierce and are reproduced here with his permission.

Egg. Nearly oval, very pale translucent green, with a very thin and delicate shell. The egg becomes whitish before hatching and the weevil can be seen distinctly curled up inside. The shell is smooth.

Adult. The adult is a reddish brown weevil somewhat less than one-fourth of an inch long.

The immature stages of Pseudanthonomus validus Dietz.* The species *Pseudanthonomus validus* Dietz belongs to a genus of reddish weevils which breed in the buds and fruit of various plants. This genus is placed in the tribe Anthonomini,—a very characteristic group in the Curculionidae.

Very little has yet been done toward differentiating the immature stages of weevils and it is, therefore, very difficult to present characters for the separation of species. Ultimately we will find characters in the arrangement of the folds of the body of the larvae as well as in the spiracles. The descriptions given herewith, used in connection with the illustrations, will serve to identify this weevil.

Larva. White, 3-4 mm. long. Head yellowish. The location of the pits and hairs on the head is of considerable importance. These are indicated in the drawing of the head. The labrum and clypeus seem to be fused and are so transparent that the mandibles can be seen through them. The ocelli are tiny and black. The antennae are single-jointed. The mandibles have two strong teeth and are slightly asymmetrical. The maxillary palpus is but 2-jointed and the labial palpus 1-jointed. See figure 57 A, B and C.

Pupa. White, 3.5 mm. long. The pupae of the tribe Anthonomini are characterized by having a chitinous apical process from the ninth dorsal abdominal segment. The genus *Pseudanthonomus* is characterized by having this process slender with the apex abruptly bifid, the 2 processes almost at right angles to the axis of the process, apex sinuate. Otherwise the pupa must be recognized by its tubercles. The prothorax is provided with 8 pair of setigerous tubercles, more or less cone shaped, 3 pair apical, 2 pair lateral, and 3 pair dorsal. The mesothorax and metathorax each have 3 pair of little setae. The first 5 abdominal segments are laterally provided with prominent setigerous tubercles, 1 to a segment, and with 2 pair of dorsal setae. The sixth, seventh and eighth segments are provided with 3 pairs of inconspicuous setigerous tubercles arranged in a row on the dorsum. The beak is comparatively short. See figure 57 D, E and F.

NATURAL ENEMIES.

Mr. Cooley has recorded that a species of *Catolaccus* parasitizes the beetles quite abundantly in Montana. The writer has bred several adult Hymenoptera which he believes were parasitic on this species, but none of them were reared under such conditions as to furnish positive data.

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*By W. Dwight Pierce.

Both in field and laboratory, at least the adult occasionally succumbs to a fungus *Sporotrichum globuliferum* Speg. which was kindly determined by Dr. Roland Thaxter of Harvard University.

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A FRUIT CATERPILLAR *Epinotia* (?) sp.

DISTRIBUTION AND HOST PLANTS.

The blueberry maggot excepted, the insect most commonly found in the fruit is a little lepidopterous larva, the adult of which the author has not yet succeeded in rearing. He has swept quite commonly on the blueberry bushes in late June and early July a little moth which seems to correspond to our specimen of *Epinotia fasciolana* Clemens. Although no conclusive data are at hand to establish his opinion, the writer believes that this is the species in question since it is of approximately the right size and no other little moth is common on the bushes at the time when the eggs are being deposited. The life history of this species is apparently unknown, but a member of the same genus has been reared from the fruit of the apple (*E. pyricolana* Murtf. U. S. Ent. Bul. 80, p. 46).

The structure of the larva found in the blueberry agrees very closely with the careful figures of the larva of *E. pyricolana* published by Mr. E. Dwight Sanderson in the Canadian Entomologist for 1903, V. 35:158-166.

This insect was rather abundant in 1913 but was very extensively parasitized, which so reduced its numbers that it was quite rare in 1914 and had not appreciably reestablished itself in 1915. During the past summer the writer has collected material from which he hopes to succeed in obtaining adults and thus definitely determining the species. He has bred the larva from the berries of *Vaccinium pennsylvanicum, V. canadense,* and *V. vacillans.* It is generally distributed through the state so far as the records of this Experiment Station show.

SEASONAL HISTORY AND LIFE HISTORY IN THE BLUEBERRY.

The egg. The eggs are deposited singly on the outside of the blueberry, usually somewhere around the calyx lobe; they may be found on either side of the sepal or on the floor of the calyx cup. Oviposition takes place while the fruit is still green, for the eggs are deposited during the latter part of June and early July, and the larva is usually at least half grown before the berry in which it is living ripens.

The larva. As is the case with most of the insects that live in the fruit itself, it does not seem possible to keep one larva under continuous observation, for they cannot stand continuous transferal from one berry to another while young, and a green berry dries up very rapidly after it has been picked.

There are 4 larval instars, and head measurements are typically .29, .43, .62 and .90. The greatest variation is in the last instar. Measurements were all made under a magnification of 20 diameters with a compound microscope by means of a camera lucida. Larvae were preserved in alcohol as they were found in dissecting the berries with a record of the date of removal and the date of collection. Head measurements were made of all specimens as obtained and thus their instar determined. A partial summary of these data is given in the following table.

Date	Instar			
1914	1st	2nd	3rd	4th
June 20			1	
July 6				1
7	1	2	3	2
9		1	2	1
13		3	1	2
15			4	3
20		2		
23				3
28			3	
Aug. 1				1
3				1
14				1

Date	Instar		
1915	1st	2nd	3rd
June 22	1		
25	5	2	
26	2		
30	4		
July 7	1	3	2
12	1		

From such observations as he has been able to make, the author would infer that 25 days is a fair estimate of the time spent in the berries. The earliest data on which a larva was found was June 22, 1915, and, in the laboratory material, July 17 was the first date on which a caterpillar was recorded as leaving the fruit that year, a period of about 25 days. About 12 days are required for the last 2 instars; this has been verified several times, as the berries have begun to ripen by the time the larvae are half grown, and they can be raised easily. As the instars are probably of about equal duration this is what one would expect if the duration of larval life is 25 days.

First instar larvae were common by June 25, and most were still in this stage at the end of the month. The majority leave the fruit about the twentieth of July in a normal season or around the thirtieth in a backward season such as 1915. A few straggle along up to mid-August. Probably most of them pass through the second instar in early July and nearly all have molted to the third instar at least by the tenth, though a few first instar larvae may be encountered even as late as July 7.

In most cases the larva when it hatches enters the berry near the calyx end usually on the outside of the berry at the base of one of the sepals, but some enter by the calyx cup and a few near the stem end. Most commonly the larva enters beneath a sepal and tunnels around the circumference of the calyx cup in a complete circle, just beneath the surface; then it burrows down to the stem end, sometimes through the center and sometimes close to the surface. Often the skin is discolored where the trail runs beneath it. From this point on, the fruit is irregularly eaten. Merely a shell of skin filled with dried pulp, the coat of the seeds and fine brown frass all woven together with silk, is left when the larva is full grown. Frequently 2 berries are webbed together. The first one is usually small and dry, full of frass webbed together; the second is larger and fresher. They are firmly attached together by silk and the larval trail leads from one into the other, at the point of attachment, usually on one side of the fruit. Rarely 3 or even 4 berries are thus united.

When full grown, the larvae leave the berries. In the laboratory they entered rotten wood in preference to sand, or earth. They spin silken cocoons in which they pass the winter as prepupae. A natural inference would be that they pupate in the spring and emerge as adults after a short pupal period, but there are no data at hand on this point.

Below is given a table showing the dates on which larvae left the fruit in the laboratory in 1913, 1914 and 1915.

1913			1914			1915		
7	on July	10	1	on July	13	1	on July	17
7		14	4		23	1		20
16		19	2		24	1		24
11		21	1		25	2		26
9		23	3		29	1		28
6		24	2	Aug.	5	3		29
2		25	4		1	1		31
3		26				3	Aug.	3
6		28				2		7
8	Aug.	2				2		9
4		4				1		11
						1		21

The extreme dates are July 10, 1913, and August 21, 1915.

Technical Description.

Egg. Oval, translucent, whitish.

Larva. Length 6-8 mm.; width 1.25-1.50 mm. Elongate, sub-cylindrical; color pinkish orange above, lighter beneath, pro- and mesothorax almost white; tubercles light brown, spiracles brown; head either dark or light brown, shining, the suture lines darker or almost black; anteclypeus and labrum brown, mandibles dark; palpi and antennae colorless; a conspicuous white line on the head on either side of the suture between the clypeus and epicranium, fusing above the clypeus and extending nearly to its base, thus forming two sides of a triangle; ocelli 6 on each side. Head often partially withdrawn under the transparent cervical shield which is straight on its cephalic margin and curved outward on its caudal. Body widest at abdomen 4, but all segments about the same size except abdomen 8, 9, and 10, which are conspicuously smaller. Legs brown, tips of prolegs brown, ninth abdominal tergite chitinous, dark brown; caudal setae prominent; 4 or 5 stiff brown setae around anus. See figure 60 G.

The above applies to the fourth instar. In the first 3 instars (rarely only in the first 2) the head is deep shining black and the cervical shield blackish, as is also the chitinized ninth abdominal tergite; the legs are almost black; the body is white, sometimes more or less orange above; the head is never withdrawn beneath the cervical shield.

Setae. The arrangement of the setae on the fifth abdominal segment, the head and the antenna is shown in figure 58. The drawing of the lateral aspect of the fifth abdominal segment was made from the right side. All drawings were made by the aid of a camera lucida.

HABITS.

Several times the writer has had an opportunity to watch half-grown larvae removed from the fruit burrow into a fresh berry, and the process seemed to be practically the same in all cases. When the larva is first put on a new berry, it leaves it and wanders around uneasily for half or three-quarters of an hour, finally returning to the fruit. For a few minutes it

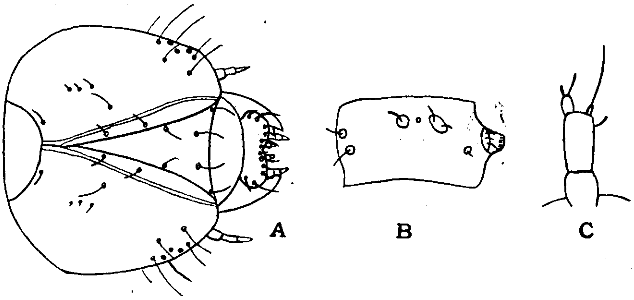

Fig. 58. *Epinotia* (?) sp. A. head of larva; B. 5th abdominal segment of larva, right lateral aspect; C. antenna of larva. All enlarged.

wanders about the outside, apparently eating something from the surface although the bloom is not rubbed off. Invariably the larva goes to the calyx cup in order to enter the fruit. If the berry is of small or medium size, before starting to burrow, the larva spins a web over the entire calyx cup, first standing right side up on the bottom, spinning a few strands across one diameter and following these with guide lines to the sides; then standing wrong side up and clinging to the under surface of the threads, it spins a dense network of silk enclosing the cup completely except for a little hole about the size of its body left diagonally opposite the point where the entrance hole is to be made. If the berry is an especially large one, frequently the larva spins over only half of the calyx cup, making in this case two silken walls at right angles to one another. Here too a hole is left in the silk. While spinning the caterpillars cling to their support by their prolegs, waving the head and thorax back and forth and from side to side. The silk appears to issue from the labium.

Ten minutes are required for the process noted above, then for some 5 minutes the larva wanders round and round in the calyx cup, occasionally pausing to peer out through the hole in the side. Finally it stops this meandering and starts work diagonally opposite the opening left in the silk, through which the latter abdominal segments project. The entrance hole is always made on the floor of the calyx cup, never in the center but always on one side, usually between 2 sepals. The caterpillar burrows in head first but wrong side up, clinging with its prolegs to the silken web which it has just spun. 10 minutes usually have elapsed before head and thorax are out of sight, for the entrance is gradual and occasionally the larva draws itself wholly out. But after this it works more rapidly and by the time another 10 minutes have passed, the entire body has disappeared. One can see the blood very plainly as it is driven forward in the heart, and the pulsations, though rapid, are regular and rhythmical, averaging quite constantly 79 per minute in all the cases counted. The last 4 segments of the abdomen contract and expand synchronously with the dorsal vessel. Approximately every 5 minutes the feces are voided, semi-fluid, dark, soon hardening into a dry frass.

No sooner has the larva entered the berry than it turns around and appears head first a minute or two later. By means of a row of stout setae on the labrum it rolls the excreta up into the silk where they stick fast. Then it disappears again into the berry for 2 or 3 minutes. The caterpillar does not feed at this time but simply chews up the pulp, soon reappearing and ejecting it as little balls which almost immediately harden into dry pellets. These balls are plastered into the silk in much the same manner as was the frass. Chewing and plastering intermittently in the course of 15 minutes it has usually covered the silk half over with dry ejecta. Now the larva seems to be tired, working more slowly with frequent resting spells, but the calyx cup is densely covered over with pellet lined silk within an hour after the insect starts to plaster.

The general habit of the caterpillar after entering the berry seems to be to tunnel straight down through the center and make another hole near the stem end. In this trail the larva lies with its caudal end projecting toward the calyx cup into which the feces are voided. When ready to leave the fruit the larva burrows out a tunnel at right angles to the other, starting from the center and ending at some point on the circumference. If one berry does not contain enough food and 2 are webbed together, invariably the larva makes its way to the surface of the first one by a trail precisely similar to this, and fastening the second very securely to this point by silk attachments, continues the trail into it.

NATURAL ENEMIES.

In 1913 this insect was attacked by parasites to a very considerable extent, which greatly reduced its numbers. Mr. E. A. Richmond of Cornell University kindly identified this for me as an Ichneumonid, *Pimpla sp.* near *P. indagatrix* Walsh from which it differs in coloration. Adults emerged between July 28 and August 22, 1913, and at corresponding dates in 1914 and 1915.

The larva is white or slightly pinkish and emerges from the caterpillar when the latter is nearly full grown, but before it has left the fruit. If 2 berries have been webbed together the larva of the parasite, if present, will always be found lying in the trail between the 2, half in one and half in the other. The pupa is pure white. In 7 instances the writer has been able to determine the pupal period exactly; it varied from 5 days to 11 days, and averaged nearly 8 days. A larva found in the fruit on August 11, 1914, formed its pupa on August 14 and emerged as an adult on August 21. This may be considered as fairly typical.

Often the head or shriveled skin of the caterpillar may be found in the same berry as the larva of the parasite. A careful examination usually shows a minute puncture in the skin of the fruit; this is probably made by the ovipositor of the adult female and, therefore, this is beyond reasonable doubt a larval parasite. A female is illustrated in figure 62 D.

THE BLUEBERRY DAMSEL-BUG *Nabis rufusculus* Reut.

DISTRIBUTION AND HOST PLANTS.

The writer has taken this species (Hemiptera, Nabidae) in Orono, Cherryfield and Unity; it is probably distributed throughout the state. While the nymphs and adults live upon the blueberry bushes, they are predaceous in their habits. In nature they probably prey upon the little psocids and spiders which abound on the bushes; in the laboratory they ate all species of aphids that were fed them. They also ate one another with equal readiness. Fresh leaves and fruit were supplied them in the laboratory, but the writer has no evidence that they take any vegetable food. The eggs are deposited in the fruit of the blueberry, but this seems to be the only way in which this plant is directly concerned in their life cycle, and it is possible that the eggs may be laid elsewhere as well. The writer has found the eggs in the berries of *Vaccinium pennsylvanicum* and *V. canadense.*

SEASONAL HISTORY AND LIFE HISTORY IN THE BLUEBERRY.

This species hibernates in the adult stage. Oviposition begins at least by June 15. The eggs are deposited indifferently in any part of the berry, which may be either green or ripe. They are inserted beneath the surface and only the perfectly round white lid of the shell is visible from the outside, fitting snugly into the oviposition puncture and lying in a very slight depression. The egg itself is elongate-cylindrical, and is slightly curved. The exposed end is a sort of lid which fits closely into the rest of the egg; when ready to emerge, the insect pushes off this cap and crawls out, the lid remaining fastened to the egg shell by a sort of hinge. The egg is about 2 mm. in length. Rarely 2 eggs are placed in the same berry.

Eggs may be found from mid-June through the middle of July. Occasionally they are met with in August; these probably represent a partial second generation. An egg found on June 16, 1915, hatched on July 5, and the embryonic period is probably about 3 weeks.

The writer was unable to rear through to the adult stage any of the individuals which hatched from the eggs that he collected, for sooner or later they died in molting, becoming hopelessly entangled in the old cuticula. But young nymphs were swept on the blueberry bushes and from these adults were bred which were very kindly determined by Mr. H. G. Barber of Roselle Park, N. J.

When first hatched the nymphs are colorless except for their red eyes and the femoro-tibial joint, which is at first red, but sooner becomes blackish. The distal border of the first antennal segment is black. The caudal half of the abdomen is dark. In the second instar, three white dots appear on the abdomen. In the third instar the eyes are red; the legs are practically colorless; the second and third segments of the antenna are black; the dorsal part of the abdomen is brown, the cephalic border of the first segment being dark brown; there is a round white spot in the middle of each of the abdominal segments 1, 2 and 3.

The older nymphs are light brown in their general color as is also the adult. The writer is not sure of the exact number of nymphal instars. In general the early instars last 5 days, the later 7 to 8, and the pre-adult 10 or more. A young nymph, (probably second instar), a nymph two molts before the imago, and an adult are shown in figure 61.

The young nymphs especially are very neat and frequently clean beak and antenna. This is usually accomplished by holding out the prothoracic legs in front of the body with the tarso-tibial joints brought together, and drawing the antenna or beak through the point of union.

The later nymphal instars and the adults may be swept quite generally on the bushes in late August and early September, the only time when they seem at all numerous.

A Scale Insect *Pseudococcus* sp.

Occasionally a little scale insect was found in the calyx end of the berry. None of these mealy bugs were sufficiently mature to render a specific determination possible. Doctor Patch kindly determine them for the writer as *Pseudococcus sp.*, closely related to, if not identical with *P. citri.*

Insects Which are Primarily Leaf Feeders.

The writer paid only slight attention to any except fruit insects until the summer of 1915. There is a large variety of insects which feed on the leaves of the blueberry, but for the most part they are neither particularly common nor injurious. The list includes principally Geometridae and Noctuidae among the Lepidoptera, Tenthredinidae among the Hymenoptera, and

Chrysomelidae among the Coleoptera. Collections were made rather extensively in 1915 but from most of this material the writer has not yet obtained adults or else the adults have not been determined, so that any detailed discussion is reserved for future publication. The only leaf-feeding insect seriously injurious to the blueberry which the writer observed in Maine was a Chrysomelid beetle, kindly determined by Mr. Eugene A. Schwartz of Washington, D. C., as *Galerucella decora* Say, to a brief discussion of which the remainder of this paper is devoted.

A Leaf Beetle *Galerucella decora* Say.

DISTRIBUTION AND HOST PLANTS.

Galerucella decora Say is the only leaf feeding insect which the writer has observed to be decidedly injurious to the blueberry in Maine. It is widely distributed through the state and has been found wherever collections have been made on the blueberry for this Station. In the vicinity of Orono this species has been very abundant during the past 3 seasons and has killed a considerable number of blueberry bushes. Doctor Smith records it on willow (Insects of New Jersey, 1909, p. 347) as does also Mr. Blatchley (Coleoptera of Indiana, p. 1170) and Mr. Chittenden (U. S. Bureau of Forestry, Bul. 46, p. 78) but the writer has not found it anywhere except on the blueberry in Maine. It breeds on *Vaccinium pennsylvanicum, V. canadense*, and *V. vacillans*.

SEASONAL HISTORY AND LIFE HISTORY ON THE BLUEBERRY.

The egg. This species hibernates in the adult stage. The overwintering beetles may be swept up abundantly by June 15 and probably appear much earlier as even then the foliage was conspicuously eaten. The first eggs were deposited on June 16, 1915, and oviposition continued about a month. One female deposits about 25 eggs, usually within 3 or 4 days after pairing. Twenty-nine is the largest number the writer has recorded for any one female. In the laboratory the eggs were mostly deposited in the cheesecloth on the bottom of the dishes in which the beetles were kept. The writer has not succeeded in finding the eggs in nature, but feels sure that they are not fastened to the leaves.

The larva. None of the several hundred eggs deposited in the laboratory hatched although they were kept under the same conditions as *Haltica* eggs, nearly all of which developed; and even when the eggs were placed on moistened cheesecloth they dried up and shriveled. Larvae were swept abundantly in the field on August 6, 1915. Nearly all were in the last instar on this date. There are probably 3 larval instars as is the case with the various species of *Haltica* which the writer has reared. In the next to the last instar the head measures .55-.60 mm. across, and in the last .75-.825 mm., .80 mm. being the normal. The ground color of the larva is very light greenish gray; the tubercles are a darker gray; the prothoracic shield is grayish; the legs brownish black; and the head brown. Immediately after molting the entire body, including head and legs, is light creamy yellowish, except the eyes which are nearly black.

A larva which molted on August 9, 1915, to the last instar entered the soil as a prepupa on August 21, a period of 12 days. This is probably but little, if any, longer than the other instars, and 30-35 days is the probable length of larval life.

The insects are voracious feeders and the larvae eat the leaves very rapidly and in great amount. The leaves are skeletonized, and only the brown ribs and upper epidermis is left. They soon wither and fall off. Bushes which are defoliated 2 or 3 years in succession usually are killed.

The pupa. The larvae enter the ground before transforming to pupae, burrowing to a depth of an inch or more. Both in 1914 and in 1915 the majority entered the soil about August 10, but the writer has swept larvae as late as September 1. The prepupal period varies from 4 to 6 days, but averages about 5. The pupal period lasts 8 or 9 days. When first formed the pupa is straw yellow, with black eyes. Gradually the wings become gray, and the legs, antennae and mandibles dark.

The adult. The adult is yellowish when it emerges but colors up reddish brown in about 20 hours. These beetles can be swept abundantly on the blueberry all summer. The adults of the new generation emerge principally in the latter half of August and in early September. There is but one generation each year.

Like the larvae, the adults are very voracious and eat the leaves greedily in exactly the same way as do the larvae so that the work of the 2 stages is indistinguishable. Occasionally the beetles also eat into the fruit from the outside. They feed both in the fall before entering their winter quarters and after they have come out of hibernation in the spring.

The egg, larva, pupa, and adult are illustrated in figures 59 A, 60 D, E, F, respectively and the work of the larvae on blueberry leaves in figure 59 B.

NATURAL ENEMIES.

Under conditions favorable to the growth of this fungus, larva, pupa and adult are subject to the attack of *Sporotrichum globuliferum* Speg. Diseased specimens were not infrequently found outdoors and in the laboratory these insects seemed very susceptible to *Sporotrichum*. This fungus was determined for me by Dr. Roland Thaxter of Harvard University.

MEANS OF CONTROL.

If this insect were to occur in sufficient numbers in any accessible locality so as to make remedial measures seem economically practicable, without doubt if could be controlled by any of the ordinary arsenical sprays.

ECONOMIC BIBLIOGRAPHY.

The writer has found only one reference to this species in the literature of economic entomology.

1904. Chittenden, Frank Hurlbut. U. S. Bureau of Forestry, Bul. 46, p. 78, fig. 23.

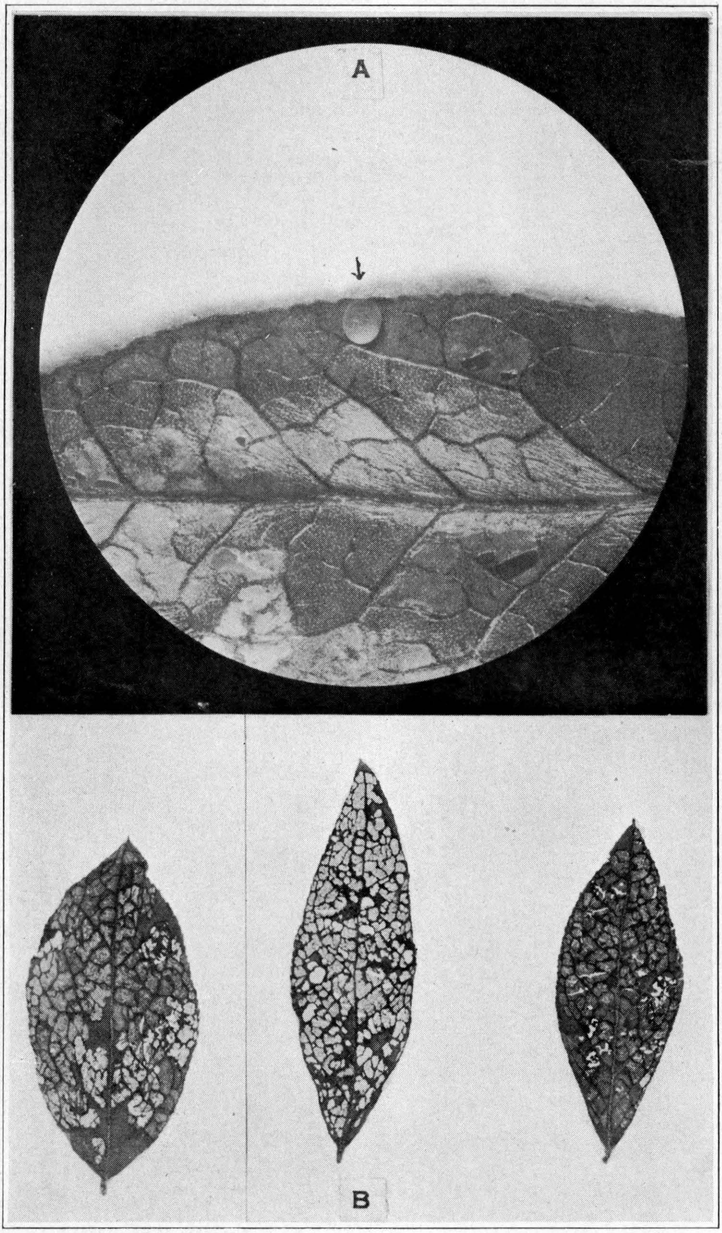

Fig. 59. *Galerucella decora* Say. A. egg near margin of leaf; B. work of larvae on leaves of *Vaccinium pennsylvanicum*.

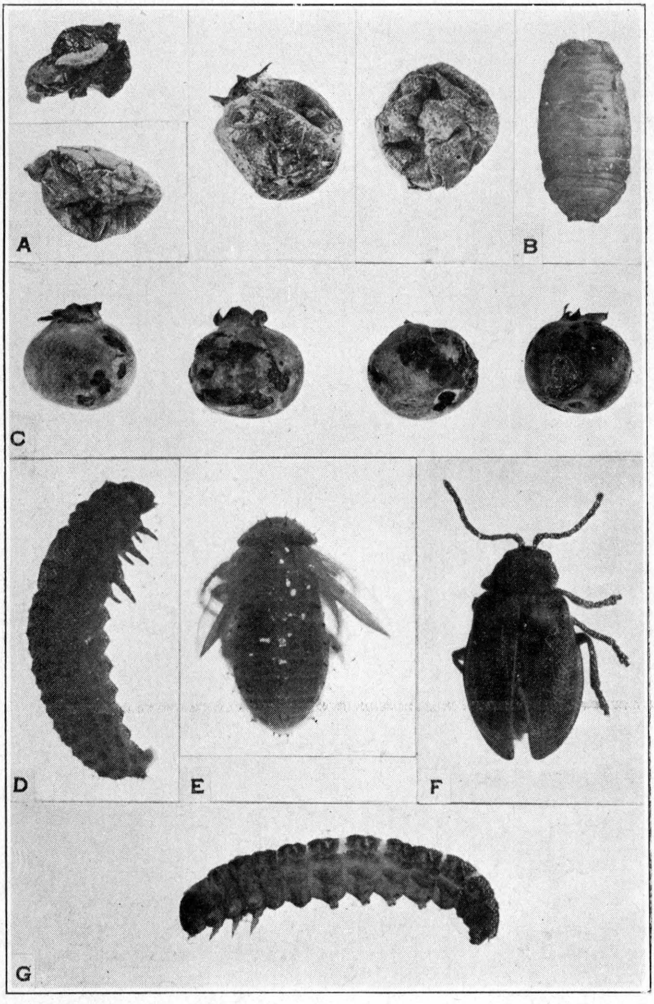

Fig. 60. A. four blueberries showing the work of the larva of *Rhagoletis pomonella* Walsh, the maggot exposed in the first berry; B. puparium of *R. pomonella,* enlarged; C. work of adult of *Pseudanthonomus validus* Dietz on blueberries; D, E, F. *Galerucella decora* Say, enlarged, larva, pupa, and adult; G. *Epinotia* (?) sp. larva enlarged.

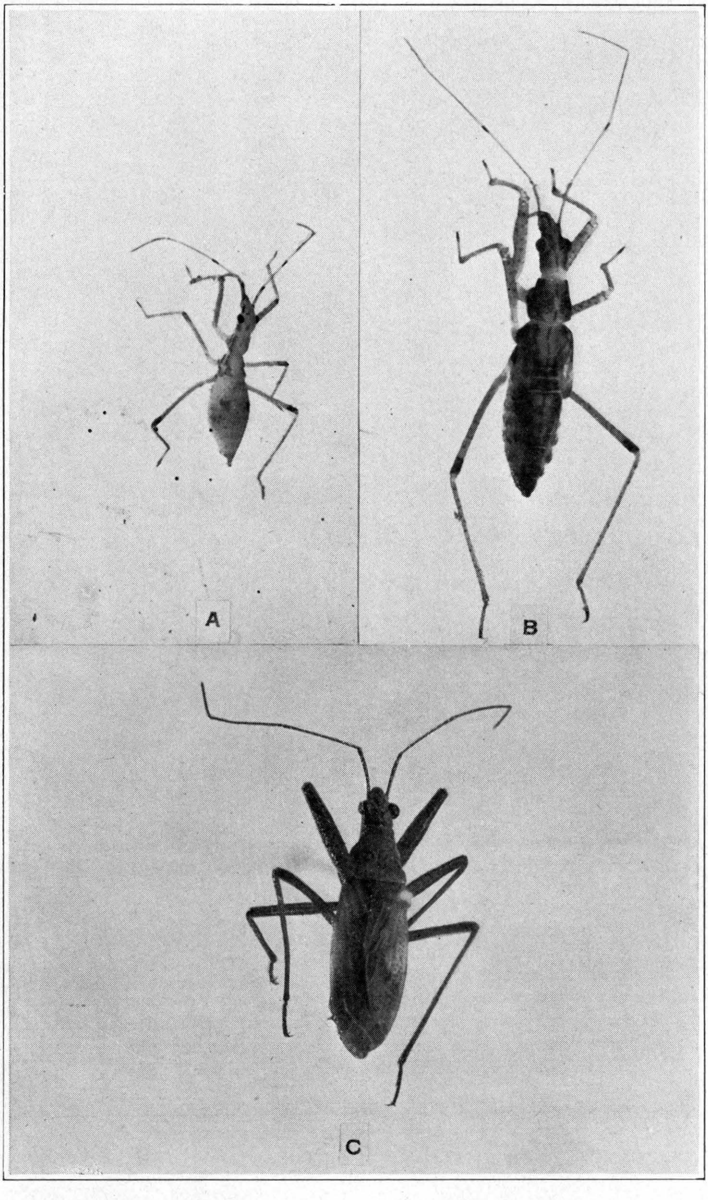

Fig. 61. *Nabis rufusculus* Reut. A. young nymph; B. insect in next to last nymphal instar; C. Adult. All enlarged.

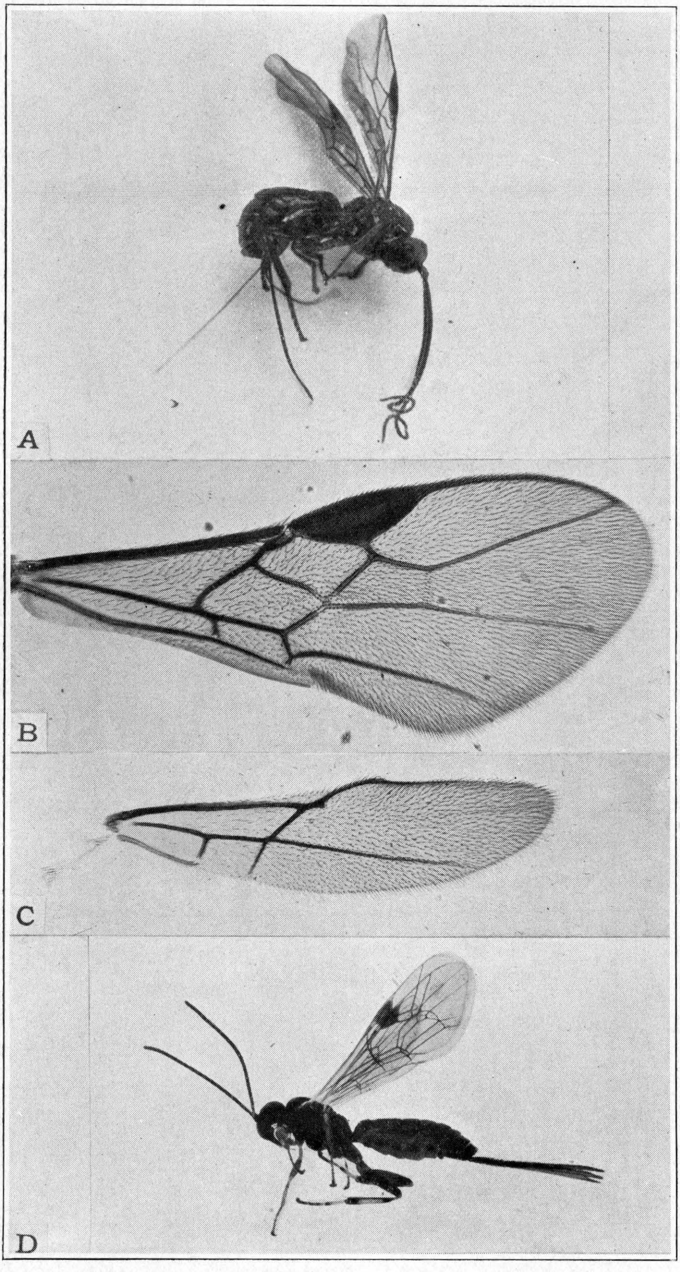

Fig. 62. A, B, C. *Biosteres rhagoletis* Richmond, enlarged, a parasite of *Rhagoletis pomonella* Walsh. A. female; B. upper wing; C. lower wing; D. *Pimpla* sp. female enlarged, a parasite of *Epinotia* (?) sp.

BULLETIN 245.

ABSTRACTS OF PAPERS PUBLISHED BY THE STATION IN 1915 BUT NOT INCLUDED IN THE BULLETINS.

A complete list of all the publications issued by and from the Station in 1915 are given on pages xii to xiv of the introduction to this Report. The following pages contain abstracts of the papers issued during the year that are not included in the Bulletins or Official Inspections for the year.

RELATION OF SIMULTANEOUS OVULATION TO THE PRODUCTION OF DOUBLE-YOLKED EGGS*.

(1) Double-yolked eggs with normal separate yolks may have all the egg envelopes common to the two yolks, or they may have some separate and some common envelopes.

(2) They may be classified with reasonable accuracy into three groups:

Type I.—Double-yolked eggs having the entire set of egg envelopes common to the two yolks.

Type II.—Double-yolked eggs having separate chalaziferous layers but all or part of the thick albumen common to the two yolks.

Type III.—Double-yolked eggs in which the yolks have entirely separate thick albumen envelopes but a common egg membrane and shell.

(3) Of the eggs studied 16.03 per cent belonged to type I, 70.99 per cent to type II, and 12.98 per cent to type III.

(4) A large series of double-yolked eggs show all gradations within and between these groups.

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*This is an abstract of a paper by Maynie R. Curtis, having the same title and published in Journal of Agricultural Research, Vol. III, pp. 375-386. Pl. XLVI-LII. 1915.

(5) The most probable interpretation of this phenomenon is that the two components unite at any level of the oviduct from the funnel mouth to the isthmus ring.

(6) The conclusion that the union of the component eggs occurs *indiscriminately* at all levels of the oviduct is strongly supported by the fact that the percentage of eggs of each type closely proportional to the percentage of the portion of the duct in which the union of two eggs would give double-yolked eggs of that type.

(7) In 36.44 per cent of the double-yolked eggs the ovulations which furnished the two yolks must have been separated by an abnormally short interval, since a normal egg had been laid on the preceding day.

(8) An examination of the egg structure, however, shows that the two yolks have passed the entire length of the duct together in only 16.28 per cent of the cases in which the ovulations are known to have been usually rapid.

(9) While a heightened rate of fecundity may result in the production of an egg of any of the three types, 68.75 per cent of the eggs of type III are single eggs. It seems probable that many of them have resulted from the delay of the first egg in the oviduct.

(10) The ovary of each pullet which had just laid a double-yolked egg as her first egg contained two normal separate follicles which had separate blood supplies. In these cases, however, the doubling of the egg had occurred near the end of the albumen-secreting region.

(11) In a case in which there was evidence from the structure of the egg that the two yolks had passed the entire length of the oviduct together the two follicles were also quite distinct, with separate blood supplies.

(12) This, together with the fact that in only a small percentage of double-yolked eggs is there any evidence of simultaneous ovulation, indicates that the fusion of follicles and a resulting common blood supply is by no means the usual cause for the production of a double-yolked egg.

(13) A simple normal follicle furnished the yolk with two germ disks; hence, the fusion of the oöcytes (if this was the origin of the two germ disks) must have occurred before the formation of the follicle.

STUDIES ON THE PHYSIOLOGY OF REPRODUCTION IN THE DOMESTIC FOWL. XII.

ON AN ABNORMALITY OF THE OVIDUCT AND ITS EFFECT UPON REPRODUCTION.*

This paper describes a case of congenital obstruction of the oviduct, of unusual character.

The bird was a year and a half old Rhode Island Red hen which had been killed for meat. She was well grown and in good flesh. When the body cavity was opened it was found full of membrane covered eggs. They represented every possible stage of absorption from a normal membrane shelled egg to collapsed empty egg membranes. Some of the eggs and empty membranes were free in the body cavity. Others were walled off in pockets either singly or in aggregates. There was one large mass (twice the size of a hen's egg) of empty tightly packed egg membranes. At the time of examination 15 absorbing eggs and a very large number of empty membranes were found. Eleven of the 15 eggs had evidently been normal eggs although many of them contained a homogeneous mixture of yolk and albumen at the time examined. Four were double eggs. That is, one egg enclosed within another. One of the four was made up of a series of four concentric eggs. The inner egg being a small "witch" or "cock" egg.

The ovary of this bird was in the same condition as the ovary of any laying bird. It had a normal series of enlarging yolks and resorbing follicles. The oviduct as far as the posterior end of the isthmus or egg membrane secreting portion was also in the normal laying condition. At the posterior end of the isthmus the duct ended blindly, although the ligament which suspends the duct from the body wall continued normally to the end of the body cavity. There was no shell gland or vagina. The only opening to the duct was the funnel mouth.

It was evident that this bird was in the midst of a normal period of reproduction and was producing eggs in a normal manner as far as her oviduct allowed. The membrane shelled eggs then backed into the body cavity from whence they were

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*This is an abstract of a paper by Maynie R. Curtis, having the same title and published in Biological Bulletin, Vol. XXVIII, pp. 154-163. Pl. I. & II. 1915.

being absorbed at a rapid rate. The occurrence of double eggs shows that one egg did not always get out of the duct in time to make way for the succeeding egg. The occurrence of the egg composed of four concentric eggs suggests that the direction of the movements of the egg must have been considerably disturbed so that this egg passed up and down the duct several times before it was discharged into the body cavity. The condition of the internal organs of the bird indicates that the physiological processes of digestion, absorption and secretion were not seriously disturbed.

The forward end of the oviduct or egg tube arises very early in the development of the chick embryo. The tube then grows backward until it reaches the region of the vent. The most probable explanation for the occurrence of the oviduct found in the case described is that in early embryonic development (probably on the sixth or seventh day of incubation) the backward growth of the oviduct stopped permanently while the differentiation of the part already formed continued in the normal manner.

As in other cases where the passage of the egg is prevented the sex organs passed through their normal reproductive cycles; the oviduct functioned as far as the point where the passage was interrupted; the eggs were then returned to the body cavity and resorbed. The number of eggs and empty egg membranes found in this fowl which was apparently in a perfectly normal physical condition show that a bird may possess very great power of resorption of its own eggs.

ON THE REFRACTIVE INDEX OF THE SERUM IN A GUINEA-CHICKEN HYBRID.*

This is a record of certain results regarding the refractive index of the blood serum of a genus-hybrid produced from the mating Cornish Indian Game ♂ × Guinea Fowl ♀.

Our results show that (1) there is a definite, characteristic, and permanent difference between the refractive index of the serum of the fowl and that of the guinea; and (2) that in the hybrid the guinea parent is dominant in respect of the physico-

*This is an abstract of a paper by Raymond Pearl and John W. Gowen, having the same title and published in Proceedings of the Society for Exper. Biology and Medicine. Vol. XII, p. 48, 1915.

chemical constitution of the blood as measured by the refractive index. Some figures on the point follow:

Source of Blood.	*nD*
Fowl (*Gallus* sp.)	1.34537
(Mean of data from 10 birds of different hereditary constitutions)	
Guinea (*Numida meleagris*)	1.34184
(Mean from 6 birds)	
Hybrid (*Gallus* ♂ × *Numida* ♀)	1.34179

FITTING LOGARITHMIC CURVES BY THE METHOD OF MOMENTS.*

The use of logarithmic curves in the analysis of various kinds of biological and agricultural data is rapidly becoming widespread and general. It was first shown by Lewenz and Pearson that the growth of children followed a logarithmic curve. Pearl demonstrated that the phenomena of growth and differentiation in Ceratophyllum also followed a logarithmic curve. Donaldson and Hatai in a series of papers dealing with the growth and quantitative relations of the whole organism and its various parts in the white rat and the frog have shown that the same law holds for growth in those forms.

Other biological phenomena than growth follow a logarithmic law. Pearl, in a case of regulation of the shape of abnormal eggs, and later Curtis for normal eggs, have shown that the changes in size and shape of successively laid eggs are graduated with a logarithmic curve. Work now in progress in the Biological Laboratory, Maine Experiment Station, of which only a preliminary notice has yet been published, shows that generally the change in milk flow with age in dairy cattle is logarithmic. Several years ago Holtsmark pointed out that the relation between the number of food units required and the milk yields of different animals was logarithmic.

From this incomplete review of the literature recording the use of logarithmic curves in biological and agricultural investigations it is clear that the workers in these fields will, as time

*This is an abstract of a paper by John Rice Miner, having the same title and published in the Journal of Agricultural Research, Vol. III, pp. 411-423. 1915.

goes on, have increasing need to be able to handle these curves easily and critically.

Up to the present time the only available method of fitting logarithmic curves was that of least squares. Several years ago Pearl and McPheters published a set of tables intended to lighten materially the labor of fitting such curves by the least-squares method. For a long time, however, the writer has felt that it would be highly desirable to bring this class of curves into the general system of curve fitting worked out by Pearson and known as the "method of moments." The theory of the method is extremely simple, involving as it does only the assumption that if we equate the area and moments of a theoretical curve to the area and moments of a series of observations we shall get a reasonable fit of the curve to the observations. Experience with the method in the hands of different workers in England and America has abundantly demonstrated that this assumption is entirely justified in the fact.

In the papers cited, and in others also, Pearson has given the equations for the calculation of the constants from the moments in the case of (*a*) skew frequency curves in general, (*b*) sine curves, (*c*) parabolas of all orders, (*d*) the point binomial, (*e*) hypergeometrical series, etc. There has been lacking, however, the determination of the equations connecting moments and constants for the general family of logarithmic curves of the type.

$$y=a+bx+cx^2+d\log(x+q)$$

and its modifications. The necessary equations are given in the paper here abstracted.

INTERPOLATION AS A MEANS OF APPROXIMATION TO THE GAMMA FUNCTION FOR HIGH VALUES OF n*

This paper is purely mathematical in subject matter and interest. The question discussed is whether a degree of approximation, sufficient for statistical purposes, to the value of log gamma n can be had by interpolating in a table of log factorial n.

*This is an abstract of a paper by Raymond Pearl, having the same title and published in Science N. S. Vol. XLI, pp 506-507.

It is shown that the interpolation method, when third differences are used, gives values slightly better than those by Forsyth's method when $n = 25$. For $n = 75$ or more the interpolation method using only second differences gives an approximation sufficiently close for all practical statistical purposes. As to the labor involved, there is no great amount of choice between Forsyth's and the interpolation method, but on the whole there appears to be a distinct, if small, advantage in favor of the interpolation.

MENDELIAN INHERITANCE OF FECUNDITY IN THE DOMESTIC FOWL, AND AVERAGE FLOCK PRODUCTION.*

In this paper it is shown that:

1. There is a marked difference in average egg production per bird of Barred Plymouth Rock pullets of the Maine Station strain at the present time as compared with what obtained during the period of simple mass-selection for this character. This is seen in Table I.

TABLE I.

MONTHLY DISTRIBUTION OF MEAN EGG PRODUCTION PER BIRD UNDER DIFFERENT BREEDING SYSTEMS

Month	Weighted Mean Under Mass Selection	Best Comparable Year to 1913-14 of Similar-sized Flocks Under Mass Selection (1905-06 100-bird Pens)	Best Month in Any Year of Mass Selection, Any Size Flock	Year 1913-14
November...	4.63	5.38	6.45 (1904-05, 100-bird flock)	*10.76*
December...	8.91	9.91	12.02 (1901-02, only 48 birds in small flocks)	*14.19*
January....	11.71	13.27	15.21 (1901-02, only 48 birds in small flocks)	*13.88*
February....	10.87	13.39	14.46 (1905-06, 50-bird flocks)	*13.37*
March......	16.11	17.33	18.29 (1905-06, 50-bird flocks)	*19.22*
April.......	15.85	16.48	18.50 (1901-02, only 48 birds in small flocks)	*18.44*
May.......	13.92	———	17.02 (1902-03, 147 birds in small flocks)	*16.88*
June........	12.46	13.47	16.88 (1901-02, only 48 birds in small flocks)	*14.56*
July........	10.87	10.49	14.90 (1901-02, only 48 birds in small flocks)	*14.52*

*This is an abstract of a paper by Raymond Pearl, having the same title and published in American Naturalist, Vol. XLIX, pp. 306-317, 1915.

2. This difference is in the direction of a substantially higher mean production at the present time, when tested on flocks of large size.

3. The increase in flock average productivity is most pronounced in respect to winter production, which is the laying cycle to which especial attention has been given in the breeding.

4. The cause of this increase in flock productivity appears, with a degree of probability which is very high and amounts nearly to certainty, to be that the method of breeding the stock now followed is more closely in accord with the mode of inheritance of fecundity than was the simple mass-selection practised in the earlier period.

5. The result announced in earlier papers that high fecundity is a sex-linked character, for which the female is heterozygous, has been confirmed by practical poultrymen in their breeding operations.

STUDIES ON THE PHYSIOLOGY OF REPRODUCTION IN THE DOMESTIC FOWL.

XIII. On the Failure of Extract of Pituitary Body (Anterior Lobe) to Activate the Resting Ovary.

From the evidence presented in this paper it appears to be clearly established that the substance of the anterior lobe of the pituitary body of the cow, when injected into the abdominal cavity of hens in which the ovary is in a completely resting condition, does not cause an activation of the ovary, in the sense of inducing ovulation at an earlier date than that at which it would normally occur.

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*This is an abstract of a paper by Raymond Pearl and Frank M. Surface, having the same title and published in Journal of Biological Chemistry, Vol. XXI, pp. 95-101. 1915.

FREQUENCY OF OCCURRENCE OF TUMORS IN THE DOMESTIC FOWL.*

The purpose of the present paper is to record the data on the frequency of occurrence of tumors in the domestic fowl which have been collected during eight years' routine autopsy work at the Maine Agricultural Experiment Station.

The chief points brought out by an analysis of these data are as follows:

(1) Of the 880 birds autopsied 79, or 8.96 per cent, had tumors. That is, there were 90 cases of tumors per 1,000 birds.

(2) There was no significant difference in frequency of occurrence of tumors between birds which died from natural causes and apparently normal birds which were killed.

(3) There is a significant positive correlation between age and the occurrence of tumors. Only 7.37 per cent of the birds under 2 1-4 years had tumors, while neoplasms were present in 19.17 per cent of those that were over that age.

(4) In birds with tumors which died from natural causes, the tumors were directly or indirectly the probable cause of death in from one-third to one-half the cases.

(5) There was a decided tendency for the association of hypertrophied (apparently due to cell infiltration) liver, spleen, or kidney with the presence of tumors in other organs.

(6) Death often resulted from internal hemorrhage from the tumor, the underlying tissue, or the hypertrophied liver or spleen.

(7) The tumors can be classified into cystic and tissue tumors; 22.78 per cent of the tumors were of cystic and 74.68 per cent of solid-tissue structure. There were two cases of tissue tumors to which cysts were attached.

(8) In the females[1] the organs most frequently affected were the genital organs; 37.76 per cent of all the tumors being in the ovary and 18.36 per cent in the oviduct and oviduct ligament.

(9) In most cases the tumors were confined to one organ. In 15 cases, however, the tumor had evidently undergone metastasis, since tumors of similar nature occurred in from two to four organs.

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*This is an abstract of a paper by Maynie R. Curtis, having the same title and published in Journal of Agricultural Research, Vol. V, pp. 397-404. 1915.

[1]Autopsies were made on too few males to yield reliable data.

SEVENTEEN YEARS SELECTION OF A CHARACTER SHOWING SEX-LINKED MENDELIAN INHERITANCE.*

In 1898 there was begun at the Maine Agricultural Experiment Station an experiment in breeding Barred Plymouth Rock fowls, having for its purpose the improvement by selection of the character winter egg production. This investigation has continued to the present time.

The experiment has fallen into three divisions or periods: viz., (1) the period from 1898 to 1907, (2) the period from 1908 to 1912, and finally (3) the period from 1912 to date. Detailed reports on the methods of breeding in operation have been published elsewhere.† For purposes of clear orientation in the present discussion it will be well here briefly to review the facts as to the methods of breeding used in each of the periods. With these facts definitely in mind we may then proceed to an examination of the results.

1. *The Period from 1898 to 1907.*—During this period the breeding followed the plan outlined at the beginning by Woods and Gowell. Essentially it consisted of the following elements.

1. Trap-nest record of the performance of each individual female.
2. Selection as breeders of all females which laid more than a definite number of eggs (150) in the first laying year.
3. Selection as breeders of males whose dams had laid more than another definite number of eggs (200).
4. The indiscriminate mass breeding, *without* individual pedigrees, of all individuals selected as described under 2 and 3, and, in consequence,

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*This is an abstract of a paper by Raymond Pearl, having the same title and published in American Naturalist, Vol. XLIX, pp. 595-608. 1915.

†Cf. particularly Woods, C. D., and Gowell, G. M., U. S. Dept. Agr. Bur. Anim. Ind. Bulletin 90, 1906, pp. 42; Pearl, R., and Surface, F. M., *Ibid.* Bulletin 110, Part I, 1909, pp. 80; Pearl, Me. Agr. Expt. Stat. Ann. Rept., 1911, pp. 113-176; and Pearl, *Jour, Exp. Zool.*, Vol. 13, 1912, pp. 153-268.

5. *No test of the progeny* of particular matings with respect to their laying ability.

This may be designated as the *period of mass selection.*

2. *The Period from 1908 to 1912.*—For reasons which have been fully set forth elsewhere[3] it was decided not to continue the breeding along the same plan after 1907. The new plan, put into operation first in the breeding season of 1908, was calculated primarily to furnish definite information regarding the mode of inheritance of the character winter egg production. It involved essentially the following items:

1. Trap-nest record of the performance of each individual female.
2. The selection of both males and females was made on a *double* basis, including in addition to the individual's own performance as in the earlier plan, also the idea of progeny performance. In practice this worked out *for hens* in the following way; Plans were made to see whether there could be formed by selection and propagated three distinct strains of winter egg producers, namely, high, mediocre and low. This involved, *on the individual performance side,* the separate selection in the first years of *three* classes of females as breeders: (*a*) good winter producers, with records before March 1 of above 30 eggs; (*b*) mediocre winter producers, with records below 30 eggs; and (*c*) poor winter producers, which laid no eggs before March 1. The division at 30 eggs was, after the first year, merely a nominal one in the selection of *high* producers. Actually only birds were used in the *a* class whose records materially exceeded 30 eggs, running up to over 100 eggs in some cases.

The *progeny performance* idea was carried out in two ways in the breeding. In the first place, no female was selected for the *high* winter production breeding pens, for example, unless, in addition to her own high winter record, all her sisters and her dam were high producers. In the second place, of all females fulfilling the above qualification only those were bred a

[3]Pearl and Surface, *loc. cit.*

second time whose progeny from the first year's mating had proven to be all high producers. Similar types of selection were followed by the mediocre and low lines, except that segregating families were put in the mediocre class.

3. The selection of males was along essentially the same lines, with only such difference as is involved in the fact that the male makes no performance record himself. Males were put into the breeding pen the first time on the basis of the records of their dams, on the one hand, and of their sisters, on the other hand. Those whose progeny proved that they were transmitting the character to which selection was being made were used a second or even third time as breeders.
4. Complete individual pedigrees, whereby each offspring individual's parentage, both male and female, was known.
5. The records of production of the progeny of each mating separately recorded and studied as a unit.

It will be noted that there are but two essential differences between the plan in this period and that followed in the earlier one. These are: first and most important, that in this second period the principle of *progeny testing* was introduced into the scheme of breeding. The second difference was that selection was carried on for low production as well as for high, which had not been previously done. A third difference is apparently found in the fact that in this second period of selection the winter record rather than the yearly record is made the basis of selection. This is in no way an essential difference.

As a result of the studies made in this period on the plan of breeding outlined the mode of inheritance of the character winter production was definitely determined, and has been confirmed by subsequent work.[4] The character was shown to be Mendelian in its genetic behavior, depending upon two factors, one of which is sex-linked.

3. *The Period from 1912 to Date.*—The only difference in the mode of breeding the stock of Barred Plymouth Rocks in

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[4]Pearl, 1912, *loc. cit.*, also Amer. Nat., Vol. XLIX, 1915, pp. 306-317, and Curtis and Pearl, *Jour. Exp. Zoology*, Vol. 19, 1915, pp. 45-59.

this period, as compared with the preceding one, is found in the fact that during this last period *all selections for low and mediocre production have been dropped.* The breeding for high production alone continues, with only such differences in the details of manipulation of the breeding stock as would naturally follow a definite knowledge of the mode of inheritance of the character, and of the gametic constitution of particular individuals with reference to that character. As a matter of fact, all low-producing lines were dropped at the end of the laying year 1911-12. Certain of the mediocre lines were continued a year longer. In the laying flock of 1913-14 there were no birds which had been bred for anything other than high production, so far as the breeder's deliberate intention went.

The results of this seventeen year selection period are set forth in Table I.

TABLE I

MEAN WINTER PRODUCTION PER BIRD OF THE BARRED PLYMOUTH ROCK FLOCKS FROM 1899 TO 1915

Laying Year	Mean Winter Production of All Birds	No. of Birds Making Winter Records	Mean Winter Production of All Birds Selected for *High* Production	Mean Winter Production of All Birds Selected for *Low* Production
1899-1900	41.03 eggs	70	-	-
1900-1901	37.88 "	85	-	-
1901-1902	45.23 "	48	-	-
1902-1903	26.01 "	147	-	-
1903-1904	26.55 "	254	-	-
1904-1905	35.04 "	515	-	-
1905-1906	40.65 "	635	-	-
1906-1907	22.44 "	635	-	-
1907-1908	19.93 "	780	-	-
1908-1909	26.69 "	359	54.16	22.06
1909-1910	31.76 "	247	47.57	25.05
1910-1911	30.49 "	264	50.58	17.00
1911-1912	35.93 "	232	57.42	16.43
1912-1913	43.01 "	182	52.61	-
1913-1914	52.20 "	192	52.20	-
1914-1915	45.89 "	179	45.89	-
Totals and means	35.05 "	4,842	51.49	20.14

The data of this table are shown graphically in Fig. 63.

From the table and diagrams the following results appear:

1. The number of individuals involved in this experiment, on each one of which exact trap-nest records have been kept, is large, amounting nearly to five thousand. This number is large enough to lead to conclusions which are trustworthy.

FIG. 1. Graph showing the course of mean winter egg production between the years 1899 and 1915. The solid lines and circles give the total flock means. The two straight lines, fitted by the method of least squares to the observed flock means, have the equations $y=43.655-2.181x$, $y=17{,}070+4.148x$. The open circles and broken (dash) line give the means of the lines selected for high winter production between the years 1908 and 1915. The dotted line and open circles give the mean winter production of the lines selected for low production between the years 1908 and 1912.

2. From the beginning of the experiment through the laying year 1907-08 the general trend of mean production was downward, with minor fluctuations from year to year. In other words during the period in which the system of breeding was mass selection for high production without progeny test there was no change of the mean in the direction of the selection. The fluctuations in mean production during this period were, in the main, due probably to two sets of causes: (*a*) environmental differences in different years acting at one point or another in the life history of the birds; (*b*) random fluctuations in the genetic constitution of the male birds used as breeders in successive years, brought about because of the ignorance of the breeder, in the absence of any individual progeny testing plan, of the ability of any particular male to transmit high fecundity to his daughters.

3. Since the laying year 1907-08 there has been a steady increase in mean winter production for the whole flock, except for the years 1910-11 and 1914-15. In the former year the decline in the mean is slight, and is probably due to unfavorable environmental influences. In 1914-15 the decline is certainly due to such causes.

4. That selection on a progeny test basis was effective is demonstrated not only by the general flock averages, but also by the fact that it was possible to propagate separately high and low producing strains. The high producing strains differed widely from the low producing in mean winter production. Taking the average for seven years in the case of the high, and four years in the case of the low, it appears that the mean winter production of the high producing strains was approximately two and a half times that of the low producing strains. At the end of the laying year 1911-12 the low producing lines were dropped. In the next year (breeding season of 1913) no birds were bred which were known to belong to segregating lines. Of course some were included which proved afterwards to have been segregating, but this fact could not, in any such case, have been told in advance from the records in hand.

A SYSTEM OF RECORDING TYPES OF MATING IN EXPERIMENTAL BREEDING OPERATIONS.*

This paper is of interest only to the experimentalist. It describes a uniform and comprehensive method of describing numerically the different forms of pedigrees which arise in Mendelian work.

MEASUREMENT OF THE WINTER CYCLE IN THE EGG PRODUCTION OF DOMESTIC FOWL.* †

In this paper quantitative evidence is presented which shows, with flocks of poultry having average hatching dates falling somewhere within the month of April, that—

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*This is an abstract of a paper by Raymond Pearl, having the same title and published in Science N. S. Vol. XLII, pp. 383-386, 1915.

*†This is an abstract of a paper by Raymond Pearl, having the same title and published in Journal of Agricultural Research, Vol. V, pp. 429-437. 1915.

(1) The correlation between the egg production to March 1 of the pullet year as one variable and the egg production up to the time when the individual is 300 days of age as the second variable is extremely high.

(2) The mean production to March 1 is, in general, higher than the mean production to 300 days of age.

(3) The production to March 1 is a relatively less variable measure (as indicated by the coefficient of variation) than the production to 300 days of age.

(4) The conclusion that the 300-day production would be a better measure of the winter cycle of fecundity than the production to March 1 is not warranted by the facts. Whatever superiority there is of one of these measures over the other is entirely in favor of the production to March 1. We may therefore conclude that the use, in the writer's investigations on fecundity, of the record of egg production to March 1 of the pullet year as a measure of the winter cycle of production is fully justified by a critical examination of the facts. The justification for the employment of the winter cycle of production as an index of innate fecundity capacity or ability is a distinct and separate problem which has been discussed at length in earlier papers.

TWO CLOVER APHIDS.*

Aphis brevis Sanderson (Long-beaked clover aphid).

In the vicinity of Orono, Me., the leaves of the hawthorn (*Crataegus* spp.) in June are commonly twisted into dark-purple swollen curls and are inhabited by an aphid the fall migrants of which were described by Prof. Sanderson as *Aphis brevis*. This insect takes flight from hawthorn during June and early July and returns late in the season before producing the sexual generation. I have taken the fall migrants on cultivated plum (*Prunus* spp.), but yet have made no spring collections from that host. In June and July, 1906, I collected apparently the same species from the twigs and terminal leaf curls of the Japan quince (*Cydonia japonica*).

*This is an abstract of a paper with the same title, by Edith M. Patch, published in the Journal of Agricultural Research, Dept. of Agriculture, Washington, D. C., Vol. III, No. 5, Feb. 15, 1915, pp. 431-433, with 3 figures.

I undertook some transfer tests during the summer of 1912, and found that *Aphis brevis* accepted both alsike and other clover (*Trifolium* spp.). Migrants placed on alsike and white clover produced nymphs that fed with apparent satisfaction on the test plants. The potted white clover was, however, more easily managed in the laboratory, so it was selected for the main rearings. The transfer was made on June 14. The migrants fed on the clover, and their abdomens became distended. At this time the head, thorax, and cornicles were black, and abdomens olive green, with distinct black lateral dots. By June 21 their abundant progeny were established on both stem and runner. The nymphs at first were pale and pellucid, with rosy head and prothorax. By June 24 this generation had matured, but did not begin to reproduce for a day or two.

Aphis bakeri Cowen (Short-beaked clover aphid).

About the middle of August, 1914, large numbers of an aphid from *Trifolium pratense* were taken by Mr. George Newman at Orono, Maine. This species is distinct from the one just discussed, and yet they resemble each other enough so that both species have sometimes been listed under the same name. The fact that both species are found on hawthorn in the spring and migrate to clover in the summer may be partly responsible for this confusion.

The habitat of the short-beaked clover aphid on clover seemed to be the ventral side of the leaf and the stem near the ground. The colonies were frequently covered by "ant sheds," as well as sometimes extending for a short distance underground.

This species is smaller, more slender and graceful than the long-beaked clover aphid. Joint V of the antenna is noticeably shorter than IV and is without sensoria, except the usual distal one, in the summer winged viviparous female. The stigma is rather narrow and the distal end acute. The beak hardly reaches the second coxa and frequently falls considerably short of it. The prothoracic and abdominal lateral tubercles are prominent, but very slender. Both species have the cornicles and cauda very short.

THE POND-LILY APHID AS A PLUM PEST.*

One of our best-known aphids common upon various water plants is *Rhopalosiphum nymphaeae* (Linn.). This has received considerable attention as a "semi-aquatic" species which on account of the waxgland areas of its body appears to be particularly adapted to a life in moist localities and to suffer no inconvenience from contact with water while feeding on aquatic plants.

One of the most troublesome of our plum aphids in Maine is a species inhabiting the shoots and the ventral surface of the leaves, ordinarily without causing curl or similar deformation of the leaf, but exhibiting a dangerous tendency to feed also upon the young fruit itself as well as tapping the fruit stems.

After watching this plum aphid several years and wondering where its summer home might be (for it is a migratory species, leaving the plum in June) it was noticed that there were apparently no structural characters to separate this from the common pond-lily aphid, *R. nymphaeae*.

In view of this the "migration test" was made this spring by placing the spring migrants (alate viviparous forms) from plum upon water plantain, *Alisma Plantago-aquatica;* arrow-head, *Sagittaria latifolia;* and cat-tail flag, *Typha latifolia;* which had been potted and kept under laboratory control. These three plants are on the approved dietary of *R. nymphaeae* and the plum migrants accepted them all readily, and the progeny of the plum migrants are perfectly content with the habitat given them.

Thus the life cycle of the ancient aphid is found to include a residence upon the plum, migrating thence to water plants for the summer and returning to the plum in the fall for the deposition of the over-wintering egg which provides for its spring generations upon that tree.

Biosteres rhagoletis Richmond, sp. n., A Parasite of *Rhagoletis pomonella* Walsh.†

During the summer of 1913 the writer was engaged in studying blueberry insects in Washington County, Maine. A maggot

*This is an abstract of a paper with the same title, by Edith M. Patch, published in Science, N. S., Vol. XLII, No. 1074, page 164, July 30, 1915.

†This is an abstract of a paper with the same title, by William C. Woods, published in The Canadian Entomologist, Vol. XLVII, pp. 293-295, with 3 figures.

was found infesting the berries, which when bred proved to be *Rhagoletis pomonella* Walsh, the apple maggot or railroad worm (Journal of Economic Entomology, 1914, Vol. VII, pp. 398-399). There were also obtained from larvae of this species collected at Cherryfield, Maine, in August and September, 1913, twenty-one specimens of a parasite, which emerged from puparia kept under laboratory conditions, at various dates between February 25 and April 21, 1914.

No parasite has been recorded from *Rhagoletis pomonella* Walsh, previous to this time.

The species belongs to the family *Braconidae* and to the subfamily *Opiinae*. In this same group are placed many of the parasites, including one of this genus, which are recorded by Silvestri as bred from various fruit-flies (Bulletin 3, Hawaii Board of Agrculture and Forestry, 1914.)

Specimens of this species were swept on the blueberry barrens of Washington County last summer, where apparently they had considerably reduced the number of the maggots as compared with the preceding season. Specimens of the Cherryfield parasites were submitted to Mr. E. A. Richmond, of Cornell University, who determined it as a new species.

EFFECT OF TEMPERATURE ON GERMINATION AND GROWTH OF THE COMMON POTATO-SCAB ORGANISM.*

The object of this study was to determine as closely as possible the optimum, maximum and minimum temperatures for the growth of the common potato scab organism in artificial cultures, also the effects of variations in temperature upon the germination of the so-called "gonidia" which it produces in the fruiting stage upon such cultures. The organism under consideration is what has been known since 1892 as *Oospora scabies* Thaxter and which Lutman and Cunningham have recently

*This is an abstract of a paper with the same title by Michael Shapovalov published in the Journal of Agricultural Research, Vol. IV, No. 2, pp. 129-134, May 15, 1915.

pronounced as identical with *Actinomyces chromogenus* Gasperini.

In making the germination tests the ordinary agar hanging-block used in studying the growth of bacteria was employed, using beef extract agar without salt. The maximum temperature for germination and growth is apparently slightly below 41° C. Germination is most rapid between 35° and 40.5° with little difference at temperatures between these points. Below this the time for germination gradually increases so that 10° C. it takes 15 or more times as long as at 35°. The largest percentage of germination is usually secured at from 30° to 37° C. Apparently the minimum temperature for germination lies somewhere near 5° C.

Exposure to cold weather, several degrees below zero centigrade, does not always kill the parasite. The organisms in cultures on cooked potato cylinders withstand low temperature better than those in beef broth cultures.

While temperatures from 35° to 40° C. are most favorable for the germination of the gonidia, they are unfavorable for long-continued growth of the organism, although at 35° a stimulating effect was produced at first. Below 20° C. growth is very much retarded and slow. The maximum temperature for growth is about 40.5°, the optimum 25° to 30°, and the minimum about 5° C.

Abnormal growths or involution forms were observed in the cultures but apparently these were produced as the result of variation in the composition of the culture media employed and were not caused by unfavorable temperatures.

METEOROLOGICAL OBSERVATIONS.

For many years the meteorological apparatus was located in the Experiment Station building and the observations were made by members of the Station Staff. June 1, 1911, the meteorological apparatus was removed to Wingate Hall and the observations are in charge of Mr. James S. Stevens, professor of physics in the University of Maine.

In September, 1914, the meteorological apparatus was again moved to Auburt Hall, the present headquarters of the physics department.

The instruments used were at Lat. 44° 54′ 2″ N. Lon. 64° 40′ 5″ W. Elevation 135 feet.

The instruments used are the same as those used in preceding years, and include: Maximum and minimum thermometers; rain gauge; self-recording anemometer; vane; and barometers. The observations at Orono now form an almost unbroken record of forty-seven years.

Meteorological Summary for 1915.

Observations Made at the University of Maine.

1915.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Average.	Total.
Highest temperature	52	64	60	73	77	87	89	89	89	76	62	54	....	....
Lowest temperature	-21	-8	6	20	25	31	49	36	30	27	19	-4	....	....
Mean temperature	23.9	28.7	30.2	45.4	51.5	62.7	65.7	66.5	62.1	50.8	38.2	28.8	46.21	....
Mean temperature in 47 years	16.4	12.3	30.1	40.1	55.7	60.8	65.8	66.0	60.0	50.9	38.3	24.4	42.73	....
Total precipitation in inches	2.49	3.56	0.34	3.28	4.97	2.47	6.67	4.67	1.19	2.62	3.04	3.57	....	38.87
Mean precipitation in 47 years	3.99	3.51	4.11	29.5	3.56	3.39	....	....	....	....	....	....	42.67	....
Number of days with precipitation of .01 or more	9	10	2	11	11	12	13	13	4	7	11	10	....	113
Snow fall in inches	9.1	14.0	0.5	13.0	....	....	....	....	....	....	....	12.5	....	49.1
Mean snow fall in 47 years	21.69	21.36	15.00	5.62	0.18	....	....	....	....	0.70	7.03	15.96	87.34	....
Number of clear days	14	13	16	13	13	14	14	15	22	19	11	13	....	177
Number of fair days	8	6	7	3	8	8	9	5	1	4	6	2	....	67
Number of cloudy days	9	9	8	14	10	8	8	11	7	8	13	16	....	121
Total movement of wind in miles	3573	3909	6080	4761	4763	3268	3130	2689	3708	3688	4789	3866	....	48224

REPORT OF THE TREASURER.

The Station is a department of the University and its accounts are kept in the office of the Treasurer of the University. The books, voucher files, etc., are, however, all distinct from those of the other departments of the University. The classification of accounts is that prescribed by the auditors on the part of the Federal Government, and approved by the State Auditor. All of the accounts are audited by the State Auditor and the Hatch Fund and Adams Fund accounts are also audited by the Office of Experiment Stations acting for the United States Secretary of Agriculture in accordance with Federal Law.

The income of the Station from public sources for the year that ended June 30, 1915, was:

U. S. Government, Hatch Fund appropriation...	$15,000 00
U. S. Government, Adams Fund appropriation...	15,000 00
State of Maine, Animal Husbandry investigation appropriation	5,000 00
State of Maine, Aroostook Farm investigation ...	5,000 00

The cost of maintaining the laboratories for the inspection analyses is borne by analysis fees and by the State Department of Agriculture. The income from sales at the experiment farms is used to meet the expenses of investigations. The printing which costs about $4,500 is paid for by an appropriation to the University.

All of the disbursements except for printing and the sheep husbandry experiment are given in the tables that follow on the two succeeding pages. The sheep husbandry expenditures were labor $182.55, seeds, plants and sundry supplies $100.22, feeding stuffs $483.59 and live stock $750.99, making a total of $1,517.35.

REPORT OF TREASURER FOR FISCAL YEAR ENDING JUNE 30, 1915.

DISBURSEMENTS.

RECEIPTS.	Hatch fund.	Adams fund.	Animal husbandry investigations.
Salaries	$5,537 01	$11,049 60	$4,722 74
Labor	3,664 04	33 03	....
Publications	113 87	....	....
Postage and stationery	717 20	144 72	56 75
Freight and express	139 05	99 58	2 28
Heat, light and power	158 75	168 00	....
Chemical and laboratory supplies	180 29	269 74	21 42
Seeds, plants and sundry supplies	325 06	246 04	35 63
Fertilizers	1,375 36	....	....
Feeding stuffs	1,018 96	1,769 08	....
Library	619 07	80 84	2 00
Tools, machinery and appliances	211 36	58 81	....
Furniture and fixtures	93 12	34 50	....
Scientific apparatus and specimens	16 20	200 09	3 71
Live stock	4 50	....	....
Traveling expenses	353 30	511 49	155 47
Contingent expenses	20 00	....	....
Buildings	452 86	334 48	....
Total	$15,000 00	$15,000 00	$5,000 00

REPORT OF TREASURER FOR FISCAL YEAR ENDING JUNE 30, 1915—Concluded.

DISBURSEMENTS.

RECEIPTS.	Aroostook farm.	General account.	Inspection analysis.
Salaries	$970 00	$4,135 54	$10,441 78
Labor	3,352 87	2,705 31	....
Publications	....	10 40	....
Postage and stationery	46 39	91 16	263 18
Freight and express	46 99	526 51	157 85
Heat, light and power	211 64	256 63	164 67
Chemical and laboratory supplies	577 16	402 62	926 79
Seeds, plants and sundry supplies	219 53	979 04	....
Fertilizers	1,869 29	24 00	....
Feeding stuffs	585 79	321 97	....
Library	....	10 70	....
Tools, implements and machinery	966 57	96 48	....
Furniture and fixtures	4 53	2 04	153 60
Scientific apparatus	....	11 85	....
Live stock	70 00	650 00	....
Traveling expenses	276 25	163 50	173 68
Contingent expenses	221 70	205 89	7 20
Buildings	468 59	129 41	....
Total	$9,887 30	$10,723 05	$12,288 75

INDEX.

Index to Reports for the Years 1911 to 1915, and to Bulletins 235 to 245 Inclusive.

In each reference the first two figures indicate the year. Thus, '15, 291, indicates page 291 of the report for 1915.

APPENDIX

Official Inspections

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SPECIAL REPORT TO COMMISSIONER OF AGRICULTURE
METHODS OF POULTRY MANAGEMENT
CULTURAL METHODS WITH OATS
REPORT OF PROGRESS ON ANIMAL HUSBANDRY

CONTENTS

January, 1915.

MAINE
AGRICULTURAL EXPERIMENT STATION,
ORONO, MAINE.
CHAS. D. WOODS, Director.

ANALYSTS

James M. Bartlett
Royden L. Hammond
Elmer R. Tobey
Herman H. Hanson
Edward E. Sawyer
Hoyt D. Lucas

Official Inspections

66

OPENED SHELL-FISH.

The Commissioner of Agriculture is the executive of the law regulating the sale of foods in Maine. It is the duty of the Maine Agricultural Experiment Station to make the analyses of the samples collected by the Commissioner, and it is the duty of the Director to publish the results of the analyses of the samples of foods, together with the names of the persons from whom the samples were obtained, the names of the manufacturers thereof and such additional information as may seem advisable.

The results of the examination of samples of oysters, scallops and clams collected and examined in the fall of 1914 are given in the tables which follow.

NOTE. All correspondence relative to the inspection laws should be addressed to the Bureau of Inspections, Department of Agriculture, Augusta, Maine.

Results of Examination of Oysters Purchased and Examined in 1914.

Station number.	Town and Dealer.	Price per pint.	Weight as purchased.	Free liquids.	Dry solids.	Remarks.
		Cts.	Ozs.	%	%	
12008	Auburn, E. A. Bickford..........	20	-	7.08	16.15	
12005	Auburn, Jerry Murphy..........	20	-	6.78	16.78	
12003	Auburn, Olfene's Market........	20	-	9.88	14.80	Solids too low.
12002	Auburn, Perryville Cash Market..	20	-	14.31	15.02	Liquids too high. Solids slightly low.
12006	Auburn, Ross' Market...........	23	-	5.97	17.25	
13758	Augusta, Rose's Market.........	23	17.5	-	17.33	
13858	Augusta, L. S. Young...........	20	16.0	6.19	16.85	
13755	Augusta, William Young.........	23	16.9	-	17.43	
13809	Bath, B. M. Campbell...........	23	16.9	14.40	21.56	Liquids too high.
13760	Bath, V. P. Emery..............	23	18.2	11.26	15.74	Solids slightly low.
13762	Bath, Jacks Fish Market........	25	15.4	8.71	17.97	
12083	Belfast, E. F. Bramhall & Co....	38	-	43.74	18.60	Liquids too high.
11965	Biddeford, Bibeau Bros.........	25	-	6.39	20.18	
13517	Biddeford, Jos. Carrier..........	20	20.0	8.82	16.18	
13519	Biddeford. John F. Hannaway....	20	14.6	6.28	19.77	
13692	Bowdoinham, Cornish's Fish Market.........................	23	17.2	21.35	16.13	Liquids too high.
13691	Brunswick, William Coffin.......	23	15.9	6.87	17.05	
13689	Brunswick, H. A. Hughes........	23	16.6	8.07	18.09	
11832	Camden, Samuel Ayers.	40	14.2	26.20	19.53	Liquids high. Package marked "Oysters containing liquid."
13522	Cornish, J. W. Thurston.........	25	17.1	12.81	15.29	Liquids too high. Solids too low.
13947	Dixfield, Stanley's Sons Grocery..	25	16.9	5.21	16.37	
13659	Fairfield, David King...........	23	17.3	3.87	17.14	
13871	Farmington, E. A. Odell.........	18	17.4	4.47	15.34	Solids slightly low.
13872	Farmington, W. M. Pratt........	25	15.1	3.72	16.93	
13873	Farmington, Searles & French...	25	17.6	5.83	13.70	Solids too low.
13810	Freeport, Dillingham's Grocery..	23	16.9	17.53	18.24	Liquids too high.
13722	Gardiner, Brann's Market.......	23	17.7	7.36	15.59	Solids slightly low.
13728	Gardiner, Cash Market Co......	23	15.7	8.97	15.75	Solids slightly low.
13724	Gardiner, Clark's Market........	23	16.3	4.33	16.44	
13727	Gardiner, A. W. Cunningham....	23	15.8	2.45	19.04	

Results of Examination of Oysters Purchased and Examined in 1914—Continued.

Station number.	Town and Dealer.	Price per pint.	Weight as purchased.	Free liquids.	Dry solids.	Remarks.
		Cts.	Ozs.	%	%	
13721	Gardiner, D. C. Jewell...........	23	17.7	5.39	18.71	
13752	Hallowell, Shea's Fish Market....	23	17.2	-	17.25	
13506	Kennebunk, Greenleaf's Restaurant........................	23	17.8	3.94	18.54	
12020	Lewiston, Atwood Market.......	28	-	10.90	17.35	
12015	Lewiston, Harvey's Market......	20	-	6.88	16.51	
12017	Lewiston, Paul Levesque.........	20	-	2.71	16.16	
12019	Lewiston, Mohican Co...........	20	-	5.15	16.77	
12011	Lewiston, J. F. Sullivan.........	15	-	23.20	12.83	Liquids too high. Solids too low.
12012	Lewiston, Walker Bros..........	20	-	6.35	16.30	
13900	Livermore Falls, Frank Hurlburt	25	16.1	35.15	15.17	Liquids too high. Solids too low.
13901	Livermore Falls, E. A. Ray's Cash Store......................	25	17.6	10.00	18.67	
13948	Mechanic Falls, C. O. Cole......	23	18.0	3.92	18.04	
13848	Norridgewock, L. H. White......	25	16.7	10.36	20.41	
13982	Norway, Walter Luck & Son.....	23	17.0	3.92	17.99	
13968	Norway, Richardson's Cash Market........................	23	17.6	2.00	18.37	
13641	Oakland, A. W. Leonard.........	23	15.9	5.33	19.42	
13888	Phillips, C. H. McKenzie........	25	20.0	2.82	20.37	
13730	Randolph, L. A. Perry...........	23	17.7	9.36	18.08	
13731	Randolph, Mideon White........	23	17.4	7.08	15.61	Solids slightly low.
11835	Rockland, H. L. Higgins.........	30	18.1	25.30	14.76	Solids too low. Liquids too high.
13931	Rumford, Gauthier Bros.........	25	17.8	4.35	16.02	
13932	Rumford, E. J. Roderick.........	25	18.4	2.87	15.19	Solids slightly low.
13930	Rumford, Rumford Public Market	25	17.7	5.00	18.13	
13520	Saco, F. S. Wallace.............	20	18.2	13.20	16.16	Liquids too high.
12131	Sanford, D. O. Forbes...........	20	16.2	24.90	12.48	Liquids too high. Solids too low.
12261	Sanford, Ideal Cash Market......	18	16.9	9.77	16.00	
14063	Sanford, Ideal Cash Market......	20	17.1	6.80	14.56	Solids slightly low.
14068	Sanford, Lizotte & Caron........	20	18.1	5.66	17.37	

Results of Examination of Oysters Purchased and Examined in 1914—Continued.

Station number.	Town and Dealer.	Price per pint.	Weight as purchased.	Free liquids.	Dry solids.	Remarks.
		Cts.	Ozs.	%	%	
14065	Sanford, Onesime Normand.......	18	18.8	28.33	16.04	Liquids too high.
14061	Sanford. Quality Market.........	20	18.5	11.09	14.56	Solids too low.
13855	Skowhegan, Jewett's Market.....	23	16.4	6.68	17.54	
13852	Skowhegan, L. B. Jewett........	25	16.9	10.25	16.44	
13851	Skowhegan, Lashon & Butler.....	25	16.8	10.52	16.51	
13853	Skowhegan, Adam Simpson......	25	14.7	5.30	18.06	
13981	South Paris, Churchill's Market..	23	16.4	6.45	17.37	
14070	Springvale, S. D. Hanson........	20	17.3	4.00	19.23	
14071	Springvale, D. H. Johnson.......	20	18.3	7.87	15.55	Solids slightly low.
14069	Springvale, H. Pitts.............	20	17.7	2.80	18.25	
13646	Waterville, City Market.........	23	16.5	8.74	15.59	Solids slightly low.
13640	Waterville, E. L. Clukey.........	23	14.0	37.63	15.35	Solids too low. Liquids too high.
13654	Waterville, Farnsworth Fish Market.........................	23	15.3	12.18	16.42	Liquids too high.
13650	Waterville, Hersom & Bonsell....	23	16.4	15.66	17.14	Liquids too high.
13643	Waterville, Maine St. Cash Grocery.........................	20	16.2	10.46	17.51	
13644	Waterville, Frank E. McCallum..	23	16.4	8.58	15.20	Solids slightly low.
13649	Waterville, B. K. Meservey......	23	16.4	5.37	17.55	
13658	Waterville, Chas. Pomerleau.....	23	17.2	26.64	15.46	Liquids too high. Solids too low.
13889	Wilton, L. F. Adams............	25	17.5	1.61	17.49	
13899	Wilton, Main St. Market........	25	16.8	8.33	18.69	
13656	Winslow, Allen's East Side Market	23	16.1	2.86	18.76	
12009	Auburn, E. A. Bickford..........	13	-	24.57	16.53	Solids too low. Liquids too high.
12004	Auburn, Jerry Murphy..........	15	-	23.52	15.80	Solids too low. Liquids too high.
12001	Auburn, Perryville Cash Market..	13	-	20.09	20.01	Liquids too high.
12007	Auburn, Ross's Market..........	15	-	29.21	14.23	Liquids too high. Solids too low.
13759	Augusta, Rose's Market.........	13	15.7	-	15.04	Solids too low.
13756	Augusta, L. S. Young...........	13	15.3	-	18.09	
13754	Augusta, William Young.........	13	16.1	-	13.23	Solids too low.
13761	Bath, V. P. Emery..............	15	18.1	19.33	15.96	Liquids too high. Solids too low.

Results of examination of Oysters Purchased and Examined in 1914—Concluded.

Station number.	Town and Dealer.	Price per pint.	Weight as purchased.	Free liquids.	Dry solids.	Remarks.
		Cts.	Ozs.	%	%	
13763	Bath, Jack's Fish Market........	13	15.5	15.98	16.93	Liquids too high. Solids too low.
12084	Belfast, E. F. Bramhall & Co.....	13	-	48.82	13.51	Liquids too high. Solids too low.
12085	Belfast, Stephens & Dennett.....	13	-	46.63	16.26	Liquids too high. Solids too low.
11966	Biddeford, J. B. E. Tartre.......	13	-	6.89	16.55	Solids too low.
13690	Brunswick, H. A. Hughes........	13	16.7	26.79	17.00	Liquids too high. Solids slightly low.
11833	Camden, Samuel Ayers..........	20	16.5	28.00	15.05	High in liquids. Low in solids. Package marked "Clams containing liquid."
13946	Dixfield, Stanley's Sons Grocery	15	15.6	21.31	15.26	Liquids too high. Solids too low.
13723	Gardiner, Brann's Market.......	15	16.6	21.23	14.73	Liquids too high. Solids too low.
13729	Gardiner, Cash Market..........	15	15.8	16.96	14.89	Liquids too high. Solids too low.
13725	Gardiner, Clarke's Market.......	15	15.6	4.31	14.90	Solids too low.
13726	Gardiner, Manson's Market......	12	15.8	26.95	15.33	Liquids too high. Solids too low.

Results of Examination of Scallops Purchased and Examined in 1914.

Station number.	Town and Dealer.	Price per pint.	Weight as purchased.	Free liquids.	Dry solids.	Remarks.
11834	Rockland, H. L. Higgins.........	25	17.0	16.80	13.52	Solids too low. Liquids too high. Ice and water in original container.
12133	Sanford, D. O. Forbes...........	25	16.4	4.10	18.13	
13847	Skowhegan, Coburn Market......	30	15.8	2.00	25.15	
13846	Skowhegan, Jewett's Market.....	30	15.2	1.41	25.62	
13655	Waterville, Farnsworth's Fish Market........................	30	15.9	0.66	28.09	
13648	Waterville, Whitcomb's Market..	30	15.7	7.43	18.37	Liquids too high.

Results of Examination of Clams Purchased and Examined in 1914.

Station number.	Town and Dealer.	Price per pint.	Weight as purchased.	Free liquids.	Dry solids.	Remarks.
		Cts.	Ozs.	%	%	
13753	Hallowell, Shea's Fish Market....	15	15.1	-	16.90	Solids slightly low.
12014	Lewiston, Harvey's Market......	15	-	6.70	22.87	
12016	Lewiston, Paul Levesque.........	13	-	-	21.15	
12018	Lewiston, Mohican Co...........	13	-	15.27	16.01	Solids slightly low. Liquids too high.
12010	Lewiston, J. F. Sullivan..........	15	-	31.20	10.44	Liquids too high. Solids too low.
12013	Lewiston, Walker Bros.........	15	-	32.78	13.94	Liquids too high. Solids too low.
13849	Norridgewock, L. H. White......	15	16.2	32.65	13.68	Liquids too high. Solids too low.
13642	Oakland, A. W. Leonard.........	12	15.3	25.98	16.16	Liquids too high. Solids too low.
13887	Phillips, George A. Beane........	15	16.1	9.84	17.49	Solids slightly low.
13500	Portland, Brown & Bishop Co....	13	-	34.69	13.82	Liquids too high. Solids too low.
13456	Portland, Cobb & Trefethen......	13	-	19.48	16.02	Liquids too high. Solids too low.
13902	Portland, W. L. Daggett & Co....	13	21.5	23.24	11.79	Liquids too high. Solids too low.
13903	Portland, Edwin Dyer...........	10	16.1	5.92	15.25	Solids too low.
13457	Portland, Gem Fish Market......	13	-	32.34	13.71	Liquids too high. Solids too low.
13458	Portland, Gribben Bros..........	13	-	30.33	13.09	Liquids too high. Solids too low.
13461	Portland, Hamilton Bros........	13	-	13.05	18.04	
13452	Portland, Dana Hamilton & Co...	13	-	10.68	19.26	
13503	Portland, Chauncey W. Lombard.	13	-	21.30	23.50	Liquids too high. No fresh water added.
13454	Portland, J. H. McDonald.......	10	-	27.79	13.19	Liquids too high. Solids too low.
13501	Portland, Louis McDonald.......	12	-	9.24	20.68	
13459	Portland, Munjoy Fish Market...	13	-	25.90	14.65	Liquids too high. Solids too low.
13460	Portland, Fred E. Peterson.......	13	-	27.25	14.04	Liquids too high. Solids too low.
13455	Portland, Geo. C. Shaw Co......	13	-	30.77	12.91	Liquids too high. Solids too low.
13563	Portland, Frank Thorndike.......	13	15.6	41.53	15.29	Liquids too high. Solids too low.

Results of Examination of Clams Purchased and Examined in 1914—Concluded.

Station number.	Town and Dealer.	Price per pint.	Weight as purchased.	Free liquids.	Dry solids.	Remarks.
		Cts.	Ozs.	%	%	
13502	Portland, Charles H. Vose.......	13	-	27.28	12.80	Liquids too high. Solids too low.
13451	Portland, Albert H. Worden......	13	-	19.34	16.70	Liquids too high. Solids too low.
13693	Richmond, Walker & Desmond...	15	18.3	24.90	13.64	Liquids too high. Solids too low.
13521	Saco, Central Fish Market.......	13	16.3	19.48	15.17	Liquids too high. Solids too low.
14064	Sanford, Ideal Cash Market......	13	19.1	33.03	12.30	Liquids too high. Solids too low.
14067	Sanford, Lizotte & Caron........	15	18.1	20.11	14.08	Liquids too high. Solids too low.
14066	Sanford, Onesime Normand......	13	18.5	37.40	12.00	Liquids too high. Solids too low.
14062	Sanford, Quality Market.........	13	18.2	10.68	14.79	Solids too low.
13854	Skowhegan, Jewett's Market.....	13	17.2	30.18	16.15	Liquids too high. Solids too low.
13850	Skowhegan, Lashon & Butler.....	25	16.1	16.45	15.62	Liquids too high. Solids too low.
13980	South Paris, Churchill's Market..	12	15.6	36.26	11.87	Liquids too high, Solids too low.
13653	Waterville, Gould's Cash Market.	13	16.3	32.25	14.75	Liquids too high. Solids too low.
13651	Waterville, Herson & Bonsell.....	13	16.8	35.78	14.67	Liquids too high. Solids too low.
13645	Waterville, Frank McCallum.....	13	16.9	16.07	24.58	Liquids too high.
13657	Waterville, Chas. Pomerleau.....	13	17.0	36.85	16.19	Liquids too high. Solids too low.
13647	Waterville, Whitcomb's Market..	12	18.2	19.34	24.17	Liquids too high.

The General Principles Which Govern the Sale of Shell-Fish in Maine.

In order to be lawfully sold in Maine, all shell-fish must be taken from unpoluted beds. They must be sold, whether opened or in the shell, as they come from the salt water beds without being "floated" in fresh or brackish waters. Freshly opened clams and oysters may be sold with the natural liquids provided they are plainly labeled to show that fact. But opened shell-fish may not be shipped with the natural liquids, as the resulting decomposition products speedily render the solids unfit for food. All opened shell-fish must be opened, drained and packed under proper sanitary conditions. They must be shipped in sanitary containers without the addition of water or direct contact with ice. If the opened shellfish need to be washed this may be done in either clean salt water or clean fresh water, but the opened shell-fish shall not stand in the wash water for more than 5 minutes of time.

OPENED OYSTERS.

Properly drained and reasonably fresh opened oysters in good condition for food will not carry more than 5 per cent of liquids that will drain from a colander in five minutes of time, and will never have less than 16 per cent of dry matter in the solids. Opened oysters that carry not less than 16 per cent dry solids and not over 10 per cent of free liquids are passed. If the dry solids are between 15 and 16 per cent or the free liquids between 10 and 12 per cent the dealer is warned. If the dry solids are less than 15 per cent or the free liquids more than 12 per cent a hearing is appointed.

OPENED CLAMS.

Clams opened at this Station, even when they have come from beds that have brackish waters, have never carried less than 18 per cent dry solids. If the dry solids are not less than 18 per cent and the free liquids not more than 12 per cent opened clams are passed. If the dry solids are between 17 and 18 per cent or the free liquids between 12 and 15 per cent the dealer is warned. If the dry solids are less than 17 per cent or the free liquids more than 15 per cent a hearing is appointed.

SCALLOPS.

The edible portion of the scallop is the muscle that holds the shell together. Scallops are always sold opened. The giant scallop as fished in deep water on the Maine coast, will carry about 22 per cent of dry solids and practically no liquids. If the dry solids are not less than 18 per cent and the free liquids not more than 4 per cent scallops are passed. If the dry solids are between 17 and 18 per cent or the free liquids between 4 and 6 per cent the dealer is warned. If the dry solids are less than 17 per cent or the free liquids more than 6 per cent a hearing is appointed.

February, 1915

MAINE
AGRICULTURAL EXPERIMENT STATION,
ORONO, MAINE.
CHAS. D. WOODS, Director.

ANALYSTS.

James M. Bartlett	Herman H. Hanson
Royden L. Hammond	Edward E. Sawyer
Elmer R. Tobey	Hoyt D. Lucas

Official Inspections

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MILK AND CREAM

The Commissioner of Agriculture is the executive of the law regulating the sale of milk and cream in Maine. It is the duty of the Maine Agricultural Experiment Station to make the analyses of the samples collected by the Commissioner, and it is the duty of the Director to publish the results of the analyses of the samples of milk and cream, together with the names of the persons from whom the samples were obtained, and the names of the manufacturers thereof and such additional information as may seem advisable.

NOTE. All correspondence relative to the inspection laws should be addressed to the Bureau of Inspections, Department of Agriculture, Augusta, Maine.

MILK.

Results of examination of samples of milk collected during the months of October, November, and December, 1914, arranged alphabetically by towns and by dealers.

Number. Station.	Number. Department.	Name.	Specific gravity.	Fat.—Per cent.	Solids not fat.* Per cent.	Total solids. Per cent.	Water.—Per cent.	Remarks.**
		ANSON AND NORTH ANSON.						
13839	4187	B. M. Berry	1.0338	4.60	9.39	13.99	86.01	Dirty.
13840	4188	B. M. Berry	1.0326	4.80	9.13	13.93	86.07	Dirty.
13843	4191	H. B. Hilton	1.0349	5.50	9.86	15.36	84.64	Slightly dirty.
13841	4189	W. J. Rand	1.0321	4.20	8.88	13.08	86.92	Slightly dirty.
13842	4190	W. J. Rand	1.0348	4.90	9.70	14.60	85.40	Slightly dirty.
13837	4185	H. C. Smith	1.0305	4.00	8.44	12.44	87.56	Dirty—Hair and fine dirt.
13838	4186	H. C. Smith	1.0305	4.00	8.44	12.44	87.56	Dirty.
		AUBURN.						
14052	4326	J. B. Baron	1.0328	3.60	8.93	12.53	87.47	Slightly dirty.
14053	4327	J. B. Baron	1.0324	3.60	8.83	12.43	87.57	No dirt.
14015	4289	W. G. Briggs & Son	1.0340	4.30	9.38	13.68	86.32	No dirt.
14016	4290	W. G. Briggs & Son	1.0322	4.60	8.99	13.59	86.41	No dirt.
14017	4291	C. H. Carroll	1.0328	4.00	9.01	13.01	86.99	No dirt.
14018	4292	C. H. Carroll	1.0320	3.80	8.77	12.57	87.43	No dirt.
14080	4343	G. W. Dill	1.0345	4.40	9.53	13.93	86.07	No dirt.
14043	4317	Dumont Bros	1.0328	3.80	8.97	12.77	87.23	Slightly dirty.
14044	4318	Dumont Bros	1.0330	3.40	8.94	12.34	87.66	Slightly dirty.
14030	4304	H. Lawrence Frank	1.0327	3.40	8.87	12.27	87.73	No dirt.
14021	4295	A. G. Haskell	1.0335	4.00	9.19	13.19	86.81	Slightly dirty.
14022	4296	A. G. Haskell	1.0335	4.20	9.24	13.44	86.56	Slightly dirty.
14025	4299	Geo. O. Huard	1.0340	4.00	9.32	13.32	86.68	No dirt.
14026	4300	Geo. O. Huard	1.0315	3.80	8.65	12.45	87.55	No dirt.
14027	4301	Geo. O. Huard	1.0330	4.60	9.19	13.79	86.21	Slightly dirty.
14031	4305	E. C. Learn	1.0320	4.50	8.92	13.42	86.58	No dirt.
14032	4306	E. C. Learn	1.0327	4.00	8.99	12.99	87.01	No dirt.

*Casein, albumen, milksugar, ash.
**For explanations under this column see paragraph on Clean and Dirty Milk, page 27.

MILK—Continued.

Number. Station.	Number. Department.	Name.	Specific gravity.	Fat.—Per cent.	Solids not fat.* Per cent.	Total solids. Per cent.	Water.—Per cent.	Remarks.**
		AUBURN—Concluded.						
14047	4321	Napoleon Leblond	1.0327	6.00	9.42	15.42	84.58	No dirt.
14048	4322	Napoleon Leblond	1.0346	5.40	9.76	15.16	84.84	No dirt.
14023	4297	L. H. Macomber	1.0332	4.00	9.11	13.11	86.89	Slightly dirty.
14024	4298	L. H. Macomber	1.0316	4.20	8.75	12.95	87.05	Slightly dirty.
14041	4315	J. A. Ness	1.0329	4.00	9.04	13.04	86.96	No dirt.
14042	4316	J. A. Ness	1.0323	4.00	8.98	13.38	86.62	No dirt.
14028	4302	H. W. Pride	1.0336	5.00	9.42	14.42	85.58	Slightly dirty.
14058	4332	Small & Lane	1.0330	4.80	9.23	14.03	85.97	No dirt.
14013	4287	Turner Center Creamery	1.0349	3.80	9.51	13.31	86.69	No dirt.
14014	4288	Turner Center Creamery	1.0350	3.60	9.49	13.09	86.91	No dirt.
14019	4293	Turner Center Creamery	1.0346	4.00	9.47	13.47	86.53	No dirt.
14035	4309	Turner Center Creamery	1.0278	12.50	7.12	19.62	80.38	No dirt. Abnormal. Probably top milk.
14045	4319	Turner Center Creamery	1.0335	4.60	9.33	13.93	86.06	No dirt.
14049	4323	Turner Center Creamery	1.0342	4.00	9.37	13.37	86.63	No dirt.
14073	4336	Turner Center Creamery	1.0337	4.40	9.33	13.73	86.27	No dirt.
14079	4342	Turner Center Creamery	1.0342	4.50	9.47	13.97	86.03	Slightly dirty.
14033	4307	L. O. Varnum	1.0325	4.20	9.05	13.25	86.75	Slightly dirty.
14034	4308	L. O. Varnum	1.0337	4.00	9.24	13.24	86.76	No dirt.
14081	4344	J. E. Young	1.0341	4.20	9.39	13.59	86.41	Slightly dirty.
14082	4345	J. E. Young	1.0337	4.40	9.33	13.73	86.27	Slightly dirty.
		BANGOR.						
13911	4231	T. A. Constantine	1.0317	4.10	8.76	12.86	87.14	Slightly dirty.
13909	4229	E. L. Dudley	1.0340	5.20	9.56	14.76	85.24	Slightly dirty.
13904	4224	D. A. Gillies	1.0352	4.20	9.67	13.87	86.13	Slightly dirty.
13913	4233	V. D. Robinson	1.0322	4.40	8.95	13.35	86.65	Slightly dirty.
13905	4225	R. D. Strickland	1.0346	4.40	9.55	13.95	86.05	Very slightly dirty
13906	4226	G. H. Witherly	1.0320	4.60	8.94	13.54	86.46	Slightly dirty.
		BATH.						
13801	4157	L. F. Andrews	1.0330	4.20	9.11	13.31	86.69	No dirt.
13802	4158	W. A. Brown	1.0327	4.60	9.10	13.70	86.30	No dirt.
13803	4159	W. A. Brown	1.0315	4.00	8.75	12.75	87.25	No dirt.
13791	4147	A. R. Donnell	1.0325	4.40	9.00	13.40	86.60	No dirt.

MILK—Continued.

Number.		Name.	Specific gravity.	Fat.—Per cent.	Solids not fat.* Per cent.	Total solids. Per cent.	Water.—Per cent.	Remarks.**
Station.	Department.							
		BATH—Concluded.						
13792	4148	A. R. Donnell	1.0330	4.60	9.07	13.67	86.33	No dirt.
13784	4140	M. F. Dunton	1.0331	4.60	8.68	13.28	86.72	Dirty.
13785	4141	M. F. Dunton	1.0320	4.20	8.85	13.05	86.95	No dirt.
13786	4142	M. F. Dunton	1.0315	4.40	8.90	13.30	86.70	Dirty.
13782	4138	H. E. Freeman	1,0300	5.60	8.64	14.24	85.76	Slightly dirty.
13776	4132	H. A. Henderson	1.0320	5.60	9.15	14.75	85.25	No dirt.
13777	4133	H. A. Henderson	1.0320	4.40	8.85	13.25	86.75	No dirt.
13787	4143	G. K. Ingalls	1,0350	5.10	9.80	14.90	85.10	No dirt.
13788	4144	G. K. Ingalls	1.0340	6.40	9.78	16.18	83.82	No dirt.
13779	4135	A. E. Mylic	1.0345	4.80	9.60	14.40	85.60	No dirt.
13780	4136	A. E. Mylic	1.0335	4.40	9.35	13.75	86.25	No dirt.
13794	4150	Harry E. Peterson	1.0340	4.40	9.40	13.80	86.20	Dirty.
13795	4151	Harry E. Peterson	1.0330	4.00	9.06	13.06	86.94	No dirt.
13808	4164	Chester Plant	1.0320	5.00	9.02	14.02	85.98	No dirt.
13781	4137	M. S. Purington	1.0330	4.80	9.23	14.03	85.97	No dirt.
13778	4134	Owen Rogers	1.0336	4.40	9.30	13.70	86.30	No dirt.
13798	4154	David Welch	1.0340	4.40	9.40	13.80	86.20	No dirt.
13799	4155	David Welch	1.0340	4.80	9.48	14.28	85.72	No dirt.
13783	4139	L. Williams	1.0320	4.60	8.94	13.54	86.46	Dirty.
13793	4149	H. T. Wing	1.0330	4.80	9.23	14.03	85.97	No dirt.
13789	4145	J. R. Wing	1.0336	4.00	9.25	13.25	86.75	Dirty.
13790	4146	J. R. Wing	1.0330	4.20	9.11	13.31	86.69	No dirt.
13796	4152	Fredk. Wright & Son	1.0335	4.00	9.20	13.20	86.80	No dirt.
13797	4153	Fredk. Wright & Son	1.0325	4.80	9.10	13.90	86.10	No dirt.
		BETHEL.						
13952	4250	E. A. Barker	1.0348	4.40	9.60	14.00	86.00	No dirt.
13953	4252	Bennett Brothers	1.0341	4.60	9.47	14.07	85.93	No dirt.
13954	4253	Bennett Brothers	1.0322	4.40	8.95	13.35	86.65	No dirt.
		BIDDEFORD.						
13483	3915	W. P. Cole	1.0336	4.20	9.26	13.46	86.54	Slightly dirty.
13484	3916	W. P. Cole	1.0322	3.60	8.78	12.38	87.62	Dirty.
13463	3895	R. E. Davis	1.0284	3.20	6.90	10.10	89.90	Very dirty. Below standard in total solids and fat.

MILK—Continued.

Number. Station.	Number. Department.	Name.	Specific gravity.	Fat.—Per cent.	Solids not fat.* Per cent.	Total solids. Per cent.	Water.—Per cent.	Remarks.**
		BIDDEFORD—Concluded.						
13464	3896	R. E. Davis	1.0324	4.00	8.91	12.91	87.09	Very dirty.
13479	3911	Z. Deschambault	1.0320	4.80	8.98	13.78	86.22	Slightly dirty.
13480	3912	Z. Deschambault	1.0326	4.00	8.96	12.96	87.04	Very dirty.
13465	3897	C. F. Gilpatric	1.0321	3.80	8.82	12.62	87.38	Very dirty.
13466	3898	C. F. Gilpatric	1.0308	3.70	8.45	12.15	87.85	Extremely dirty.
13485	3917	Merrill Harper	1.0312	3.00	8.56	11.56	88.44	Slightly dirty. High ash due to foreign mineral matter. Below standard for total solids and fat.
13486	3918	Merrill Harper	1.0302	3.80	8.30	12.12	87.88	No dirt.
13498	3930	S. Meserve & Son	1.0303	3.60	8.06	11.66	88.34	No dirt. Below standard for total solids.
13499	3931	S. Meserve & Son	1.0313	3.00	8.30	11.30	88.70	No dirt Below standard for total solids and fat. Poor milk.
13487	3919	H. J. Michie	1.0338	4.60	9.36	13.99	86.01	No dirt.
13488	3920	H. J. Michie	1.0301	4.20	8.40	12.60	87.40	No dirt.
13462	3894	F. H. Moulin	1.0305	4.10	8.58	12.68	87.32	Slightly dirty.
13497	3929	George Nutter	1.0292	4.40	8.00	12.40	87.60	No dirt.
13495	3927	H. P. Witham	1.0292	3.80	7.74	11.54	88.46	Slightly dirty. Below standard for total solids.
13496	3928	H. P. Witham	1.0305	4.30	8.57	12.87	87.13	No dirt.
		BOWDOINHAM.						
13694	4075	A. P. M. Given	1.0335	4.80	9.36	14.16	85.84	No dirt.
13695	4076	A. P. M. Given	1.0334	4.80	9.33	14.13	85.87	No dirt.
		BRADLEY.						
13575	3990	C. W. Carney	1.0331	4.50	9.20	13.70	86.30	Slightly dirty.
13576	3991	C. W. Carney	1.0331	3.80	9.05	12.85	87.15	Slightly dirty.
13583	3998	L. O. Knapp	1.0324	4.10	8.93	13.03	86.97	Dirty.
13587	3999	L. O. Knapp	1.0326	4.00	8.96	12.96	87.04	Slightly dirty.
13580	3995	T. Michaud & Son	1.0321	4.40	8.93	13.33	86.67	Dirty.
13588	4000	E. A. Welch	1.0325	3.90	8.92	12.82	87.18	Slightly dirty.
13589	4001	E. A. Welch	1.0322	3.60	8.78	12.38	87.62	Slightly dirty.
13590	4002	E. A. Welch	1.0324	3.60	8.83	12.43	87.57	Slightly dirty.
13591	4003	E. A. Welch	1.0324	4.10	8.93	13.03	86.97	Slightly dirty.

MILK—Continued.

Number. Station.	Number. Department.	Name.	Specific gravity.	Fat.—Per cent.	Solids not fat.* Per cent.	Total solids. Per cent.	Water.—Per cent.	Remarks.**
		BREWER.						
13910	4230	L. L. Lewis	1.0321	4.20	8.88	13.08	86.92	Dirty.
		BRUNSWICK.						
13679	4065	Mitchell Biette	1.0328	4.30	9.08	13.38	86.62	Slightly dirty.
13680	4066	Mitchell Biette	1.0327	4.60	9.12	13.72	86.28	No dirt.
13684	4070	Octave Castonguay	1.0330	4.00	9.06	13.06	86.94	Slightly dirty.
13677	4063	Henry K. Day	1.0345	5.40	9.74	15.14	84.86	No dirt.
13678	4064	Henry K. Day	1.0334	4.60	8.97	13.57	86.43	No dirt.
13671	4057	F. E. Harmon	1.0325	4.20	8.98	13.18	86.82	No dirt.
13672	4058	F. E. Harmon	1.0322	4.20	8.73	12.93	87.07	No dirt.
13673	4059	D. H. Higgins	1.0320	4.80	8.98	13.78	86.22	No dirt.
13674	4060	D. H. Higgins	1.0333	3.80	9.10	12.90	87.10	Slightly dirty.
13675	4061	H. C. Hunt	1.0327	4.60	9.12	13.72	86.28	No dirt.
13676	4062	H. C. Hunt	1.0327	4.20	9.03	13.23	86.77	No dirt.
13687	4073	J. L. Marse	1.0315	5.60	9.02	14.62	85.38	Slightly dirty.
13688	4074	J. L. Marse	1.0327	4.20	9.03	13.23	86.77	No dirt.
13685	4071	J. Frank Snow	1.0336	4.00	9.21	13.21	86.79	Slightly dirty.
13686	4072	J. Frank Snow	1.0325	4.80	9.11	13.91	86.09	Slightly dirty.
13662	4048	S. H. Toothaker	1.0333	4.40	9.23	13.63	86.37	No dirt.
13663	4049	S. H. Toothaker	1.0330	5.00	9.27	14.27	85.73	Slightly dirty.
13664	4050	S. H. Toothaker	1.0341	3.80	9.10	12.90	87.10	Slightly dirty.
13681	4067	A. A. Wheeler	1.0331	3.50	8.99	12.49	87.51	No dirt.
13682	4068	A. A. Wheeler	1.0332	4.00	9.11	13.11	86.89	Slightly dirty.
		BUCKSPORT.						
13611	4022	R. R. Homer	1.0336	4.60	9.34	13.94	86.06	Slightly dirty.
13612	4023	R. R. Homer	1.0325	4.20	8.98	13.18	86.82	Slightly dirty.
13613	4024	L. S. Masson	1.0320	4.20	8.85	13.05	86.95	Very dirty.
13614	4025	L. S. Masson	1.0331	4.60	9.22	13.82	86.18	Very dirty.
		CANTON.						
13934	4249	M. F. Mitchell, Jr.	1.0350	5.40	9.86	15.26	84.74	Slightly dirty.
		DIXFIELD.						
13935	4268	Chas. Brown	1.0320	4.10	8.83	12.93	87.07	Slightly dirty.
13936	4269	Chas. Brown	1.0326	4.60	9.09	13.69	86.31	Very dirty.

MILK—Continued.

Number. Station.	Number. Department.	Name.	Specific gravity.	Fat.—Per cent.	Solids not fat.* Per cent.	Total solids. Per cent.	Water.—Per cent.	Remarks.**
		Dixfield—Concluded.						
13937	4270	Geo. J. Brown	1.0342	4.80	9.53	14.33	85.67	Dirty.
13938	4271	Geo. J. Brown	1.0342	5.10	9.59	14.69	85.31	Dirty.
		Dryden.						
13883	4214	H. L. Adams	1.0332	4.90	9.30	14.20	85.80	Slightly dirty
13884	4215	H. L. Adams	1.0335	4.80	9.36	14.16	85.84	Slightly dirty.
13885	4216	H. L. Adams	1.0338	7.20	9.80	17.00	83.00	Slightly dirty.
13886	4217	H. L. Adams	1.0332	4.30	9.18	13.48	86.52	Slightly dirty.
		Ellsworth.						
13607	4018	S. S. Estey	1.0312	4.40	8.69	13.09	86.91	Slightly dirty.
13608	4019	S. S. Estey	1.0313	4.70	8.78	13.48	86.52	Slightly dirty.
13609	4020	S. S. Estey	1.0324	5.20	9.16	14.36	85.64	Slightly dirty.
13610	4021	P. L. Haggerty	1.0324	4.20	8.95	13.15	86.85	Slightly dirty.
13602	4013	Chas. T. Joy	1.0333	6.00	9.56	15.56	84.44	Dirty.
13603	4014	Chas. T. Joy	1.0333	5.80	9.52	15.32	84.68	Dirty.
13604	4015	F. G. Smith	1.0333	5.10	9.37	14.47	85.53	Slightly dirty.
13605	4016	F. G. Smith	1.0326	4.40	9.05	13.45	86.55	Slightly dirty.
13606	4017	F. G. Smith	1.0326	4.80	9.13	13.93	86.07	Slightly dirty.
		Fairfield.						
13630	4039	F. G. Alexander	1.0331	4.80	9.26	14.06	85.94	No dirt.
13631	4040	F. G. Alexander	1.0344	5.00	9,62	14.62	85.38	Slightly dirty.
13550	3967	Clark & Varney	1.0332	5.10	9.34	14.44	85.56	No dirt..
13636	4045	I. C. Hodges	1.0340	4.60	9.44	14.04	85.96	No dirt.
13637	4046	I. C. Hodges	1.0342	4.60	9.49	14.09	85.91	Slightly dirty.
13629	4038	David King	1.0340	4.60	9.44	14.04	85.96	No dirt.
13632	4041	E. T. Pillsbury	1.0339	5.40	9.58	14.98	85.02	No dirt.
13633	4042	E. T. Pillsbury	1.0338	4.80	9,43	14.23	85.77	Slightly dirty.
13634	4043	E. T. Pillsbury	1.0327	5.00	9.20	14.20	85.80	Slightly dirty.
13626	4035	L. E. Prentiss	1.0339	4.40	9.38	13.78	86.22	No dirt.
13627	4036	L. E. Prentiss	1.0338	4.60	9.39	13.99	86.01	Extremely dirty.
13628	4037	G. A. Savage	1.0346	3.50	9.37	12.87	87.13	No dirt.

MILK—Continued.

Number. Station.	Number. Department.	Name.	Specific gravity.	Fat.—Per cent.	Solids not fat.* Per cent.	Total solids. Per cent.	Water.—Per cent.	Remarks.**
		Farmington.						
13880	4211	L. B. Bangs	1.0333	5.00	9.35	14.35	85.65	Dirty.
13874	4205	H. Corbett	1.0324	4.50	9.02	13.52	86.48	Dirty.
13875	4206	H. Corbett	1.0321	4.90	9.03	13.93	86.07	Dirty.
13867	4201	Doyen Bros	1.0337	5.60	9.58	15.18	84.82	Slightly dirty.
13868	4202	Doyen Bros	1.0342	5.80	9.74	15.54	84.46	Slightly dirty.
13877	4208	W. J. Gould	1.0325	4.40	9.03	13.43	86.57	Very dirty.
13860	4194	W. F. Haines	1.0330	5.20	9.31	14.51	85.49	Very slightly dirty
13861	4195	W. F. Haines	1.0316	4.20	8.75	12.95	87.05	Slightly dirty.
13869	4203	E. A. Odell	1.0344	5.50	9.73	15.23	84.77	Slightly dirty.
13870	4204	E. A. Odell	1.0342	5.40	9.66	15.06	84.94	Dirty.
13862	4196	W. R. Partridge	1.0331	5.20	9.34	14.54	85.46	Slightly dirty.
13863	4197	W. R. Partridge	1.0336	5.30	9.48	14.78	85.22	Slightly dirty.
13864	4198	W. R. Partridge	1.0320	4.70	8.96	13.66	86.34	No dirt.
13865	4199	H. A. Titcomb	1.0337	4.60	9.37	13.97	86.03	Dirty.
13866	4200	H. A. Titcomb	1.0337	5.10	9.47	14.57	85.43	Dirty.
		Freeport.						
13770	4126	B. F. Conant	1.0330	5.00	9.27	14.27	85.73	No dirt.
13774	4130	Mrs. C. W. Luce	1.0335	4.50	9.25	13.75	86.25	No dirt.
13775	4131	Geo. A. Miller	1.0320	7.40	9.48	16.88	83.12	No dirt.
13771	4127	F. G. True	1.0330	4.40	9.15	13.55	86.45	Dirty.
13772	4128	F. G. True	1.0325	4.60	9.00	13.60	86.40	Slightly dirty.
13773	4129	F. G. True	1.0320	4.30	8.88	13.18	86.82	No dirt.
		Gardiner.						
13711	4091	H. J. Bowie	1.0338	4.40	9.35	13.75	86.25	Dirty.
13703	4083	G. R. Danforth	1.0324	4.60	9.04	13.64	86.36	Slightly dirty.
13704	4084	G. R. Danforth	1.0331	5.40	9.39	14.79	85.21	Very dirty.
13705	4085	G. R. Danforth	1.0332	4.60	9.24	13.84	86.16	Slightly dirty
13699	4079	R. H. Gardiner	1.0330	4.00	9.06	13.06	86.94	Slightly dirty.
13700	4080	R. H. Gardiner	1.0335	4.00	9.19	13.19	86.81	Slightly dirty.
13709	4089	H. Goldsmith & Son	1.0338	5.40	9.56	14.96	85.04	Extremely dirty
13710	4090	H. Goldsmith & Son	1.0338	5.40	9.56	14.96	85.04	Very dirty.
13732	4101	A. Hastings & Son	1.0341	5.00	9.55	14.55	85.45	No dirt.

MILK—Continued.

Number. Station.	Number. Department.	Name.	Specific gravity.	Fat.—Per cent.	Solids not fat.* Per cent.	Total solids. Per cent.	Water.—Per cent.	Remarks.**
		GARDINER—Concluded.						
13733	4102	A. Hastings & Son	1.0339	5.00	9.40	14.40	85.60	No dirt.
13720	4100	Johnson House	1.0332	8.00	9.94	17.94	82.06	Dirty.
13697	4077	S. Jones & Son	1.0324	4.80	9.08	13.88	86.12	Dirty.
13698	4078	S. Jones & Son	1.0327	5.00	9.20	14.20	85.80	Dirty.
13714	4094	A. L. Reed	1.0331	5.40	9.39	14.79	85.21	Slightly dirty.
13715	4095	A. L. Reed	1.0339	4.60	9.42	14.02	85.98	Slightly dirty.
13706	4086	J. E. Troop	1.0336	4.60	9.34	13.94	86.06	Extremely dirty.
13707	4087	J. E. Troop	1.0334	4.20	9.21	13.41	86.59	Slightly dirty.
13701	4081	F. A. Wadsworth	1.0342	5.00	9.57	14.57	85.43	Slightly dirty.
13702	4082	F. A. Wadsworth	1.0342	5.00	9.57	14.57	85.43	Slightly dirty.
		HALLOWELL.						
13749	4118	B. H. Blake	1.0340	4.80	9.48	14.28	85.72	No dirt.
13750	4119	B. H. Blake	1.0339	5.00	9.40	14.40	85.60	No dirt.
13741	4110	Joe Cipriano	1.0311	4.20	8.63	12.83	87.17	No dirt.
13738	4107	Wm. J. Cole	1.0340	4.20	9.36	13.56	86.44	No dirt.
13739	4108	Wm. J. Cole	1.0340	4.60	9.44	14.04	85.96	Slightly dirty.
13748	4117	Ernest Courier	1.0344	4.20	9.46	13.66	86.34	No dirt.
13742	4111	C. E. Doucette	1,0339	4.20	9.34	13.54	86.46	No dirt.
13743	4112	C. E. Doucette	1.0340	4.80	9.48	14.28	85.72	No dirt.
13740	4109	S. Hayes	1.0320	5.50	9.12	14.62	85.38	No dirt.
13747	4116	A. J. Hersom	1.0342	5.00	9.57	14.57	85.43	No dirt.
13734	4103	Maple Shade Farm	1.0330	4.00	9.06	13.06	86.94	No dirt.
13735	4104	Maple Shade Farm	1.0313	5.40	8.93	14.33	85.67	No dirt.
13746	4115	C. E. Merrill	1.0341	4.20	9.39	13.59	86.41	No dirt.
13744	4113	Geo. Rich	1.0342	4.80	9.53	14.33	85.67	No dirt.
13745	4114	Geo. Rich	1,0332	4.60	9.24	13.84	86.16	No dirt.
13736	4105	W. E. Rollins	1.0339	5.00	9.40	14.40	85.60	Slightly dirty.
13737	4106	W. E. Rollins	1.0332	4.20	9.16	13.36	86.64	No dirt.
		HAMPDEN AND EAST HAMPDEN.						
13907	4227	E. P. Barnes	1.0334	4.80	9.33	14.13	85.87	Slightly dirty.
13912	4232	J. E. Perry	1.0320	4.10	8.83	12.93	87.07	Slightly dirty.

MILK—Continued.

Number. Station.	Number. Department.	Name.	Specific gravity.	Fat.—Per cent.	Solids not fat.* Per cent.	Total solids. Per cent.	Water.—Per cent.	Remarks.**
		KENNEBUNK.						
13514	3939	P. D. Greenleaf	1.0342	4.60	9.49	14.09	85.91	Very dirty.
13510	3935	C. W. Hatch	1.0323	4.60	9.02	13.62	86.38	Slightly dirty.
13511	3936	C. W. Hatch	1.0322	4.20	8.90	13.10	86.90	Slightly dirty.
13512	3937	A. F. Smith	1.0331	5.00	9.30	14.30	85.70	Dirty.
13513	3938	A. F. Smith	1.0296	3.60	7.80	11.40	88.60	Slightly dirty. Below standard for total solids. Watered.
		KENNEBUNKPORT.						
13507	3932	F. O. Bailey	1.0331	4.20	9.13	13.33	86.67	Slightly dirty.
13508	3933	F. O. Bailey	1.0327	4.00	8.99	12.99	87.01	Slightly dirty.
13509	3934	F. O. Bailey	1.0335	4.00	9.19	13.19	86.81	Dirty.
13515	3940	Wildes Bros	1.0337	4.10	9.26	13.36	86.64	Slightly dirty.
13516	3941	Wildes Bros	1.0337	3.20	8.59	11.79	88.21	Slightly dirty. Below standard for fat. Skimmed.
		LEWISTON.						
14085	4348	Jos. Brunell	1.0335	3.80	9.15	12.95	87.05	No dirt.
14077	4340	L. Cassavant	1.0325	4.80	9.11	13.91	86.09	Dirty.
14078	4341	L. Cassavant	1.0343	5.00	9.60	14.60	85.40	Dirty.
14039	4313	L. M. Donnell	1.0330	4.00	9.06	13.06	86.94	No dirt.
14040	4314	L. M. Donnell	1.0330	4.20	9.11	13.31	86.69	No dirt.
14086	4349	Chas. Dube & Son	1.0339	3.40	10.17	13.57	86.43	No dirt.
14037	4311	Morris Goff	1.0327	4.00	8.99	12.99	87.01	No dirt.
14038	4312	Morris Goff	1.0330	4.00	9.06	13.06	86.94	No dirt.
14054	4328	R. G. Kinnon & Son	1.0333	2.80	10.08	12.88	87.12	No dirt. Below standard for fat. Skimmed some.
14055	4329	R. G. Kinnon & Son	1.0326	4.20	9.00	13.20	86.80	No dirt.
14072	4335	I. N. Leclair	1.0346	4.40	9.55	13.95	86.05	No dirt.
14074	4337	I. N. Leclair	1.0335	5.00	9.40	14.40	85.60	No dirt.
14089	4352	Marcotte, Cote & Co	1.0340	3.60	9.24	12.84	87.16	No dirt.
14083	4346	R. Michaud	1.0337	4.00	9.24	13.24	86.76	No dirt.
14084	4347	R. Michaud	1.0335	4.00	9.19	13.19	86.81	Slightly dirty.
14090	4353	F. Ouellette	1.0327	3.80	8.95	12.75	87.25	Slightly dirty.
14050	4324	Geo. Raymond	1.0330	4.40	9.15	13.55	86.45	No dirt.

MILK—Continued.

Number. Station.	Number. Department.	Name.	Specific gravity.	Fat.—Per cent.	Solids not fat.* Per cent.	Total solids. Per cent.	Water.—Per cent.	Remarks.**
		LEWISTON-Concluded.						
14051	4325	Geo. Raymond	1.0328	3.80	8.97	12.77	87.23	Slightly dirty.
14087	4350	Geo. Roberge	1.0338	4.20	9.31	13.51	86.49	No dirt..
14088	4351	Geo. Roberge	1.0335	4.00	9.19	13.19	86.81	No dirt.
14056	4330	G. M. Stetson	1.0329	4.00	9.04	13.04	86.96	No dirt.
14057	4331	G. M. Stetson	1.0328	4.00	9.01	13.01	86.99	No dirt.
14059	4333	H. O. Wood	1.0336	4.20	9.26	13.46	86.54	No dirt.
14060	4334	H. O. Wood	1.0339	4.20	9.34	13.54	86.46	No dirt.
14075	4338	D. S. Woodard	1.0340	4.60	9.44	14.04	85.96	No dirt.
14076	4339	D. S. Woodard	1.0339	4.40	9.38	13.78	86.22	No dirt.
		LIVERMORE FALLS.						
13896	4221	E. P. Bryant	1.0332	5.40	9.41	14.81	85.19	Slightly dirty.
13897	4222	G. W. Pettingill	1.0335	4.60	9.32	13.92	86.08	Dirty.
13893	4218	E. R. Southern	1.0356	5.40	10.01	15.41	84.59	Slightly dirty.
13894	4219	E. R. Southern	1.0344	5.40	9.71	15.11	84.89	Slightly dirty.
13895	4220	E. R. Southern	1.0343	6.30	9.86	16.16	83.84	Slightly dirty.
13898	4223	M. A. Thompson	1.0342	5.10	9.59	14.69	85.31	Dirty.
		MADISON.						
13833	4181	F. L. Gray	1.0350	6.00	9.98	15.98	84.02	Slightly dirty.
13834	4182	F. L. Gray	1.0340	5.80	9.69	15.49	84.51	Slightly dirty.
13835	4183	Frank Smith & Son	1.0345	4.90	9.63	14.53	85.47	Dirty.
13836	4184	Frank Smith & Son	1.0335	4.10	9.21	13.31	86.69	Dirty.
		MECHANIC FALLS.						
13941	4274	Otis Bailey	1.0331	3.70	9.03	12.73	87.27	Dirty.
13939	4272	C. H. Burns	1.0332	4.60	9.21	13.81	86.19	Dirty.
13942	4275	H. L. Jewett	1.0335	4.20	9.24	13.44	86.56	Dirty.
13943	4276	H. L. Jewett	1.0340	4.70	9.46	14.16	85.84	Slightly dirty.
13944	4277	J. W. Whitman	1.0330	3.50	8.96	12.46	87.54	Dirty.
13945	4278	J. W. Whitman	1.0326	3.60	8.88	12.48	87.52	Dirty.
		MILFORD.						
13592	4004	J. H. Foss	1.0333	4.60	9.27	13.87	86.13	Dirty.
13593	4005	J. H. Foss	1.0324	4.80	9.08	13.88	86.12	Dirty.

MILK—Continued.

Number. Station.	Number. Department.	Name.	Specific gravity.	Fat.—Per cent.	Solids not fat.* Per cent.	Total solids. Per cent.	Water.—Per cent.	Remarks.**
		NEWPORT.						
13618	4028	C. D. Katen	1.0319	3.60	8.71	12.31	87.69	Slightly dirty.
13619	4029	C. D. Katen	1.0330	4.70	9.21	13.91	86.09	Slightly dirty.
13620	4030	C. D. Katen	1.0318	5.20	9.01	14.21	85.79	Slightly dirty.
13616	4026	F. B. Williams	1.0324	4.80	9.08	13.88	86.12	Dirty.
13617	4027	F. B. Williams	1.0324	4.00	8.91	12.91	87.09	Dirty.
		NORRIDGEWOCK.						
13830	4178	H. C. Albee	1.0343	5.80	9.77	15.57	84.43	Very slightly dirty
13831	4179	H. C. Albee	1.0343	5.50	9.71	15.21	84.79	Dirty.
13832	4180	C. A. Whiting	1.0348	5.80	9.89	15.69	84.31	Dirty.
		NORTH JAY.						
13881	4212	F. A. Webber	1.0343	4.20	9.44	13.64	86.36	No dirt.
13882	4213	F. A. Webber	1.0333	4.60	9.27	13.87	86.13	Very slightly dirty
		NORWAY.						
13956	4255	A. R. Buswell	1.0334	4.40	9.25	13.65	86.35	No dirt.
13957	4256	A. R. Buswell	1.0333	4.80	9.31	14.11	85.89	No dirt.
13960	4259	A. R. Buswell	1.0342	5.00	9.57	14.57	85.43	Slightly dirty.
13961	4260	A. R. Buswell	1.0337	5.00	9.43	14.43	85.57	Slightly dirty.
13962	4261	D. W. Goodwin	1.0330	5.00	9.27	14.27	85.73	Slightly dirty.
13963	4262	D. W. Goodwin	1.0316	4.40	8.79	13.19	86.81	No dirt.
13959	4258	Walter Luck & Son	1.0330	2.30	8.49	10.79	89.21	No dirt. Below standard for total solids and fat. Skimmed.
13964	4263	Richardson's Market	1.0329	3.40	8.83	12.23	87.77	No dirt.
13965	4264	Richardson's Market	1.0329	3.40	8.83	12.23	87.77	No dirt.
13967	4266	Richardson's Market	1.0332	3.20	8.95	12.15	87.85	Slightly dirty. Slightly below standard for fat.
		OAKLAND.						
13556	3973	M. A. Goodwin	1.0335	4.40	9.28	13.68	86.32	Slightly dirty.
13557	3974	M. A. Goodwin	1.0332	4.40	9.20	13.60	86.40	Slightly dirty.
13558	3975	T. L. Reynolds	1.0311	4.10	8.61	12.71	87.29	Slightly dirty.
13559	3976	T. L. Reynolds	1.0307	4.00	8.49	12.49	87.51	Dirty.
13560	3977	H. P. Sawtelle	1.0312	5.80	8.99	14.79	85.21	Slightly dirty.
13561	3978	H. P. Sawtelle	1.0309	4.60	8.66	13.26	86 74	Slightly dirty.

MILK—Continued.

Number. Station.	Number. Department.	Name.	Specific gravity.	Fat.—Per cent.	Solids not fat.* Per cent.	Total solids. Per cent.	Water.—Per cent.	Remarks.**
		OLD TOWN.						
13573	3988	F. A. Potter	1.0319	4.20	8.83	13.03	86.97	No dirt.
13574	3989	F. A. Potter	1.0323	3.40	8.77	12.17	87.83	Slightly dirty.
13577	3992	F. A. Potter	1.0330	3.90	9.04	12.94	87.06	Slightly dirty.
13578	3993	F. A. Potter	1.0310	5.00	8.76	13.76	86.24	Dirty.
13579	3994	F. A. Potter	1.0331	3.60	9.01	12.61	87.39	Dirty.
13581	3996	M. B. Rogers	1.0327	3.60	8.91	12.51	87.49	Dirty.
13582	3997	M. B. Rogers	1.0311	4.20	8.63	12.83	87.17	Very dirty.
		ORONO.						
13600	4012	A. Fornier	1.0323	4.10	8.91	13.01	86.99	Dirty.
13598	4010	N. E. Goodrich	1.0329	4.00	9.04	13.04	86.96	Very dirty.
13599	4011	N. E. Goodrich	1.0330	3.80	9.02	12.82	87.18	Very dirty.
13596	4008	E. H. Homestead	1.0339	4.50	9.40	13.90	86.10	Slightly dirty.
13597	4009	E. H. Homestead	1.0338	3.60	9.18	12.78	87.22	Dirty.
13594	4006	J. H. Huddilston	1.0326	4.20	9.01	13.21	86.79	Dirty.
13595	4007	J. H. Huddilston	1.0318	3.80	9.72	13.52	86.48	Slightly dirty.
		ORRINGTON.						
13908	4228	Austin Johnson	1.0334	4.80	9.33	14.13	85.87	Slightly dirty.
		OXFORD.						
13979	4286	L. A. Twitchell	1.0322	4.00	8.86	12.86	87.14	Slightly dirty.
		PHILLIPS.						
13876	4207	O. A. Badger	1.0321	4.30	8.91	13.21	86.79	Dirty.
13878	4209	O. A. Badger	1.0325	5.10	9.17	14.27	85.73	Slightly dirty.
		PITTSFIELD.						
13571	3985	L. J. Byther	1.0338	6.00	9.61	15.61	84.39	Dirty.
13572	3986	L. J. Byther	1.0334	4.50	9.17	13.67	86.33	Dirty.
13565	3979	C. F. Gerald	1.0336	4.90	9.25	14.15	85.85	Slightly dirty.
13566	3980	C. F. Gerald	1.0335	5.10	9.29	14.39	85.61	Slightly dirty.
13567	3981	Chas. Hurd	1.0333	3.50	8.96	12.46	87.54	Slightly dirty.
13568	3982	Chas. Hurd	1.0314	3.30	8.42	11.72	88.28	Slightly dirty.
13569	3983	Chas. Hurd	1.0315	4.30	8.62	12.92	87.08	Slightly dirty.
13570	3984	Chas. Hurd	1.0328	4.50	9.05	13.55	86.45	Slightly dirty.

MILK—Continued.

Number. Station.	Number. Department.	Name.	Specific gravity.	Fat.—Per cent.	Solids not fat.* Per cent.	Total solids. Per cent.	Water.—Per cent.	Remarks.**
		RANDOLPH.						
13712	4092	E. A. Brown.................	1.0322	5.00	9.07	14.07	85.93	Slightly dirty.
13713	4093	E. A. Brown.................	1.0339	4.40	9.38	13.78	86.22	Slightly dirty.
		RICHMOND.						
13716	4096	F. N. Libby..................	1.0334	4.60	9.29	13.89	86.11	No dirt.
13717	4097	F. N. Libby..................	1.0339	5.60	9.62	15.22	84.78	No dirt.
13718	4098	Turner Center Creamery......	1.0339	4.00	9.29	13.29	86.71	No dirt.
		RUMFORD AND SOUTH RUMFORD.						
13926	4244	James Carey.................	1.0327	4.00	8.99	12.99	87.01	Dirty.
13927	4245	James Carey.................	1.0299	3.60	8.21	11.81	88.19	Dirty.
13918	4236	Fred Cote...................	1.0332	4.00	9.11	13.11	86.89	Dirty.
13929	4247	Edward Frazer...............	1.0306	7.10	9.08	16.18	83.82	Extremely dirty Unfit to offer for food.
13922	4240	L. L. Haines................	1.0331	3.50	8.99	12.49	87.51	Slightly dirty.
13928	4246	L. L. Haines................	1.0320	3.30	8.67	11.97	88.03	Dirty.
13919	4237	John W. Holland.............	1.0337	3.00	9.04	12.04	87.96	Dirty. Slightly below standard for fat.
13923	4241	John W. Holland.............	1.0332	3.30	8.97	12.27	87.73	Dirty.
13924	4242	John W. Holland.............	1.0322	4.20	8.90	13,10	86.90	Dirty.
13916	4234	Turner Center Creamery......	1.0330	3.90	9.04	12.94	87.06	Very slightly dirty
13917	4235	Turner Center Creamery......	1.0337	4.30	9.31	13.61	86.39	Slightly dirty.
13920	4238	Turner Center Creamery......	1.0329	4.30	9.11	13.41	86.59	Dirty.
		SACO.						
13475	3907	Deamas Cassavant...........	1.0330	4.40	9.15	13.55	86.45	Slightly dirty.
13476	3908	Deamas Cassavant...........	1.0319	3.80	8.75	12.55	87.45	Extremely dirty.
13493	3925	John D. Fernald.............	1.0318	4.40	8.84	13.24	86.76	Very dirty.
13494	3926	John D. Fernald.............	1.0329	4.00	9.04	13.04	86.96	Dirty.
13489	3921	J. Frank Fogg...............	1.0325	4.40	9.03	13.43	86.57	Slightly dirty.
13471	3903	A. Gonville.................	1.0321	4.20	8.88	13.08	86.92	Dirty.
13472	3904	A. Gonville.................	1.0314	4.00	8.66	12.66	87.34	Slightly dirty.
13481	3913	Fred A. Lamb................	1.0295	3.60	8.32	11.92	88.08	Dirty.
13482	3914	Fred A. Lamb................	1.0320	4.00	8.81	12.81	87.19	Dirty.
13467	3899	Adolph Melancon.............	1.0316	4.20	8.75	12.95	87.05	No dirt.

MILK—Continued.

Number. Station.	Department.	Name.	Specific gravity.	Fat.—Per cent.	Solids not fat.* Per cent.	Total solids. Per cent.	Water.—Per cent.	Remarks.**
13468	3900	Adolph Melancon	1.0327	4.40	9.08	13.48	86.52	Very dirty.
13469	3901	F. Ouellette	1.0322	4.00	8.86	12.86	87.14	Extremely dirty.
13470	3902	F. Ouellette	1.0319	4.20	8.83	13.03	86.97	Extremely dirty.
13473	3905	Palmer Bros	1.0313	4.20	8.68	12.88	87.12	No dirt.
13474	3906	Palmer Bros	1.0309	3.40	8.42	11.82	88.18	Slightly dirty.
13491	3923	H. W. Sanborn	1.0332	4.40	9.20	13.60	86.40	No dirt.
13490	3922	Stackpole Farm	1.0325	5.00	9.15	14.15	85.85	No dirt.
13492	3924	Stackpole Farm	1.0338	4.20	9.31	13.51	86.49	No dirt.
13477	3909	Gideon Talbot	1.0312	4.20	8.65	12.85	87.15	Slightly dirty.
13478	3910	Gideon Talbot	1.0309	2.80	8.88	11.68	88.32	Dirty. Below standard for total solids and fat. Skimmed.
		SHAWMUT.						
13844	4192	F. Langlais	1.0330	4.40	9.15	13.55	86.45	Slightly dirty.
13845	4193	F. Langlais	1.0340	4.40	9.40	13.80	86.20	Dirty.
		SKOWHEGAN.						
13816	4166	W. O. Chase	1.0325	4.20	8.98	13.18	86.82	Dirty.
13817	4167	W. O. Chase	1.0325	4.50	9.05	13.55	86.45	Dirty.
13820	4170	F. L. Horne	1.0332	4.60	9.24	13.84	86.16	Slightly dirty.
13825	4175	F. L. Horne	1.0327	6.00	9.41	15.41	84.59	Slightly dirty.
13818	4168	Malhon Bros	1.0340	5.20	9.56	14.76	85.24	Slightly dirty.
13819	4169	Malhon Bros	1.0340	4.80	9.48	14.28	85.72	Slightly dirty.
13823	4173	McGinnis Bros	1.0326	5.20	9.21	14.41	85.59	Dirty.
13824	4174	McGinnis Bros	1.0327	5.20	9.24	14.44	85.56	Dirty.
13821	4171	Cyrus Newton	1.0332	4.20	9.16	13.36	86.64	Slightly dirty.
13822	4172	Cyrus Newton	1.0326	4.20	9.00	13.20	86.80	No dirt.
13815	4165	G. F. Paddock	1.0312	5.30	8.88	14.18	85.82	No dirt.
13826	4176	F. Vincent & Son	1.0328	4.30	9.08	13.38	86.62	Slightly dirty.
13827	4177	F. Vincent & Son	1.0325	4.30	9.01	13.31	86.69	No dirt.
		SOUTH PARIS.						
13971	4267	F. L. Cotton	1.0339	5.00	9.50	14.50	85.50	No dirt.
13972	4279	F. L. Cotton	1.0329	4.00	9.04	13.04	86.96	Slightly dirty.

MILK—Continued.

Number. Station.	Number. Department.	Name.	Specific gravity.	Fat.—Per cent.	Solids not fat.* Per cent.	Total solids. Per cent.	Water.—Per cent.	Remarks.**
		SKOWHEGAN—Concluded						
13977	4284	Henry Fletcher	1.0333	3.40	9.02	12.42	87.58	Slightly dirty.
13974	4281	A. U. Tylor	1.0330	4.60	9.19	13.79	86.21	Slightly dirty.
13975	4282	A. U. Tylor	1.0330	4.60	9.19	13.79	86.21	Slightly dirty.
		STRONG.						
13879	4210	H. W. Allen & Son	1.0332	4.60	9.24	13.84	86.16	Slightly dirty.
		TOPSHAM.						
13665	4051	J. P. Hayward	1.0341	4.30	9.43	13.73	86.27	No dirt.
13666	4052	J. P. Hayward	1.0346	4.80	9.63	14.43	85.57	No dirt.
13668	4054	A. C. Morrill	1.0342	4.80	9.53	14.33	85.67	No dirt.
13669	4055	A. C. Morrill	1.0332	5.40	9.41	14.81	85.19	No dirt.
13670	4056	A. C. Morrill	1.0341	5.20	9.59	14.79	85.21	No dirt.
		WATERVILLE.						
13527	3944	Wm. Glidden	1.0303	3.30	8.25	11.55	88.45	Slightly dirty. Solids slightly low.
13528	3945	Wm. Glidden	1.0306	3.30	8.33	11.63	88.37	Slightly dirty. Solids slightly low.
13638	4047	Wm. Glidden	1.0319	4.10	8.81	12.91	87.09	No dirt.
13536	3953	C. H. Marcia	1.0332	5.00	9.32	14.32	85.68	Slightly dirty.
13537	3954	C. H. Marcia	1.0325	4.30	9.01	13.31	86.69	Slightly dirty.
13525	3942	E. C. Mathews	1.0320	4.00	9.06	13.06	86.94	Slightly dirty.
13526	3943	E. C. Mathews	1.0330	3.60	9.24	12.84	87.16	Slightly dirty.
13531	3948	H. J. Ordway	1.0328	4.00	9.01	13.01	86.99	Slightly dirty.
13532	3949	H. J. Ordway	1.0320	4.00	8.81	12.81	87.19	Slightly dirty.
13533	3950	H. J. Ordway	1.0325	3.90	8.92	12.82	87.18	Slightly dirty.
13625	4034	H. J. Ordway	1.0336	4.60	9.34	13.94	86.06	No dirt.
13529	3946	W. L. Rhoades	1.0315	5.10	8.91	14.01	85.99	Slightly dirty.
13530	3947	W. L. Rhoades	1.0330	3.70	9.00	12.70	87.30	Slightly dirty.
13541	3958	Shrewsbury Farm Dairy Co.	1.0329	3.10	8.86	11.96	88.04	Slightly dirty.
13542	3959	Shrewsbury Farm Dairy Co.	1.0318	3.90	8.74	12.64	87.36	Slightly dirty.
13622	4031	Shrewsbury Farm Dairy Co.	1.0332	3.80	9.07	12.87	87.13	No dirt.
13539	3956	A. W. Stetson	1.0309	4.30	8.60	12.90	87.10	Slightly dirty.
13540	3957	A. W. Stetson	1.0329	3.70	8.98	12.68	87.32	Dirty.

MILK—Concluded.

Number. Station.	Number. Department.	Name.	Specific gravity.	Fat.—Per cent.	Solids not fat.* Per cent.	Total solids. Per cent.	Water.—Per cent.	Remarks.**
		WATERVILLE—Concluded.						
13545	3962	G. F .Terry	1.0335	4.10	9.21	13.31	86.69	Slightly dirty.
13546	3963	G. F. Terry	1 0337	3.80	9.20	13.00	87.00	Slightly dirty.
13534	3951	A. N. Ward	1.0320	4.30	8.88	13.18	86.82	Slightly dirty.
13535	3952	A. N. Ward	1.0320	4.20	8.85	13.05	86.95	Slightly dirty.
		WINNEGANCE.						
13806	4162	Chas. T. Small	1.0348	5.00	9.75	14.75	85.25	No dirt.
13807	4163	Chas. T. Small	1.0327	5.00	9.20	14.20	85.80	Slightly dirty.
13804	4160	E. E. Williams	1.0315	4.50	8.80	13.30	86.70	No dirt.
13805	4161	E. E. Williams	1.0340	5.20	9.56	14.76	85.24	No dirt.
		WINSLOW.						
13554	3971	L. M. Emery	1.0329	4.00	9.04	13.04	86.96	Slightly dirty.
13555	3972	L. M. Emery	1.0319	4.10	8.81	12.91	87.09	Dirty.
13623	4032	Patterson Bros	1.0345	6.00	9.85	15.85	84.15	Very dirty.
13624	4033	Patterson Bros	1.0331	4.40	9.18	13.58	86.42	Very dirty.
		YARMOUTH.						
13764	4120	L. J. Lombard	1.0330	6.00	9.48	15.48	84.52	No dirt.
13765	4121	L. J. Lombard	1.0325	4.00	8.93	12.93	87.07	No dirt.
13766	4122	L. J. Lombard	1.0330	4.00	9.00	13.00	87.00	No dirt.
13767	4123	F. G. Simonton	1.0325	4.00	8.93	12.93	87.07	No dirt.
13768	4124	F. G. Simonton	1.0325	4.60	9.19	13.79	86.21	No dirt.
13769	4125	F. G. Simonton	1.0330	4.60	9.19	13.79	86.21	No dirt..

CREAM.

Results of examination of samples of cream collected during the months of October, November and December, 1914.

		AUBURN.						
14029	4303	Geo. A. Fogg	-	23.00	-	-	-	No dirt..
14020	4294	Turner Center Creamery	-	21.00	-	-	-	No dirt.
14036	4310	Turner Center Creamery	-	21.50	-	-	-	No dirt.
14046	4320	Turner Center Creamery	-	21.00	-	-	-	No dirt.

CREAM—Concluded.

Number. Station.	Number. Department.	Name.	Specific gravity.	Fat.—Per cent.	Solids not fat.* Per cent.	Total solids. Per cent.	Water.—Per cent.	Remarks.**
		Bethel.						
13955	4254	H. E. Jordan.................	-	27.00	-	-	-	No dirt.
		Brunswick.						
13683	4069	W. S. Totman................	-	41.00	4.24	45.24	54.76	No dirt.
		Canton.						
13933	4248	Whiting's Creamery...........	-	38.00	-	-	-	Very slightly dirty
		Fairfield.						
13635	4044	E. T. Pillsbury..............	-	40.00	5.56	45.56	54.44	No dirt.
		Gardiner.						
13719	4099	W. J. Goodwin...............	-	35.00	4.80	39.80	60.20	No dirt.
13708	4088	Pine Tree State Farm.........	-	32.00	4.61	36.61	63.39	No dirt.
		Mechanic Falls.						
13940	4273	C. H. Burns..................	-	21.00	-	-	-	Dirty.
		Norway.						
13958	4257	A. R. Buswell................	-	29.00	-	-	-	No dirt.
13966	4265	Richardson's Market..........	-	21.00	-	-	-	Very dirty.
		South Paris.						
13973	4280	F. L. Cotton................	-	23.50	-	-	-	Dirty.
13978	4285	Henry Fletcher...............	-	22.00	-	-	-	Slightly dirty.
13976	4283	A. U. Tyler..................	-	22.00	-	-	-	No dirt.
		Rumford and South Rumford.						
13925	4243	J. M. Holland................	-	34.00	-	-	-	No dirt.
13921	4239	Turner Center Creamery......	-	20.50	-	-	-	Dirty.
		Topsham.						
13667	4053	E. C. Patten.................	-	40.00	4.65	44.65	55.35	No dirt.
		Waterville.						
13538	3955	F. S Garland................	-	25.00	-	-	-	Dirty.
13543	3960	Shrewsbury Farm Dairy Co....	-	21.00	-	-	-	Slightly dirty.
13544	3961	Shrewsbury Farm Dairy Co...	-	32.00	-	-	-	Slightly dirty.
		West Benton.						
13553	3970	Turner Center Creamery......	-	20.40	-	-	-	Slightly dirty.

*Casein, albumen, milk, sugar, ash.
**For explanations under this column see paragraph on Clean and Dirty Milk,page 27

Clean and Dirty Milk and Cream.

In addition to the chemical analysis of the samples of milk and cream they are examined for visible dirt. When present the visible dirt consists of such materials as particles of sawdust or other bedding material, of cow manure, cow hairs and the like. When the milk is received at the laboratory the bottles are allowed to stand quietly for 30 to 40 minutes, and are carefully examined for visible dirt. The following terms are used in the table to roughly indicate the cleanliness of the milk.

Clean milk contains no visible dirt.

Very slightly dirty milk contains at least one particle of dirt.

Slightly dirty milk contains several particles of dirt.

Dirty milk has quite a large number of particles of dirt.

Very dirty milk has a large amount of visible dirt.

There seems to be little reason for milk being so poorly handled that it will fall into either of the two last classes.

STATEMENT BY THE EXECUTIVE OF THE LAW.

A. M. G. Soule, Chief, Bureau of Inspection.

The results of the inspection for the last quarter of the year have, on the whole, been very satisfactory and this statement is borne out by the results of the analyses. Out of four hundred and sixty samples collected and analyzed since October, only a very few have shown a deficiency or have in any way warranted asking for a hearing or even a request for an explanation. In some instances the milk has been found slightly dirty—more particularly in the bulk milk examined—but in most cases the samples have been found to carry a high butter fat content and the milk, in general, of good quality.

There are still many changes to be suggested, however, in the milk situation, and in some cases it seems necessary to caution the milk dealers to take more care in producing clean milk. The demand for clean milk, or any legislation framed to insure a clean product, must be drafted with care so that in no way will it resemble prohibition but rather a regulation for the sale of this useful food product.

Some of the provisions of the statute should be more carefully observed by milk dealers; for instance, in numerous cases no license number is displayed on the outside of the wagon; this is required by law and should be carefully observed. It has also been brought to our attention that people are selling milk without a license, in some cases, from stores and it has been discovered that a regular milk business has been carried on from a delivery team, not having taken care to procure a license. This seems inexcusable, as obtaining a license carries no expense except the postage for application.

It has been noticed that in some cases when selling from cans the milk is not dispensed consistently when portions are drawn. Care should be taken that the can is turned frequently so the cream will be well mixed with the milk and thus insure a standard quality. It is also recommended to milk dealers that some method be adopted to prevent milk in their delivery wagons from freezing, as freezing renders the milk more liable to decompose, injures its keeping qualities and consequently increases its unfitness for food.

Another practice to be advised against very strongly is that of filling bottles in the street, using the bottles as they have been returned from the consumer and thus being subjected to the danger that the bottles have not been sterilized and also to the contamination of the dust of the street or vehicle. In this connection the milk men should consider carefully the danger of violating the clause of the Pure Food Law which provides that foods shall at all times, when offered or exposed for sale, be carefully protected from filth, flies, dust and other contamination.

It is not intended to be over technical in the requirements but there is no excuse to be offered for the unclean appearance of a driver or horse, and the unsanitary condition of wagons employed in the delivery of milk.

March, 1915.

MAINE
AGRICULTURAL EXPERIMENT STATION
ORONO, MAINE.

ANALYSTS.

James M. Bartlett
Royden L. Hammond
Elmer R. Tobey
Herman H. Hanson
Edward E. Sawyer
Hoyt D. Lucas

Official Inspections

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FUNGICIDE AND INSECTICIDE INSPECTION

The Commissioner of Agriculture is the executive of the law regulating the sale of fungicides and insecticides in Maine. It is the duty of the Maine Agricultural Experiment Station to make the analyses of the samples collected by the Commissioner, and it is the duty of the Director to publish the results of the analyses of the samples of fungicides and insecticides, and such additional information as may seem advisable.

CONTENTS.

NOTE. All correspondence relative to the inspection laws should be addressed to the Bureau of Inspections, Department of Agriculture, Augusta, Maine.

REFERENCE LIST OF FUNGICIDES AND INSECTICIDES REGISTERED IN 1914.

The first page number refers to the tabulated reports and the second number to the page on which the results are discussed.

Arsenate of Lead Paste.

Name and Address of Maker and Name of Goods.	Claims Made on Certificate or on Label.	Results of Examination.
A. B. Ansbacher & Co., New York City. Ansbacher's Triangle Brand Quick-Death Arsenate of Lead Paste.	Contains not less than 15 per cent arsenic oxide, at least 50 per cent dry arsenate of lead, not over ½ per cent water soluble. 1 pound.	Full weight. Composition as claimed. Passed.
The Bowker Insecticide Company, Boston. Mass. Bowker's Arsenate of Lead (Disparene Brand).	Arsenic oxide not less than 14 per cent. Water soluble arsenic oxide not more than .6 per cent and water not more than 50 per cent.	Goods not sampled in 1914
Corona Chemical Co., Newark, N. J. Corona Arsenate of Lead.	Contains over 30 per cent arsenic oxide. Not over .75 percent water soluble. One pound.	Full weight. Composition as claimed. Passed.
The Grasselli Chemical Co. of Mass. Boston. Grasselli Arsenate of Lead Paste.	Contains not less than 13½ per cent total arsenic oxide, not more than .50 per cent water soluble and not more than 50 per cent water. The claim on label is in terms of lead arsenate. Twopounds	Net weight 29.7 ounces. Composition as claimed on certificate. Not properly labeled. Short weight.
Hemingway & Company, Inc., Bound Brook, N. J. Hemingway's Pure Lead Arsenate (Paste Form).	Not less than 15 per cent arsenic oxide, not more than ½ per cent soluble and not more than 50 per cent water.	Goods not sampled in 1914.
Interstate Chemical Co., Jersey City, N. J. Key Brand Arsenate of Lead (Paste).	Not less than 9 per cent arsenic oxide and not more than .48 per cent soluble.	Goods not sampled in 1914.
Merrimac Chemical Co., Boston, Mass. Swift's Arsenate of Lead.	Not less than 12½ per cent arsenic oxide, not more than .75 per cent soluble and not more than 50 per cent water. These facts are not stated on label. One pound.	Net weight 15.34 oz. Composition enough above that claimed to offset short weight. Not properly labeled. Short weight.
Niagara Sprayer Company, Middleport, N. Y. Niagara Brand Arsenate of Lead.	Not less than 15 per cent arsenic oxide, not more than .75 per cent soluble arsenic oxide and not more than 50 per cent inert ingredients.	Goods not sampled in 1914.
Powers-Weightman-Rosengarten Company, Philadelphia, Penn. Lead Arsenate Paste.	Not less than 12½ per cent arsenic oxide, not more than .75 per cent soluble and less than 45 per cent inert ingredients. 1 lb.	Full weight. Composition as claimed. Passed.
The Sherwin Williams Co., Boston, Mass. Sherwin-Williams 15 per cent Arsenate of Lead.	Contains not less than 15 per cent arsenic oxide and not more than .75 water soluble. 1 pound.	Net weight 15.3 ounces. Composition as claimed. Total arsenic oxide is enough above claim to offset short weight.
The Sherwin Williams Co., Boston, Mass. Sherwin-Williams New Process Arsenate of Lead.	Not less than 12 per cent arsenic oxide. Not over .75 per cent soluble. Not over 50 per cent water. One pound.	Full weight. Composition as claimed. Passed.
Thomson Chemical Co., Baltimore, Md. Orchard Brand Arsenate of Lead Standard Paste.	Not less than 9.8 per cent metallic arsenic, not over .48 per cent soluble and not over 50 per cent inert ingredients.	Goods not sampled in 1914.

Dry Powdered Arsenate of Lead.

Name and Address of Maker and Name of Goods.	Claims Made on Certificate or on Label.	Results of Examination.
A. B. Ansbacher & Co., New York City. Ansbacher's Neutral Quick-killing Arsenate of Lead Insecticide.	No certificate filed. One pound. 30 per cent arsenic oxide.	Full weight. Composition as claimed. Not registered in 1914. Sale unlawful.
The Corona Chemical Company, Milwaukee, Wis. Corona Dry Powdered Arsenate of Lead.	One pound. Not less than 30 per cent arsenic oxide, not over .75 per cent water soluble.	Weighed 15.6 ounces. Composition as claimed. Higher composition offsets short weight.
F. W. Devoe & C. T. Reynolds Co., New York City. Dry Materials for Making Arsenate of Lead.	Not less than 30 per cent arsenic oxide.	Not sampled in 1914.
The Grasselli Chemical Co. of Mass. Boston Grasselli Arsenate of Lead Powdered.	Not less than 27 per cent arsenic oxide and not more than 1 per cent soluble .5 lbs.	Full weight. Composition as claimed. Passed.
Hemingway & Company, Inc., New York City. CAASCU (Pronounced K. S. Q. Trade mark) (Dry Powdered Form).	Not less than 34 per cent arsenic oxide. Not more than ½ per cent soluble.	Not sampled in 1914.
Powers-Weightman-Rosengarten Co., Philadelphia, Penn. Lead Arsenate Powder.	Not less than 25 per cent arsenic oxide. Not over .75 per cent soluble. Not more than 6 per cent inert ingredients.	Not sampled in 1914.
The Sherwin-Williams Co., Boston, Mass. Sherwin-Williams Dry Powdered Arsenate of Lead.	Not less than 30 per cent arsenic oxide, not over 1.5 per cent soluble. 1 lb.	Full weight. Composition as claimed. Passed.

Arsenate of Zinc Preparations.

Name and Address of Maker and Name of Goods.	Claims Made on Certificate or on Label.	Results of Examination.
Thomsen Chemical Co., Baltimore, Md. Orchard Brand Arsenite of Zinc Paste.	Contains not less than 15 per cent metallic arsenic and not more than 1 per cent soluble and not over 55 per cent inert.	Not sampled in 1914.
Thomsen Chemical Co., Baltimore, Md. Orchard Brand Arsenite of Zinc Powder.	Contains not less than 30.5 per cent arsenic, not more than .75 per cent soluble and not over 10 per cent inert. 1 pound.	Net weight 12.8 ounces. Composition as claimed. Short weight.
Thomsen Chemical Co., Baltimore, Md. Orchard Brand Arsenite of Zinc combined with Bordeaux Mixture.	Contains not less than 5 per cent metallic arsenic, not less than 6 per cent metallic copper, not over .75 per cent soluble arsenic and not over 79 per cent inert materials.	Not sampled in 1914.

Paris Green.

Name and Address of Maker and Name of Goods.	Claims Made on Certificate or on Label.	Results of Examination.
A. B. Ansbacher & Co., New York City, Ansbacher's Paris Green.	One pound. At least 50 per cent arsenious oxide and less than 3½ per cent soluble.	Full weight. Composition as claimed. Passed.
James A. Blanchard Co., New York. Lion Brand Paris Green.	Not less than 50 per cent arsenious oxide and not more than 3½ per cent water soluble. Two lbs.	Weight 30.54 ounces. Water soluble arsenious oxide 3.04 per cent. Total as claimed. Short weight. Too much water soluble.
F. W. Devoe & C. T. Reynolds Co., New York City. Reynolds' Paris Green.	Not less than 56 per cent total arsenious oxide, and not more than 2 per cent water soluble. One lb.	Full weight. Total arsenious oxide as claimed. 2.53 per cent water soluble.
Morris Hermann & Co., New York. Hermann's Hi-Grade Pure Paris Green.	One pound. On label not less than 50 per cent and certificate not less than 57 percent total arsenious oxide. Not more than 3½ per cent water soluble.	Full weight. Above claim on certificate. Passed.
Fred L. Lavenburg, New York City. Star brand Paris Green.	One pound. More than 50 per cent arsenious oxide. Less than 3½ per cent soluble in water.	Full weight. Composition as claimed. Passed.
John Lucas & Co., Inc., Boston, Mass. Lucas Paris Green.	Two pounds. Not less than 50 per cent arsenious oxide. Not more than 3½ per cent water soluble.	Weighed 31.34 ounces. Composition as claimed. Short weight.
The Sherwin-Williams Co., Boston, Mass. Sherwin-Williams Paris Green.	One pound. Not less than 50 percent arsenious oxide or more than 3½ per cent soluble.	Full weight. Composition as claimed. Passed.

Water Soluble Arsenical Poisons.

Name and Address of Maker and Name of Goods.	Claims Made on Certificate or on Label.	Results of Examination.
Briggs Hardware Co., Caribou. Briggs Soluble Arsenate.	2 lbs. Contains not less than 40 per cent total arsenic all of which is soluble.	Full weight. Composition as claimed. Passed.
Morris Herrman and Company, New York City. Herrman's Arsite.	One pint. Total and water soluble arsenic not less than 28.8 per cent.	Full measure. Composition as claimed. Passed.
John Watson & Co., Houlton. Watson's Soluble Arsenoid.	2 lbs. Contains not less than 35 per cent total and water soluble arsenic.	Full weight. Composition as claimed. Passed.

Combined Fungicides and Insecticides Containing Copper and Arsenic.

Name and Address of Maker and Name of Goods.	Claims Made on Certificate or on Label.	Results of Examination.
The Bowker Insecticide Co., Boston, Mass. Bowker's Pyrox.	Contains not less than 1.5 per cent. copper and 5.25 per cent. arsenic oxide and not over 80.25 per cent. inert ingredients. 1 lb.	Net weight 16.8 ounces. Contained 2.38 per cent. copper and 7.80 per cent. arsenic oxide. Passed.
Frost Insecticide Co., Arlington, Mass. Arlington Brand Bordo-Lead.	Contains not less than 4.5 per cent. total arsenic.	Not sampled in 1914.
The Grasselli Chemical Co. of Mass. Boston, Grasselli Bordeaux-Lead Arsenate Mixture Paste.	Contains not less than 3½ per cent. arsenic oxide and 5 per cent. copper hydroxide and not over 85¼ per cent. inert ingredients. 1 lb.	Net weight 14.4 ounces. Contained 2.75 per cent. copper and 3.68 per cent. arsenic oxide. Short weight.
Morris Hermann & Co., New York City. Herrmann's Tonicide (Blue Label No. 1).	Contains not less than 3.69 per cent. metallic arsenic and not over 78.31 per cent. inert ingredients.	Not sampled in 1914.
Morris Herrmann & Co., New York City. Herrmann's Tonicide (Red Label).	Contains not less than 5.21 per cent. metallic arsenic, and not over 72.4 per cent. inert ingredients.	Not sampled in 1914.
Interstate Chemical Co., Jersey City, N. J. Key Brand Bordo-Lead.	Contains not less than 4½ per cent. metallic arsenic and 2 per cent. copper. Weight not stated on label.	Net weight 15.6 ounces. Contained 6.06 per cent. arsenic and 2.19 per cent. copper.
Kil-Tone Co., Newark, N. J. Fru-Tone.	Contains not less than 7 per cent. arsenic oxide and 4 per cent. copper hydrate and not over 89 per cent. inert ingredients.	Not sampled in 1914.
Kil-Tone Co., Newark, N. J. Kil-Tone.	Contains not less than 7 per cent. arsenic oxide and 8 per cent. copper hydrate and not over 85 per cent. inert ingredients.	Not sampled in 1914.
Leggett & Brother, New York City. Dry Bordeaux Mixture and Paris Green Compound.	Contains not less than 14.62 per cent. metallic arsenic and not over 57½ per cent. inert ingredients.	Not sampled in 1914.
The Sherwin Williams Co., Cleveland, O., and Boston, Mass. Tuber Tonic.	Contains 3.6 per cent. arsenate of lead, 26.1 per cent. arsenites of calcium and copper and 6.3 per cent. copper of Bordeaux. Not over 64 per cent. inert ingredients. 1 lb.	Net weight, 16.7 ounces. Contained 7.4 per cent. copper and 10.07 per cent. arsenic oxide. Passed.
Sterling Chemical Co., Cambridge, Mass. Sterlingworth Ar-Bo.	No certificate filed. Claimed on label to contain 1.75 per cent. copper of Bordeaux, 4 per cent. metallic arsenic. Not over 73.3 per cent. inert. 1 lb.	Net weight 15.5 ounces. Contained 2.3 per cent. copper, 4.39 per cent. arsenious oxide. Not registered in 1914. Not lawfully sold.

Prepared Bordeaux Mixture.

Name and Address of Maker and Name of Goods.	Claims Made on Certificate or on Label.	Results of Examination.
Joseph Breck and Sons, Boston, Mass. Acme Brand Liquid Bordeaux Mixture.	No certificate filed. Copper 3.5 per cent. Irert 96.5 per cent. 1 qt.	Net weight, 41.6 ounces. Composition as claimed. Not registered in 1914.
Grasselli Chemical Co. of Boston, Mass. Grasselli Bordeaux Mixture Paste.	Not less than 7 per cent. copper hydroxide 95½ per cent. inert.	Not sampled in 1914.
Kil-Tone Company, Newark, N. J. Veg-Tone.	Contains not less than 8 per cent. copper hydrate and not over 92 per cent. inert ingredients.	Not sampled in 1914.
Sterling Chemical Co., Cambridge, Mass. Sterlingworth Bordeaux Mixture, Dry.	No claims on package for composition. 1 lb. No certificate filed.	Net weight 15.9 ounces. Copper found 16.78 per cent. Water 5.35 per cent. Not registered in 1914.
Sterling Chemical Co., Cambridge, Mass. Sterlingworth Liquid Bordeaux.	Not over 97 per cent. inert. On label, 14 per cent. copper sulphate. 1 quart.	Net weight, 42.85 ounces. Composition as claimed. Passed.

Lime-Sulphur Solution.

Name and Address of Maker and Name of Goods.	Claims Made on Certificate or on Label.	Results of Examination.
The Bowker Insecticide Co., Boston, Mass. Bowker's Concentrated Lime-Sulphur.	Not less than 27 per cent calcium polysulphides. Not less than .50 per cent calcium thiosulphate Not over 72.5 per cent inert. No claims on label.	Net weight 25.27 ounces. Total sulphur found 27.23 per cent. Weight not stated as required by law.
The Frost Insecticide Co., Arlington, Mass. Arlington Brand Lime Sulphur Solution.	Not less than 25 per cent total sulphur and not over 68 per cent inert.	Not sampled in 1914.
The Grasselli Chemical Co. of Boston, Mass. Grasselli Lime Sulphur Solution.	Not less than 25 per cent sulphur and not over 68 per cent inert. 1 quart.	Net weight 41.23 ounces. Total sulphur found 24.13 per cent. Sulphur below amount claimed.
The Sherwin-Williams Co., Boston, Mass. Sherwin-Williams Lime-Sulfur Solution.	Not less than 30 per cent calcium polysulphid and 2 per cent calcium thiosulphate. Not over 68 per cent inert. On label 24 per cent sulphur. 1 qt.	Net weight 41.63 ounces. Sulphur as claimed. Passed.
Thomsen Chemical Co., Baltimore, Md. Orchard Brand Lime-Sulphur Solution.	Not less than 24 per cent sulphur and not over 70 per cent inert.	Not sampled in 1914.

Soluble Sulphur Compound.

Under this name the Niagara Sprayer Company of Middleport, N. Y., registered a brand that was claimed to carry 58 per cent. sulphur, not more than 40 per cent. sodium, and 2 per cent. inert ingredients. The goods were not sampled in 1914.

Hammond's Slug Shot.

Under the above name, Benjamin Hammond, Beacon, New York, has registered an insecticide guaranteed to contain not less than 1 per cent. of arsenic and not over 85 per cent. inert ingredients. The goods were not sampled in 1914.

Bug Death.

Under the above name, the Danforth Chemical Company of Leominster, Mass. registered "a safe and sure remedy for all plant eating pests." It is claimed to carry not less than 47 per cent. zinc oxide, not more than 5 per cent. lead oxide and not more than 48 per cent. inert ingredients. The sample examined weighed 17.6 ounces and carried 48.23 per cent. zinc oxide and 5.10 per cent. lead oxide. Passed.

Powdered Hellebore.

Name and Address of Maker and Name of Goods.	Claims Made on Certificate or on Label.	Results of Examination.
The Jas. A. Blanchard Co., New York City. Lion Brand Pure Powdered Hellebore.	½ lb. net.	Net weight, 8.9 ounces. No adulteration. Passed.
Brewer & Co., Worcester, Mass. Powdered White Hellebore.	100 per cent. pure.	Not sampled in 1914.
Carter, Carter & Meigs Co., Boston, Mass. Powdered White Hellebore.	100 per cent. pure.	Not sampled in 1914.
Cook, Everett & Pennell, Portland, Maine. Pure Powdered White Hellebore.	Weight not stated on label.	Net weight, 5.3 ounces. No adulteration.
Leggett & Brother, New York City. Anchor Brand Powdered Hellebore.	Pure. Weight not stated on label.	Net weight, 7.9 ounces. Adulterated by addition of cereal starch.
Lehn & Fink, New York City. Powdered Hellebore.	100 per cent. pure, ¼ lb.	Net weight, 4.8 ounces. No adulteration. Passed.
Jaynes Drug Co., Boston, Mass. Powdered White Hellebore.	Pure.	Not sampled in 1914.

Dalmation Insect Powder.

Insect powder was registered in 1914 by the following:
Archibald & Lewis Co., New York City, Black Diamond Brand.
The James A. Blanchard Co., New York City, Lion Brand.
Brewer & Co., Worcester, Mass.
Carter, Carter & Meigs Co., Boston, Mass.
Cook, Everett & Pennell, Portland, Maine.
Jaynes Drug Company, Boston, Magic Brand.
Leggett & Brother, New York City, Anchor Brand.
Lehn & Fink, New York City.
Stallman Co., New York City.
Caldwell Sweet Co., Bangor.

Only one sample of Dalmation powder was collected by the inspectors in 1914 and that was found to be without adulteration.

Plant Lice Insecticides.

Name and Address of Maker and Name of Goods.	Claims Made on Certificate or on Label.	Results of Examination.
Kentucky Tobacco Product Co., Inc., Louisville, Ky. Black Leaf, 40.	Not over 60 per cent. inert ingredients.	Not sampled in 1914.
Kentucky Tobacco Product Co., Inc. Louiseville, Ky. Nico-Fume Liquid.	Contains not over 60 per cent. inert ingredients.	Not sampled in 1914.
Parke, Davis & Co., Detroit. Mich. Nictone.	Contains 10 per cent. nicotine and 90 per cent. water.	Not sampled in 1914.
Sterling Chemical Co., Cambridge, Mass. Sterlingworth Fish Oil Soap and Tobacco.	Contains not over 40 per cent. inert ingredients, 1 lb.	Net weight 14.9 ounces. A soap containing fish oil and tobacco extract.
Sterling Chemical Co., Cambridge, Mass. Sterlingworth Kerosene Emulsion.	Contains not over 33 per cent. inert ingredients. Weight or volume not given on label.	Net volume .94 quart. Apparently a kerosene emulsion.

Potato Scab and Oat Smut Preventives.

Name and Address of Maker and Name of Goods.	Claims Made on Certificate or on Label.	Results of Examination.
Parke, Davis & Co., Detroit, Mich. Formaldehyde Solution.	Contains not less than 37 per cent. formaldehyde and six per cent wood alcohol. Inert ingredients not over 56 per cent.	Not sampled in 1914.
Sterling Chemical Co., Cambridge, Mass. Sterlingworth No Scab.	Contains not over 56 per cent. inert ingredients, 1 lb.	Net volume, 16.1 ounces. Consists of formaldehyde solution.

Mange, Flea, Dog and Poultry Lice Insecticides.

Name and Address of Maker and Name of Goods.	Claims Made on Certificate or on Label.	Results of Examination.
G. E. Conkey Company, Cleveland, Ohio. Conkey's Head Lice Ointment.	Not over 1 per cent inert. weight not given.	Net weight .56 ounce. Not examined for composition as sample was so small.
The G. E. Conkey Co., Cleveland, Ohio. Conkey's Lice Liquid.	Not over 18 per cent inert. 1 quart.	Net volume 1.05 quarts. A liquid coal tar preparation. Passed.
The G. E. Conkey Co., Cleveland, Ohio. Conkey's Lice Powder.	Not over 83.5 per cent inert. 5 ounces.	Net weight 5.5 ounces. Contains lime, tobacco and sulphur (15.25 per cent). Passed.

Mange, Flea, Dog and Poultry Lice Insecticides—Continued.

Name and Address of Maker and Name of Goods.	Claims Made on Certificate or on Label.	Results of Examination.
The G. E. Conkey Co., Cleveland, Ohio, Conkey's Noxicide.	Not over 12 per cent inert.	Not sampled in 1914.
Dr. A. C. Daniels, Inc., Boston, Mass. Dr. Daniel's Flea Powder.	Not over 12 per cent inert. Weight not given.	Net weight 2.96 ounces. Contains insect powder, tobacco, naphthaline and has an odor of menthol. The inert material is loam.
Dr. A. C. Daniels, Inc., Boston, Mass. Dr. A. C. Daniels Mange Remedy (called specific on label).	Kaolu 10 per cent, Umber 1 per cent. Inert 14½ per cent.	A salve. Not examined.
Gilbert & Rolfe, Boston, Mass. Verm-O-Line.	Not over 95.44 per cent inert. Composition not claimed on label. Weight not given on label.	Net weight 1.3 ounces. A strongly acid ointment in a tube. Not analyzed.
H. Clay Glover, N. Y. Glover's Mange Remedy.	No certificate filed. Composition not claimed on label. Weight not given on label.	Contains 6 5-8 ounces. A heavy hydrocarbon with the odor of tar. Unregistered. Not lawfully sold
Dr. Hess & Clark, Ashland, Ohio. Instant Louse Killer.	Not over 31.08 per cent inert ingredients. 1 lb.	Net weight 18.3 ounces. A mixture of yellow ochre and tobacco and a small amount naphthaline. Passed.
International Stock Food Co., Minneapolis, Minn. International Louse Killer.	Not over 93.6 per cent inert ingredients. Weight not given on label.	Net weight 18.4 ounces. Composed of lime and talc with some tobacco.
Geo. H. Lee Co., Omaha, Neb. Lee's Lice Killer.	Not over 6 per cent inert ingredients.	Not sampled in 1914.
O. K. Stock Food Co., Chicago, Ill. Lambert's Death to Lice Powder.	Inert ingredients not over 98.9 per cent. Nicotine 5 per cent. Oil creosote 6 per cent. 15 ounces.	Net weight 15.5 ounces. Contains tobacco, sand, lime, and small amount of creosote oil. Passed.
The Park and Pollard Co., Boston, Mass. Park's Lice Killer.	Not over 95 per cent inert.	Not sampled in 1914.
The Park and Pollard Co., Boston, Mass. Park & Pollard Company's Lice Powder.	Not over 95 per cent inert.	Not sampled in 1914.
Pratt Food Co., Philadelphia, Penn. Pratt's Powdered Lice Killer.	Hydrated magnesium silicate 22.4 per cent. 1 lb.	Net weight 13.8 ounces. A mixture of talc and tobacco with some iron and lime compounds present. Short weight.
Pratt Food Co., Philadelphia, Penn. Pratt's Liquid Lice Killer.	Rock oil 80 per cent. Creosote oil 20 per cent. 1 qt.	Net volume 1.07 quarts. Mixture of crude petroleum and creosote oil. Passed.
Pratt Food Co., Philadelphia, Penn. Pratt's Head Lice Ointment.	Flowers of sulphur 6.3 per cent. petrolatum 67.8 per cent, phenol 3.1 per cent, oil of capsicum .8 per cent, and wax and rosin each 11 per cent.	Not sampled in 1914.

Mange, Flea, Dog and Poultry Lice Insecticides—Concluded.

Name and Address of Maker and Name of Goods.	Claims Made on Certificate or on Label.	Results of Examination.
Pratt Food Co., Philadelphia, Penn. Pratt's Powdered Lice Killer.	Not over 22.4 per cent inert.	Not sampled in 1914.
Roberts (Dr. David) Veterinary Co., Waukesha, Wis. Dr. David Roberts' Diolice.	Not over 65 per cent inert.	Not sampled in 1914.
Roberts (Dr. David) Veterinary Co., Waukesha, Wis. Dr. David Roberts' Poultry Louse Powder.	Not over 73 per cent inert.	Not sampled in 1914.
Sterling Chemical Company, Cambridge, Mass. Sterlingworth Lice Powder.	Not over 77 per cent inert. Contains powdered tobacco. 5 ounces.	Net weight 5.2 ounces. Contains tobacco and a coal tar preparation. Passed.
Sterling Chemical Company, Cambridge, Mass. Sterlingworth Liquid Lice and Mite Killer.	Not over 3 per cent inert.	Not sampled in 1914.
United Drug Company, Boston, Mass. Elkay's Flea Destroyer.	Contains lard, cottonseed oil, sodium hydrate, water, alcohol, cresol.	Not sampled in 1914.
United Drug Company, Boston, Mass. Elkay's Mange Lotion.	Contains cottonseed oil, alcohol, water, potassium hydrate and cresol. Weight not given on label	Net volume 7¼ ounces. Not analyzed.

Sheep Dips.

Name and Address of Maker and Name of Goods.	Claims Made on Certificate or on Label.	Results of Examination.
William Cooper & Nephew, Chicago, Ill. Cooper's Sheep Dipping Powder.	Contains not less than 16.75 per cent. arsenic soluble in water. Weight not stated on label.	Net weight 36 ounces. Total arsenic 18.2 per cent. Water soluble arsenic 16.66 per cent.
Dr. Hess and Clark, Ashland, Ohio. Dr. Hess Dip and Disinfectant.	Not over 9½ per cent. inert ingredients, 1 quart.	Net volume, .94 quart. A liquid coal tar preparation.
Pratt Food Co., Philadelphia, Penn. Pratt's Dip & Disinfectant.	Not over 9 per cent. inert ingredients. Composed of phenols, rosin, water, soap, creosote.	Not sampled in 1914.
Parke, Davis & Co., Detroit, Mich. Kreso Dip.	Not over 5 per cent. inert ingredients, one pint.	Net volume, .97 pint. A heavy hydro carbon with coal tar.
Sterling Chemical Co., Cambridge, Mass. Sterlingworth Sheep Dip.	Not over 15 per cent. inert ingredients.	Not sampled in 1914.
West Disinfecting Co., New York City. Chloro-Napholeum Dip.	Not over 10 per cent. inert ingredients.	Not sampled in 1914.

Insecticides for Flies on Cattle, in Stables, etc.

Brands Registered in 1914. These goods were not sampled in 1914. They are very much alike and depend upon a mixture of vegetable oils, hydrocarbons from petroleum, crude petroleum and coal tar derivatives for their repelling powers.

Name and Address of Maker and Name of Goods.	Claims Made on Certificate.
The J. H. Ames Co., Bowdoinham, Maine, Eureka Fly Killer.	No inert ingredients.
Carpenter-Morton Co., Boston, Mass. Cow-Ease.	No inert ingredients.
W. D. Carpenter Co., Syracuse, N. Y. No-Fly.	No inert ingredients.
Cook, Everett and Pennell, Portland. Cattle Oil.	Contains not more than 72 per cent. inert ingredients and is composed of paraffin oil, tar oil, carbolic acid and oil citronella.
The G. E. Conkey Co., Cleveland, Ohio Conkey's Fly Knocker.	Contains not over 2 per cent. inert ingre-. ents.
The Dirigo Chemical Co., Hermon, Maine. Knox-Em-All (Fly Oil).	No inert ingredients.
Eureka Mower Co., Utica, N. Y. Cows' Favorite Oil.	No inert ingredients.
Eureka Mower Co., Utica, N. Y. Will Kill Flies.	No inert ingredients.
Gould and Cutler Corporation, Boston, Mass. Cow Comfort Oil.	Not over 11 per cent. inert ingredients.
Dr. Hess & Clark, Ashland, Ohio. Dr. Hess' Fly Chaser.	Not to exceed 3 per cent. inert ingredients.
The R. M. Hollingshead Co., Camden, N. J. Whiz Fly Spray.	No inert ingredients. Composed of mineral and cresota oils.
Kimball Bros. & Co., Enosburg Falls, Vt. Kimball's Fly Oil.	No inert ingredients.
George W. Lewis & Son, Westboro, Mass. Lewis' Lice and Fly Destroyer.	Contains oils only. No inert ingredients.
Northwood Mfg. Co., Potsdam, N. Y. Dr. Thatcher's Fly Killer.	No inert ingredients.
Pratt Food Co., Philadelphia, Penn. Pratt's Fly Chaser.	No inert ingredients. Consists of pine tar oil, rock oil, creosote oil.
Sterling Chemical Co., Cambridge, Mass. Guaranteed Cattle Oil.	No inert ingredients.
Abner L. Whiting, Wells Depot, Maine. Whiting's Instant Insecticide and Animal Ease.	Not more than 11 per cent. inert ingredients.
W. A. Wood Co., Boston, Mass. H. & C. Cattle Oil.	No inert ingredients. Consists wholly of a hydrocarbon and a distilled vegetable oil.

Insecticides for Roaches, etc.

Name and Address of Maker and Name of Goods.	Claims Made on Certificate or on Label.	Results of Examination.
American Druggists Syndicate, Long Island City, N. Y. Sure Shot Roach Powder.	Not over 33⅓ per cent inert ingredients.	Not sampled in 1914.
Barrett Chemical Co., New York City. Roachsault.	Sodium fluoride 50 per cent. Inert ingredients 50 per cent. 6½ ounces.	Net weight 6.4 ounces. Composition as claimed. Passed.
Eastern Drug Co., Boston, Mass. Barnard & Co's Infallible Water Bug and Roach Exterminator.	Composition and weight not given on label. No certificate filed.	Phosphoros is evidently the active ingredient of which the sample examined carried 1.4 per cent. Net weight 3.84 ounces. Unregistered. Not lawfully sold.
S. Gumpert & Co., Brooklyn, N. Y. Killsemal.	No inert ingredients. Composed of sodium borate and sodium fluoride.	Not sampled in 1914.
O. H. Jadwin and Sons, Inc., New York City. Hooper's Fatal Food for Roaches.	Not less than 25 per cent sodium fluoride and not over 75 per cent inert. Weight not given on label	Net weight 5.57 ounces. Composition as claimed.
Jaynes Drug Company (Riker-Jaynes Drug Co. on label), Boston, Mass. Roachicide.	13 per cent rye flour, 6 per cent glue, 6 per cent sodium chloride and 75 per cent borax. Weight not given on label.	Net weight 3.1 ounces. Composition as claimed.
Nyal Company, Detroit, Mich. Nyal's Roach Powder.	Borax 48 per cent, inert matter 52 per cent. Trace color.	Not sampled in 1914.
Chas. Parsons & Co. Parsons & Co's Vermin and Insect Exterminator.	No certificate filed. Composition not claimed on label. No weight given.	Phosphorus is evidently the active constituent of which the sample examined carried .74 per cent. Unregistered. Not lawfully sold.
W. M. Peterman, New York City. Peterman's Roach Food	No certificate filed. Composition not claimed on label. Weight not given.	Net weight 6.6 ounces The sample examined carried sodium fluoride, and starch. Unregistered. Not lawfully sold.
Pfeiffer Chemical Co., Philadelphia, Penn. Hobson's Rat and Roach Paste.	Not less than 2¾ per cent arsenic and not over 97¼ per cent inert ingredients.	Not sampled in 1914.
The Rat Biscuit Company, Springfield, Ohio. Rat Bis-Kit Paste.	Not less than 2 per cent phosphorus and not over 98 per cent inert. Weight not given on label.	Net weight 2.08 ounces Phosphorus found in sample examined was 1.8 per cent.
Stearns Electric Paste Co., Chicago, Ill. Stearns Electric Rat and Roach Paste.	No certificate filed. Composition not given on label. Weight not given.	Phosphorus is evidently the active constitutent of which the sample examined carried 1.31 per cent. Unregistered. Not lawfully sold.
Sterling Chemical Company, Cambridge, Mass. Sterlingworth Roach Killer.	Claimed that it contains no inert materials.	Not sampled in 1914.

Insecticides for Roaches, etc.—Concluded.

Name and Address of Maker and Name of Goods.	Claims Made on Certificate or on Label.	Results of Examination.
United Drug Company, Boston, Mass. Elkay's Ant, Bug and Roach Powder.	Borax 38 parts, cocoa, 6 parts, starch 9 parts, sugar 3 parts, Dalmation insect powder 10 parts. Weight no, given on label.	Net weight 1.8 ounces. Composition as claimed.
Waltham Chemical Co., Waltham, Mass. Martin's Pest Exterminator for Cockroaches.	No certificate filed. Composition not on label. Weight not given.	Net weight 3.1 ounces. Active constituent sodium fluoride. Unregistered. Not lawfully sold.
West Disinfecting Company, New York City. Kilroach.	Not over 20 per cent inert ingredients.	Not sampled in 1914.
Yankee Chemical Co., Springfield, Ohio. Yankee Roach Powder.	No certificate filed. Composition not on label. Weight not given.	Net weight 3.88 ounces. A mixture of insect powder, borax and corn starch. Unregistered. Not lawfully sold.

Larkspur and Similar Lotions for Head Lice.

Name and Address of Maker and Name of Goods.	Claims Made on Certificate or on Label.	Results of Examination.
Asa F. Abbott, Portland, Me. Concentrated Solution Larkspur.	Fluid extract larkspur seed 25 per cent. Remainder inert.	Not sampled in 1914.
Jaynes Drug Company, Boston, Mass. Capitina.	Soluble constituents larkspur seed 10 per cent. Remainder inert. 4 ounces.	Net volume 4¼ ounces. Composition as claimed. Passed.
Nyal Company, Detroit, Mich. Nyal's Compound Larkspur Lotion.	Larkspur, sabadilla and stavesacre equal parts and inert solvents. Weight not given.	Net volume 3⅛ ounces. Composition as claimed.
Nyal Company, Detroit, Mich. Dike's Delphin Lotion.	Larkspur 2.4 per cent Stavesacre 2.25 per cent, Sabadilla 2.25 per cent. Inert ingredients 93.1 per cent.	Not examined in 1914.
Orion Laboratories, Inc., Long Island City, N. Y. Larkspur Lotion.	Composition not claimed on certificate or label. Weight not given.	Net volume 3¼ ounces. Larkspur active ingredient.
United Drug Company, Boston, Mass. Rexall Compound Larskpur Lotion.	Larkspur seed 2 per cent, sabadilla seed 8 per cent. Inert solvent. 3 ounces.	Net volume 3⅛ ounces. Composition as claimed. Passed.

Insecticides for Destruction of Bed Bugs.

Name and Address of Maker and Name of Goods.	Claims Made on Certificate or on Label.	Results of Examination.
Brewer & Co., Worcester Mass. Diamond Bug Exterminator.	No inert ingredients. Composed of napthaleine, benzine and kerosene.	Not sampled in 1914.
Brewer & Co., Worcester, Mass. "Kill Em" Bug Exterminator.	No inert ingredients. Composed of benzine, kerosene and napthaleine.	Not sampled in 1914.
Fredk. Dutcher Drug Co., St. Albans. Vt. Dead Shot.	No certificate filed. Composition not claimed on label.	Wood alcohol and an organic poison. Not registered. Not lawfully sold.
Chas. M. Hay Paint Co., Portland. Farewell to Bed Bugs.	No certificate filed. Composition not claimed on label.	Contains naptha and turpentine. Unregistered. Not lawfully sold.
Jaynes Drug Company, Boston, Mass. Bed Bug Exterminator.	Consists of powdered sabadilla seed and talc. Weight not stated on label.	Net weight 10.5 ounces. Composition as claimed.
Jaynes Drug Company, Boston Mass. Bed Bug Poison.	Contains 10 per cent corrosive sublimate dissolved in muriate of ammonia, salt and water.	Not sampled in 1914.
Jaynes Drug Company, Boston, Mass. Jaynes Best Known Bugcide Exterminator.	Consists of kerosene, carbon tetrachloride and cresol. No inert ingredients.	Not sampled in 1914.
Leggett & Brother, N. Y. Magic Fluid for Bed Bugs.	No certificate filed. Composition not claimed on label. Weight not given.	Contains 11 fluid ounces. Turpentine and petroleum. Unregistered. Not lawfully sold.
None Such Bug Killer Company, Auburn, Me. None Such Bug Killer.	No inert ingredients. Composed of gasoline, kerosene and camphor.	Not sampled in 1914.
The E. L. Patch Co., Boston, Mass. Sure Death Bug Exterminator.	No inert ingredients. 11 ounces	Contains 11.6 ounces. Mostly naptha.
Penn. Chemical Co., Philadelphia, Penn. Dead Stuck.	"Kills all insects." Volume not given.	14.9 ounces. Contains naptha.
West Disinfecting Company, New York City. Kilbug Insecticide.	No inert ingredients.	Not sampled in 1914.

Cloth and Carpet Insect Insecticides.

Name and Address of Maker and Name of Goods	Claims Made on Certificate or on Label.	Results of Examination.
Barrett Manufacturing Co., Boston, Mass. Mothex.	Contains no inert ingredients, one pound.	Net weight, 15.3 ounces. Consists of naphthaline.
Barrett Manufacturing Co., Boston, Mass. Naphthaline.	Consists of naphthaline.	Not sampled in 1914.
Carter, Carter & Meigs Co., Boston, Mass. Fragrant Naphthaline, Naphthalin balls and Naphthaline Flakes.	100 per cent. pure.	Not sampled in 1914.

Cloth and Carpet Insect Insecticides—Concluded.

Name and Address of Maker and Name of Goods.	Claims Made on Certificate or on Label.	Results of Examination.
Carter, Carter & Meigs, Boston, Mass. Campho Naphthaline.	100 per cent. pure mixture camphor and naphthaline.	Not sampled in 1914.
Carter, Carter & Meigs, Boston, Mass. Cedar Lavender with Naphthaline.	100 per cent. pure mixture cedar lavendar and naphthaline.	Not sampled in 1914.
Cook, Everett & Pennell, Portland. Buffalo Bug Exterminator.	Consists of benzine, naphthaline and oil cedar.	Not sampled in 1914.
The Crest Mfg. Co., Stoughton, Mass. Searles Lotus Disinfectant Powder.	Consists of oil of mirbane and red cedar sawdust.	Not sampled in 1914.
Hub Chemical Co., Boston, Mass. Campho-Naphthaline.	No certificate filed.	A mixture of camphor and naphthaline. Unregistered. Not lawfully sold.
Jaynes Drug Co., Boston, Mass., registered. Cedar Chest Compound and Cedar Lavender Compound with same formula.	Consists of naphthaline, cedar chips, lavender flowers and oils of cedar and lavender. One pound.	Net weight, 16.2 ounces. Composition as claimed. Passed.
The E. L. Patch Co., Boston, Mass. Aromatic Naphthaline and Camphor, under card of Whitman Chemical Co., Inc.	A combination of naphthaline, oil of camphor and oil of cedar.	Not sampled in 1914.
Union Chemical Co., Providence, R. I. Banner Cedar Spray.	No inert ingredients.	Not sampled in 1914.
United Drug Co., Boston, Mass. Red Cedar Compound.	Red cedar sawdust and naphthaline, nine ounces.	Net weight, eight ounces. Composition as claimed.

Poison Fly Paper and Similar Preparations.

The Allen-Clark Co., Boston, Mass. Electric Fly Poison Paper.	Not more than 7 per cent. water soluble arsenic and not more than 94 per cent. inert ingredients.	Not sampled in 1914.
American Druggists Syndicate, New York. A. D. S. Poison Fly Paper.	No certificate filed. On label 79 per cent. water soluble arsenic.	Contained 4.3 per cent. water soluble arsenic. Unregistered. Not lawfully sold.
I.X.L. Poison Fly Paper Co., Boston, Mass. I. X. L. Poison Fly Paper.	Contains 21.6 grains arsenate of soda.	Contained 18.7 grains arsenate of soda.
Nyal Co., Detroit, Mich. Nyal's Death to Flies.	Contains not less than 6 per cent. water soluble arsenic and not over 94 per cent. inert ingredients.	Contained 4.27 per cent. arsenic.
Pfeiffer Chemical Co., Philadelphia, Penn. Pfeiffer Chem. Co. Sure Death Fly Paper.	Contains 2.22 per cent. soluble arsenic and not over 97.78 per cent. inert ingredients.	Not sampled in 1914.
H. E. Seibert, St. Paul, Minn. Handy Fly Tin.	Not less than 60 per cent. soluble arsenic and not over 20.8 per cent. inert ingredients.	Contained 48.35 per cent. arsenic.

Poison Fly Paper and Similar Preparations—Concluded.

H. E. Seibert, St. Paul, Minn. Magic Fly Killer.	Contains not less than 60 per cent. soluble arsenic and not over 20.8 per cent. inert ingredients.	Not sampled in 1914.
H. E. Seibert, St. Paul, Minn. Seibert Poison Fly Paper.	Not less than 2 per cent. water soluble arsenic and not over 96.3 per cent. inert ingredients.	Contained 2.34 per cent. water soluble arsenic.
Willson & Co., South Boston, Mass. Eagle or Improved German Poison Fly Paper.	Not less than 6 per cent. water soluble arsenic and not over 92 per cent. inert ingredients.	Not sampled in 1914.
Nathan Wood & Son, Portland, Maine. Wood's Poison Fly Paper.	Contains not less than 6 per cent. water soluble arsenic and not over 90 per cent. inert ingredients.	Not sampled in 1914.

Black Fly and Mosquito Repellents.

Name and Address of Maker and Name of Goods.	Claims Made on Certificate.
Cook, Everett and Pennell, Portland. Black Fly Lotion.	Contains beechwood creosote, oil of citronella, oil of tar, cotton seed oil.
Cook, Everett and Pennell, Portland. Fisherman's Protector.	Contains petrolatum, beeswax, oil of tar, oil of citronella, beechwood creosote and camphor.
Cook, Everett and Pennell, Portland. Fisherman's Friend.	Contains beechwood creosote, oil of citronella and cottonseed oil.
Cummings Manufacturing Company, Morristown, N. J., Getaway Mosquito Puffs.	
East Side Pharmacy, Bangor. Skeeter Scatter.	Contains petrolatum, oil of citronella and camphor.
Fred E. Hall, Inc., Providence, R. I. Cedarmist or Hall's Cedar Spray.	
H. H. Hay Sons, Portland. Hay's Bite-Not.	
H. H. Hay Sons, Portland. Hay's Black Fly Lotion.	
Nyal Company, Detroit, Mich. Nyal's Mosquito Lotion.	-Contains citronella, oil of citronella, oil of lavendar, terpenes, and turpentine.
Pfeiffer Chemical Company, Philadelphia, Penn. Hobson's Anti Skeeter Talc.	Contains carbonate of magnesia, oil of citronella, and a trace of carbolic acid.
Riker and Hegeman Co., New York City. Mosquito Lotion.	Contains oils of hemlock, hedeoma, citronella and tar, spirits of camphor and ammonia, and alcohol.
Riker and Hegeman Co., New York City. Mosquito Talcum Powder.	Contains oil of citronella and talcum.
Caldwell Sweet Co., Bangor. Sportsman's Comforter.	
Thurston and Kingsbury, Bangor. Sportsman's Friend.	Contains citronella and oil.
United Drug Company, Boston, Mass. Rexall Skeeter Skoot.	Contains oils of eucalyptus, tar, sassafras, rosemary, citronella, camphor, origanum, lavendar, turpentine and cottonseed.

Miscellaneous Fungicides and Insecticides.

Fungicides and insecticides registered in 1914, but not sampled. The certificates did not make clear for what purpose the materials were to be used. They are arranged alphabetically by makers' names.

Name and Address of Maker and Name of Goods.	Claims Made on Certificate.
Aphine Manufacturing Co., Madison, N. J. Aphine.	Not over 97.20 per cent. inert ingredients.
Barrett Manufacturing Co., Boston, Mass. Carbonol.	Not over 9.5 per cent. inert ingredients.
Barrett Manufacturing Co., Boston, Mass. Creonoid.	Not over 3 per cent. inert ingredients.
Berlin Aniline Works, New York City. Agfa Weevil Oil.	A chemical known as Amidobenzene.
Berlin Aniline Works, New York City. Antimot (Agfa Dichlorbenzene).	A chemical known as Dichlorbenzene or Dichlorobenzene.
Brewer & Co., Worcester, Mass. Creosanthal	Consists of phenols, coal tar hydrocarbons and water. Not over 7 per cent. inert.
Samuel Cabot, Inc., Boston, Mass. Cabot's Gypsy Moth Creosote.	No inert ingredients.
Caledonia Chemical Co., Caledonia, N. Y. Stock & Poultry Remedy, "Crel Oil."	Consists of carbolic acid, corrosive sublimate and Pearson-Creolin.
Carbolineum Wood Preserving Co., N. Y. City. Avenarius Carbolineum.	Consists of hydrocarbons.
W. D. Carpenter, Syracuse, N. Y. Disinfectone.	Not over 10 per cent. inert ingredients.
Carter, Carter & Meigs Co., Boston, Mass. Cresonol.	Consists of phenols, coal tar hydrocarbons and water. Not over 9 per cent. inert ingredients.
Carter, Carter & Meigs Co., Boston, Mass. Fectol.	Consists of phenols, coal tar hydrocarbons and water. Not over 7 per cent. inert ingredients.
Archibald Dakin, Boston, Mass. Bents No.1.	An aqueous infusion of quassia and small amount of alcohol.
Dr. A. C. Daniels, Inc., Boston, Mass. Dr. A. C. Daniels Carbo Negus.	Not over 10 per cent. inert ingredients.
Jaynes Drug Co., Boston, Mass. Kreothol.	Consists of creosols, oils and water.
Merck & Co., N. Y. City. Creolin-Pearson.	Consists of phenols, rosin acids, hydrocarbons and oils. Not over 10 per cent. inert ingredients.
A. C. Meyer & Co., Baltimore, Md. Death Dust.	Consists of sodium carbonate, and chlorides-sulphates of alkalies.
H. K. Mulford Co., Philadelphia, Pa. Mulford Disinfectant Krelos.	Consists of phenols, rosin acids, and hydrocarbons. Not over 17 per cent. inert ingredients.
Parke, Davis & Co., Detroit, Mich. Compound Solution of Cresol, U. S. P.	Not over 25 per cent. inert ingredients.
Parke, Davis & Co., Detroit, Mich. Cresylone	Not over 25 per cent. inert ingredients.
Parke, Davis & Co., Detroit, Mich. Kreso.	Not over 9 per cent. inert ingredients.
Parke, Davis & Co., Detroit, Mich. Neko.	Not over 5 per cent. inert ingredients.
Parke, Davis & Co., Detroit, Mich. Septico.	Not over 8 per cent. inert ingredients.

Miscellaneous Fungicides and Insecticides—Concluded.

Name and Address of Maker and Name of Goods.	Claims Made on Certificate.
Powers-Weightman-Rosengarten Co., Philadelphia, Pa. Sodium Cyanide.	Not over 4 per cent. inert ingredients.
Pratt Food Co., Philadelphia, Pa. Pratt's Germ-a-thol.	Not over 9 per cent. inert ingredients.
Roberts (Dr. David) Veterinary Co., Waukesha, Wis. Dr. David Roberts Disinfectall.	Consists of phenols, rosin acids and hydro carbons.
Sawyer Crystal Blue Co., Boston, Mass. Septola.	Not over 7 per cent. inert ingredients.
Sterling Chemical Co., Cambridge, Mass. Sterlingworth Ant-i-cide.	Not over 50 per cent. inert ingredients.
Sterling Chemical Co., Cambridge, Mass. Sterlingworth Cut Worm Killer.	Not over 50 per cent. inert ingredients.
Sterling Chemical Co., Cambridge, Mass. Sterlingworth Hellebore and Sterlingworth Po Tobacco.	
Sulpho-Napthol Co., Boston, Mass. Sulpho-Napthol.	Not over 7 per cent. inert ingredients.
Geo. L. Warncke, Canaan, Conn. Cutworm Food.	Not over 7-8 per cent. inert ingredients.
West Disinfecting Co., N. Y. City. CH or Chloro-Naptholeum Disinfectant.	Not over 7 per cent. inert ingredients.
West Disinfecting Co., N. Y. City. Pyro Disinfectant.	Not over 10 per cent. inert ingredients.

Requirements of the Law.

The law regulating the sale of fungicides and insecticides was enacted by the legislature of 1911. It is comparatively new and is only coming to be fully understood. During the years 1912 and 1913 a large part of the work of inspection was instructing dealers relative to the law and what they must do to conform with it. Nearly all of the dealers in fungicides and insecticides were visited by the inspectors during those years and many hundred letters were written regarding the law and its requirements. While much progress was made the law is still only partly understood. The need for the law, shown in the results of the first general and imperfect survey, is still more apparent as the inspections have been continued. The situation at the start would have been very discouraging were it not for the fact that it was no worse than was the case with grass seeds or feeding stuffs when the laws regulating those commodities were enacted.

The scope of the law is the same as the National Law. It is very broad and includes all materials which are used for preventing, destroying, repelling or mitigating fungi and insects that infest vegetation, man and other animals, or houses, or any environment whatever.

Every lot or package shall be plainly marked with the number of net pounds in the package, the name or trademark under which the article is sold, the name and address of the manufacturer or shipper, the minimum percentage of total arsenic and the maximum percentage of water soluble arsenic.

Before a fungicide or insecticide can be lawfully sold in the State it is necessary that it be registered and for that purpose there must be deposited with the Commissioner of Agriculture a certified copy of the statements named above, a registration fee of $10.00, and, if the commissioner requires, a sample of the fungicide or insecticide.

The registration fee is not assessed on a brand consisting of organic matter and not containing any added inorganic matter or mineral chemical, provided that a complete chemical analysis is given in, and as a part of, the required certificate.

A fungicide or insecticide is adulterated if:—its strength or purity falls below the professed standard under which it is sold; any substance has been substituted wholly or in part for the article; any valuable constituent of the article has been wholly or in part extracted; or if it contains any substance or substances injurious to vegetation.

A fungicide or an insecticide is misbranded if:—the package or label bears any statement, design or device which is false or misleading in any particular; the container does not carry the statements named above; the printed statement attached to the container differs from the statements in the certificate; the registration fee has not been paid; it is in imitation of or offered for sale under the name of another article; it is labeled or misbranded so as to deceive the purchaser; any of the contents of the package as originally put up have been removed in whole or in part and other contents placed in such packages; or it consists partially or completely of any inert substance or substances which do not prevent, destroy, repel or mitigate insects or fungi and does not have the percentage amount of such inert substances plainly stated on the label.

It is necessary that every insecticide containing arsenic carry in addition to the weight, a chemical analysis stating the minimum percentage of total arsenic and the maximum percentage of water soluble arsenic which it contains. Standards are fixed for Paris green following the Federal law so that Paris green is adulterated if it does not contain at least 50 per cent of arsenious oxide (As_2O_3) or if it contains arsenic in water soluble form that is equivalent to more than 3.5 per cent of arsenious oxide (As_2O_3); and in the case of lead arsenate it is adulterated if it contains more than 50 per cent of water, if it contains total arsenic equivalent to less than 12.5 per cent of arsenic oxide (As_2O_5) and if it contains arsenic in water soluble form equivalent to more than .75 per cent of arsenic oxide (As_2O_5).

It is unfortunate that in the Federal Act the arsenic is stated in two ways: one in the form of arsenious and the other as arsenic oxide, because it makes it difficult to compare the strength of arsenate of lead, for instance, with Paris green from the analysis stated thereon. Inasmuch as the Federal Act requires the statement in the terms of arsenious oxide and arsenic oxide it is held by the executive of the Maine Insecticide Law that the plainly printed statement of the chemical analysis in these terms conforms to the requirements of the law, although it would have been better if it could have been stated in terms of arsenic. A little more than 75 per cent of arsenious oxide is arsenic, and a little more than 65 per cent of arsenic oxide is arsenic.

The Federal Law.

The Maine law in its requirements is based upon the national law. An insecticide that is in accord with the requirements of the National law and that is registered in Maine can be lawfully sold. The enforcement of the National law which has been well begun will materially aid in the enforcement of the law within this State. The following quoted from the Annual Report of the Insecticide and Fungicide Board of the U. S. Department of Agriculture about publicity under the federal law is encouraging in its bearing upon the sale of insecticides in this in common with other states.

"The advantage of carrying on a campaign of education through which the trade, State officials, and the consuming public might acquire a familiar knowledge of the insecticide law, its purposes, and the methods of its enforcement has not been overlooked. Necessary information has been disseminated throughout the United States by means of form letters to State officials and dealers and by the distribution of copies of the law, regulations issued thereunder, and insecticide decisions, to members of scientific societies, official representatives of foreign countries, and to those directly and indirectly connected with the manufacture and sale of insecticides, Paris greens, lead arsenates, and fungicides. Approximately 65,000 public documents of the character above described have been distributed, while information has been further conveyed through the medium of press notices summarizing insecticide decisions and other matters of general interest. A voluminous correspondence has been conducted with persons who have been sufficiently interested in the law to make special inquiries. From the tenor of the correspondence received at this department and from the oral hearings which have been held it is evident that an overwhelming majority of the manufacturers, jobbers, and dealers of this country desire to conform to the provisions of the act and to accede to the opinions of this department respecting its construction. It is hoped, therefore, that the publication of the opinions and decisions of the department will give to manufacturers the information necessary to enable them to comply with the law and thus avoid litigation."

Discussion of Results.

The law requires the publication of the results of the analyses together with such additional information as may seem advisable.

In this report the names of the dealers from whom the samples were obtained is not given as the articles are on general sale. The particular dealer from whom these regular registered and widely distributed articles were obtained is of no public importance.

Also the numerical results of the analyses are rarely given, although full examination, chemical and otherwise, was made so as to insure that the preparations were in conformity with the law and with the statements contained in the certificates and upon the packages. To publish the results of analyses showing the percentages of arsenic, for instance, in the different samples of lead arsenate might be misleading to the purchaser. For there is no assurance that in purchasing in 1915 these percentages would hold. All that the consumer has the right to expect is that the goods conform to the claims made upon the package.

The object of the laboratory examination is to see if the goods are as claimed. When the goods do not conform to the claims or unlawfully sold in any way the facts are reported to the State Department of Agriculture. The Department fully investigates each case thus reported and takes the necessary steps to protect the public. Prosecutions are made only when other methods of correction fail.

Arsenate of lead is sold in two forms—the paste and dry powdered. The tabular results are given on pages 31 and 32.

Lead arsenate paste is adulterated if it contains more than 50 per cent of water, if it contains less than 12.5 per cent of arsenic oxide, if it contains more than 0.75 per cent arsenious oxide soluble in water, or any substance has been mixed or packed with it so as to reduce or lower or injuriously effect its quality or strength, provided, however, that extra water may be added to lead arsenate if the resulting mixture is labeled "lead arsenate and water" with the percentage of extra water plainly and correctly stated on the label.

Five of the registered brands were not sampled by the inspectors in 1914. All of those that were sampled were up to their claimed composition and were lawful in that particular. It will be noted that several of them are short weight but that in two instances they carried sufficient excess of lead and arsenic to offset the shortage in weight.

There are no special requirements for the sale of dry powdered arsenate of lead. It will be noted that in all of the samples examined the composition was in accordance with the claims made upon the label. One sample was found to be short weight, but that had a sufficiently high composition to offset the slight shortage in weight.

The *arsenate of zinc* preparations were all registered by the Thomsen Chemical Company. Only one of them was sampled and that was found to be seriously short weight, although its composition was as claimed.

Paris green is adulterated if it does not contain at least 50 per cent of arsenic oxide; contains more than 3.5 per cent of arsenious oxide soluble in water; or any substance has been mixed or packed with it so as to reduce or lower or injuriously affect its quality or strength.

The injurious effect to foliage resulting from the use of Paris green is due not to the arsenic that is in combination with the copper but the free water soluble arsenic. Under the statute a very liberal amount, equivalent to 3.5 per cent of arsenious oxide, or 2.65 per cent arsenic is permitted in the case of water soluble Paris green. Several samples of Paris green were examined previous to 1913 and like all of the other greens which we have examined they carried more arsenious oxide than could be combined with the copper present. That is, the total amount of arsenic exceeded in every instance the minimum required under the law. This follows, as pointed out in earlier publications from the fact that white arsenic is the cheapest ingredient that goes into the makeup of Paris green, and hence the manufacturers will always use as much of it as possible and still have a green of good color. It is gratifying to note the marked improvement in the quality of Paris green in respect to its water soluble arsenic.

It will be noted that two of the samples examined (see table on page 33) were short weight. One sample contained more water soluble arsenic than claimed, and one contained more water soluble arsenic than is allowed under the law.

Water soluble poisons, consisting practically of sodium arsenate, are prepared for the purpose of being used on potatoes to fight potato bugs in connection with bordeaux mixture. The three brands registered in 1914 were found to be in accordance with their claimed composition. The tabular results are given on page 33.

Fungicides and Insecticides Containing Both Copper and Arsenic. There are a number of brands, consisting of copper in combination more or less analogous to that in bordeaux mixture to which has been added some poison, usually Paris green or lead arsenate, which are registered within the State. These are convenient preparations for the small grower, although if used in accordance with directions they are not as effective in preventing blight as regular bordeaux mixtures. They are usually better insecticides than they are fungicides. The tabular results are given on page 34.

Five *Prepared Bordeaux Mixtures* were found on sale in the State or else registered in 1914. The tabular results are given on page 35. There is apparently a decreasing demand for this class of materials, which are far more expensive than home-made bordeaux mixture and if used in accordance with directions are not as effective. If used in sufficient quantity so as to be comparable with the home-made bordeaux mixture they are effective but are expensive.

Lime Sulphur Solutions. It requires some special apparatus for the home preparation of lime-sulphur solution, which brings it about that most of the small orchardists prefer to buy a ready-made lime-sulphur solution than to make one themselves. So far as these goods have been examined they have been found to be in accord with their guarantees and in experimental work they have been found to be practically as effective, using the same strength, as though they were home made. The tabular report is given on page 35.

Powdered Hellebore and Insect Powders. A few samples were obtained of this class of goods in 1914 out of the number of brands registered. The results are given on page 36. The value of powdered hellebore and insect powder depends not merely upon their purity but upon their freshness. It will be noted that one sample of powdered hellebore was found to be adulterated. The dalmation powders were practically not at all sampled in 1914.

Plant Lice Insecticides. Commercial articles for the control of plant lice consist of solutions of tobacco, kerosene and other emulsions and soaps for producing emulsions. The results of the examination are given on page 37.

Potato Scab and Oat Smut Preventives. These consist of formaldehyde, and practically every farmer buys this direct under this particular name from a local druggist or dealer in agricultural seeds. The solutions specially registered are 40 per cent solutions of commercial formaldehyde in water. The analyses are given on page 37.

Dog and Poultry Lice Insecticides. Under this general classification are included a large list of various materials that are sold for the purpose of relieving dogs from fleas, and poultry from lice and other insects. It will be noted that these materials differ quite widely in their composition and they doubtless vary greatly in their efficiency. The tabulated results are given on pages 37, 38 and 39.

Sheep Dips. Only one of the sheep dips offered in Maine contained water soluble arsenic. It is doubtful if this is any more effective than the sheep dips which depended upon hydrocarbons for their efficiency and the latter are far safer to use. The results are given in the table on page 39.

Insecticides for Flies on Cattle in Stables, etc. There are a good many of these brands on sale in the State. They are all quite alike, depending upon the mixture of vegetable oils, hydrocarbons, crude petroleum and coal tar derivatives for their repelling powers. They are all more or less effective. Where flies are very numerous, unless very frequently used they lose their efficiency. The tabulated results are given on page 40.

Insecticides for Roaches. Most of the insecticides prepared for roaches are also intended for rodents, which probably accounts for there being so many brands on sale in Maine. Maine has no true roaches. It will be noted that some of these are called "rat and roach exterminators." They would not come under the insecticide law if it were not for the claims which are made upon them for roaches. The results of the examination of these are given on pages 41 and 42.

Remedies for Head Lice. Extract of larkspur is the standard remedy for head lice and is sold for this purpose by all druggists. There are a few proprietary articles put up for this purpose which consist essentially of larkspur. The results of the examination are given on page 42.

Bed Bug Insecticides. These consist of poisonous materials and of hydrocarbons, benzine, etc., which kill by contact. Most of those listed will be fairly effective for slight infestations. They would probably not clean up a house that was badly infested. For that purpose a really effective remedy seems to be a poisonous gas, which can only be used with the greatest care because of its danger to human life. To anyone desiring it a circular on bed bugs describing all remedies will be sent on application. The results of the examination are given on page 43.

The cloth and carpet insect insecticides consist practically of napthaline, which is more or less effective for these pests. The results of the examination are given on pages 43 and 44.

Poison fly paper consists of a paper soaked in water to which has been added water soluble arsenic and then dried. The results of the examination are given on page 44. They are all practically what they claim and are effective.

The blackfly and mosquito repellents are composed of such materials as oil of citronella, oil of cedar, oil of lavender, creosote, tar, camphor, etc., that have some power of driving blackflies and mosquitoes, and of materials as oils and vaseline that help allay the irritation to the skin produced by the repellents themselves. The oils also have some repellent properties. When freshly applied these repellents are more or less helpful in repelling these annoying and in some instances dangerous insects. The tabulated results of the examination are given on page 45.

Miscellaneous Fungicides and Insecticides. There were quite a number of fungicides and insecticides registered which were not sampled in 1914. From the filed certificates it was not readily determined for what purpose they were sold. These are given together, arranged alphabetically, with the name and address of the manufacturer and the claims made on the certificates. The tables are on pages 46 and 47.

STATEMENT BY THE EXECUTIVE OF THE LAW.

A. M. G. Soule, Chief Bureau of Inspections.

The inspection and registration of fungicides and insecticides have occasioned considerable labor, especially in the way of correspondence, due to the fact that the law in the State of Maine is somewhat different from the law regulating the sale of these commodities in other States. As this law is of comparatively recent enactment, we have found it to be not thoroughly understood by many offering these products for sale as to just what constitutes an insecticide under the definition of the statute, which seems to cover rather a wider range than was probably originally intended; however, according to the definition in the statute, insecticides include Paris green, lead arsenate and "any substance or mixture of substances intended to be used for preventing, destroying, repelling, or mitigating any insect which may infest vegetation, man or other animals, or houses, or be present in any environment whatsoever."

The work of inspection has been carried on carefully, and one hundred and seven samples have been collected for analysis, including Arsenate of Lead, Arsenate of Zinc, Paris Green, Lime Sulphur Solution, Lice Killers, Moth Repellents, Larkspur Lotions, Rat-Bis-Kit Paste, (carrying insecticidal claims), Cooper's Sheep Dipping Powders, and other numerous preparations.

The results of the analyses as noted in the tabulations have shown no serious discrepancy between the analysis and that guaranteed in the manufacturer's certificate and on the package, and no hearings on this charge have been arranged.

The total number of brands registered for sale in Maine during the year 1914 was two hundred and nineteen. The Inspectors found a large number of insecticides offered for sale without registration. however, and one hundred and twenty-eight hearings were arranged as the result of these violations; in most cases, when the facts were obtained, it developed that the goods had been purchased in some previous year, registration having been arranged at that time, and carried over without re-registration; sometimes it has proven to be an oversight on the part of the manufacturers in not protecting the dealers selling their products, and in still other cases—when notices have been sent to manufacturers that their goods must be registered in order to legalize their sale—the products have been withdrawn from sale in the State of Maine; the latter conditions, however, have not been found true of the insecticides and fungicides sold in large quantities—such as Paris Green and Arsenate of Lead. In the case of certain remedies, not expressly designed as insecticides but carrying rather elaborate statements in the way of insecticidal claims, when the existing law has been brought to the attention of the manufacturers they have released the products from registration requirements by changing the phraseology of their labels and eliminating such claims from their advertising matter.

April, 1915.

MAINE
AGRICULTURAL EXPERIMENT STATION
ORONO, MAINE.

ANALYSTS.

James M. Bartlett	Herman H. Hanson
Royden L. Hammond	Edward E. Sawyer
Elmer R. Tobey	Hoyt D. Lucas

Official Inspections

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CREAM AND MILK.

The Commissioner of Agriculture is the executive of the law regulating the sale of milk and cream in Maine. It is the duty of the Maine Agricultural Experiment Station to make the analyses of the samples collected by the Commissioner, and it is the duty of the Director to publish the results of the analyses of the samples of milk and cream, together with the names of the persons from whom the samples were obtained, and such additional information as may seem advisable.

NOTE. All correspondence relative to the inspection laws should be addressed to the Bureau of Inspections, Department of Agriculture, Augusta, Maine.

REQUIREMENTS OF LAW REGULATING SALE.

In order to be lawfully sold in Maine milk and cream must be of good standard quality, free from adulteration or the addition of water or any foreign substance. The cows from which the milk is drawn must be free from disease. The cans and other utensils must be clean and in a sanitary condition. Milk from which any of the cream has been removed cannot be sold as milk but may be sold as skim milk. Cream must contain not less than 18 per cent milk fat. Milk must contain not less than 11.75 per cent of milk solids and not less than 3.25 per cent of milk fat. All dairy products from the time they are produced until they reach the consumer must be protected from filth, flies, dust or other contamination, or other unclean, unhealthful or unsanitary conditions. A lawful gallon of milk contains 231 cubic inches and all sub-divisions of the gallon in the same proportion. Bottles used for the distribution of milk must be sealed by the State, town, or city sealer of weights and measures.

RESULTS OF EXAMINATION.

The results of the examination of the samples of milk and cream collected during the months of January, February and March are here reported.

Instead of printing the figures showing percentages of fat, total solids, water and the specific gravity, the results are here stated in words. It is hoped this may make the reports more readily and completely understood by the users of milk, for whose benefit the reports are printed.

QUALITY AND CLEANLINESS.

In the column under "Remarks" the terms used have the meaning as follows: The terms "excellent," "good," "fair," refer to the fat content in milk that is up to the standard in milk solids.

"Quality excellent" means more than 4.5 per cent milk fat.

"Quality good" means between 3.5 and 4.5 per cent milk fat.

"Quality fair" means between 3.25 and 3.50 per cent milk fat.

"Below standard" refers to the fat or the solids as stated in table.

"No dirt milk" contains no visible dirt.

"Very slightly dirty" milk contains at least one particle of visible dirt.

"Slightly dirty" milk contains several particles of visible dirt.

"Dirty milk" has quite a large number of particles of visible dirt.

"Very dirty" milk has a large amount of visible dirt.

"Lawful" milk is free from visible dirt, and is up to, or above, the minimum requirements for milk solids and milk fat.

CREAM.

Table showing the results of the examination of samples of cream collected in January, February and March, 1915.

Station number.	Name and Address.	Milk fat—Per cnt.	Remarks.*
	Light Cream. Standard 18 Per Cent Milk Fat.		
14570	Geo. A. Fogg, Auburn	21.0	No dirt. Lawful.
14427	R. G. Vickery, Auburn	20.0	Extremely dirty.
14519	D. E. Foster, Augusta	28.5	No dirt. Lawful.
14521	Geo. E. Macomber, Augusta	18.0	No dirt. Lawful.
14553	Webber & Hewett, Augusta	26.0	Very slightly dirty.
14318	Highland Creamery, Bridgton	19.5	Extremely dirty.
14277	Albert Hall, Thomaston	24.0	Slightly dirty.
14274	E. Lermond, Thomaston	23.0	Slightly dirty.
14532	Worthing & Parmentor, Augusta	28.0	No. dirt. Lawful.
	Heavy Cream. No Standard.		
14518	D. E. Foster, Augusta	38.0	No dirt.
14531	Worthing & Parmentor, Augusta	32.0	No dirt. Rather poor for heavy cream.
14320	Highland Creamery, Bridgton	38.0	Slightly dirty.
14252	Hollis A. Dean, Lincolnville	34.0	No dirt.
14176	Portland Creamery, Westbrook	41.0	No dirt.

* For explanation of cleanliness see page 58.

MILK.

Table showing the results of the examination of samples of milk collected in January, February and March 1915.

Station number.	NAME.	Results of Examination.*
	AUBURN.	
14456	J. B. Baron	Quality good. Slightly dirty.
14457	J. B. Baron	Quality good. Slightly dirty.
14563	J. B. Baron	Quality good. Slightly dirty.
14564	J. B. Baron	Quality good. Very slightly dirty.
14463	S. A. Bennett	Quality excellent. No dirt. Lawful.
14464	S. A. Bennett	Quality excellent. No dirt. Lawful.
14419	H. A. Bigelow	Quality good. No dirt. Lawful.
14417	F. R. Blake	Quality good. Very dirty.
14418	F. R. Blake	Quality good. Very dirty.
14416	M. C. Briggs & Son	Quality good. No dirt. Lawful.
14428	R. F. Burnham	Quality good. Slightly dirty.
14415	C. H. Carroll	Quality good. Slightly dirty.
14558	C. H. Carroll	Quality good. Slightly dirty.
14559	C. H. Carroll	Quality good. Slightly dirty.
14459	G. C. Chouinard	Quality good. Very slightly dirty.
14461	Hobert Cote	Quality excellent. Very slightly dirty.
14565	G. W. Dill	Quality good. Extremely dirty.
14566	G. W. Dill	Quality good. Slightly dirty.
14560	Dumont Bros	Quality excellent. Dirty.
14561	Dumont Bros	Quality good. Slightly dirty.
14556	A. C. & A. Fortin	Quality excellent. No dirt. Lawful.
14557	A. C. & A. Fortin	Quality good. No dirt. Lawful.
14402	A. C. & A. Fortin	Quality excellent. Dirty.
14422	H. L. Frank	Quality excellent. Extremely dirty.
14423	H. L. French	Quality fair. Dirty.
14465	F. F. Goss	Quality good. Slightly dirty.
14466	F. F. Goss	Quality good. No dirt. Lawful.
14455	Archie Greenwood	Quality good. No dirt. Lawful.
14424	A. G. Haskell	Quality good. Slightly dirty.
14571	John Laboute	Quality good. No dirt. Lawful.

* For explanation of quality and cleanliness see page 58.

MILK—Continued.

Station number.	Name.	Results of Examination.*
14400	E. G. Learn	Quality good. Very slightly dirty.
14401	E. G. Learn	Quality excellent. Slightly dirty.
14403	Nap. Leblond	Quality excellent. Extremely dirty.
14393	M. C. Lowell	Quality good. Dirty.
14404	F. Lussier	Quality good. Extremely dirty.
14405	F. Lussier	Quality good. Slightly dirty.
14430	L. H. Macomber	Quality good. Very slightly dirty.
14458	O. S. Montplasier	Quality good. No dirt. Lawful.
14406	J. A. Ness	Quality good. Slightly dirty.
14420	J. A. Ness	Quality good. No dirt. Lawful.
14421	R. W. Penley	Quality excellent. Very dirty.
14431	H. W. Pride	Quality excellent. No dirt. Lawful.
14460	Mrs. R. Rubin	Quality good. No dirt. Lawful.
14397	Small & Lane	Quality excellent. Very dirty.
14429	K. Steinman	Quality fair. No dirt. Lawful.
14391	Turner Center Creamery	Quality good. Dirty.
14392	Turner Center Creamery	Quality good. Dirty.
14394	Turner Center Creamery	Quality good. Slightly dirty.
14414	Turner Center Creamery	Quality good. No dirt. Lawful.
14395	L. O. Varnum	Quality good. Extremely dirty.
14425	J. E. Young	Quality good. Slightly dirty.
14426	J. E. Young	Quality good. Dirty.
	AUGUSTA.	
14527	J. B. Arnold	Quality excellent. No dirt. Lawful.
14528	J. B. Arnold	Quality good. Slightly dirty.
14524	W. R. Ayers	Quality excellent. No dirt. Lawful.
14542	W. R. Ayers	Quality good. No dirt. Lawful.
14547	C. Beaulieu	Quality excellent. No dirt. Lawful.
14529	H. L. Cummings	Quality excellent. No dirt. Lawful.
14550	F. L. Daggett	Quality excellent. No dirt. Lawful.
14551	F. L. Daggett	Quality excellent. Very slightly dirty.
14538	C. P. Dutton	Quality excellent. Slightly dirty.
14539	C. P. Dutton	Quality good. Very slightly dirty.

*For explanation of quality and cleanliness see page 58.

MILK—Continued.

Station number.	NAME.	Results of Examination.*
14543	L. T. Dutton	Quality excellent. Very dirty.
14544	L. T. Dutton	Quality excellent. No dirt. Lawful.
14522	Nat. Johnson	Quality excellent. Very slightly dirty.
14516	C. A. Knowles	Quality good. Very slightly dirty.
14517	C. A. Knowles	Quality good. Very slightly dirty.
14554	E. Locke	Quality excellent No dirt. Lawful.
14520	Geo. E. Macomber	Quality good. No dirt. Lawful.
14548	J. S. McLain	Quality excellent. No dirt. Lawful.
14549	A. E. Percival	Quality good. No dirt. Lawful.
14525	A. R. Scribner	Quality excellent. No dirt. Lawful.
14526	A. R. Scribner	Quality excellent. No dirt. Lawful.
14552	Webber & Hewett	Quality excellent. Very slightly dirty.
14545	G. E. Weeks & Son	Quality excellent. No dirt. Lawful.
14546	G. E. Weeks & Son	Quality excellent. No dirt. Lawful.
14540	E. Withee	Quality excellent. No dirt. Lawful.
14541	E. Withee	Quality excellent. No dirt. Lawful.
14530	Worthing & Parmenter	Quality good. No dirt. Lawful.
14535	S. B. Worthley	Quality excellent. No dirt. Lawful.
14536	S. B. Worthley	Quality excellent. Very slightly dirty.
14537	S. B. Worthley	Quality excellent. Very slightly dirty.
	BELFAST.	
14300	J. H. Elms	Quality excellent. Slightly dirty.
14301	J. H. Elms	Quality excellent. Very slightly dirty.
14296	Ralph Hayford	Quality excellent. Slightly dirty.
14297	Ralph Hayford	Quality excellent. Dirty.
14298	Geo. Littlefield	Quality excellent. Slightly dirty.
14299	Geo. Littlefield	Quality excellent. Very slightly dirty.
14303	E. P. Piper	Quality excellent. Very slightly dirty.
14304	E. P. Piper	Quality excellent. Very slightly dirty.
14293	C. H. Simmons	Quality excellent. Slightly dirty.
14294	C. H. Simmons	Quality excellent. Slightly dirty.
14302	C. H. Simmons	Quality excellent. Slightly dirty.

*For explanation of quality and cleanliness see page 58.

MILK—Continued.

Station number.	NAME.	Results of Examination.*
	BIDDEFORD.	
14449	B. A. Hill	Below standard in total solids. Watered. Very slightly dirty. Unlawful.
14450	B. A. Hill	Below standard in total solids and fat. Watered. Very slightly dirty. Unlawful.
14451	B. A. Hill	Below standard in total solids. Watered. Very slightly dirty. Unlawful.
14452	E. E. Wakefield	Below standard in total solids. Very slightly dirty. Unlawful.
14453	E. E. Wakefield	Below standard in total solids. Very slightly dirty. Unlawful.
14454	E. E. Wakefield	Below standard in total solids. Very slightly dirty. Unlawful.
	BRIDGTON.	
14317	M. D. Corson	Quality good. Slightly dirty.
14319	M. D. Corson	Quality good. Slightly dirty.
14316	G. W. Morrison	Quality good. Slightly dirty.
	BURNHAM.	
14292	W. C. Hunt	Quality excellent. Slightly dirty.
14295	W. C. Hunt	Quality excellent. Slightly dirty.
	CAMDEN.	
14247	R. W. Hardy	Quality excellent. Slightly dirty.
14248	R. W. Hardy	Quality excellent. Slightly dirty.
14240	N. B. Hopkins	Quality good. Slightly dirty.
14241	N. B. Hopkins	Quality excellent. Slightly dirty.
14251	N. B. Hopkins	Quality excellent. Very slightly dirty.
14249	M. L. Keene	Quality good. Very slightly dirty.
14250	M. L. Keene	Quality excellent. Very slightly dirty.
14244	E. C. Maddocks	Quality excellent. Slightly dirty.
14245	A. W. Rich	Quality excellent. Dirty.
14246	A. W. Rich	Quality excellent. Dirty.
14242	F. V. Rolerson	Quality excellent. Slightly dirty.
14243	F. V. Rolerson	Quality excellent. Slightly dirty.
	LEWISTON.	
14567	W. L. Carville	Quality good. No dirt. Lawful.
14568	W. L. Carville	Quality good. Very slightly dirty.

* For explanation of quality and cleanliness see page 58.

MILK—Continued.

Station number.	Name.	Results of Examination.*
14389	Louis Cassavant	Quality excellent. Dirty.
14390	Louis Cassavant	Quality good. Very dirty.
14471	W. L. Cornville	Quality good. No dirt. Lawful.
14472	W. L. Cornville	Quality good. Very slightly dirty.
14398	M. M. Goff	Quality excellent. Very dirty.
14399	M. M. Goff	Quality good. Very slightly dirty.
14474	O. E. Johnson	Quality good. No dirt. Lawful.
14569	H. G. Jones	Quality fair. Very slightly dirty.
14473	R. C. Kinner & Son	Quality good. Very slightly dirty.
14467	I. N. Leclair	Quality good. Very slightly dirty.
14468	I. N. Leclair	Quality good. Very slightly dirty.
14407	F. W. Mitler	Quality fair. Very dirty.
14469	Geo. Raymond	Quality good. Slightly dirty.
14470	Geo. Raymond	Quality good. No dirt. Lawful.
14562	Geo. Raymond	Quality good. No dirt. Lawful.
14462	C. A. Stevens	Quality good. Very slightly dirty.
14408	D. S. Woodard	Below standard in total solids. Slightly dirty Unlawful.
	MINOT.	
14396	Dumont & Bray	Quality good. Extremely dirty.
	PITTSFIELD.	
14306	H. H. Caston	Quality excellent. Slightly dirty.
14307	H. H. Caston	Quality excellent. No dirt. Lawful.
	PORTLAND.	
14125	H. L. Bremner	Below standard in total solids and fat. Slightly dirty. Unlawful.
14128	L. M. Bryant	Quality good. Slightly dirty.
14113	W. A. Bryant	Quality good. No dirt. Lawful.
14119	Geo. C. Cilley	Quality good. No dirt. Lawful.
14111	Clough & Wilson	Quality good. Dirty.
14121	H. F. Cotton	Quality good. No dirt. Lawful.
14130	J. S. Gordon	Quality good. No dirt. Lawful.
14285	W. T. Howe	Quality excellent. No dirt. Lawful.
14126	M. B. Hutchings	Quality good. Very slightly dirty.

* For explanation of quality and cleanliness see page 58.

MILK—Continued.

Station number.	NAME.	Results of Examination.*
14284	B. L. Johnson	Quality good. No dirt. Lawful.
14106	F. A. Johnson	Quality good. Very dirty.
14104	J. G. Johnson	Quality good. No dirt. Lawful.
14116	L. C. Knight	Quality excellent. No dirt. Lawful.
14098	A. C. Leadbetter	Quality good. No dirt. Lawful.
14118	A. C. Leadbetter	Quality good. No dirt. Lawful.
14117	M. P. Leighton	Quality good. No dirt. Lawful.
14103	C. S. Lovejoy	Quality good. No dirt. Lawful.
14110	Maine Dairy Co	Quality good. Slightly dirty.
14124	John McDonald	Quality good. No dirt. Lawful.
14114	C. E. Moreland	Quality good. Slightly dirty.
14115	L. C. Patterson	Quality good. No dirt. Lawful.
14096	E. Perry	Quality good. No dirt. Lawful.
14095	Portland Creamery Co	Quality good. No dirt. Lawful.
14107	Portland Creamery Co	Quality excellent. Slightly dirty.
14108	Portland Creamery Co	Quality excellent. No dirt. Lawful.
14120	John Proctor Est	Quality excellent. No dirt. Lawful.
14127	W. O. Putnam	Quality good. Slightly dirty.
14122	J. Henry Rines	Quality excellent. No dirt. Lawful.
14100	G. E. Roberts	Quality excellent. No dirt. Lawful.
14109	Peter W. Rowe	Quality good. Slightly dirty.
14129	A. W. Shaw	Quality good. Very slightly dirty.
14097	J. E. Skillin	Quality good. No dirt. Lawful.
14099	A. E. Small	Quality good. No dirt. Lawful.
14112	R. O. Stockman	Quality good. Slightly dirty.
14123	Turner Center Creamery	Quality excellent. Slightly dirty.
14102	E. S. Wilson	Quality good. No dirt. Lawful.
	ROCKLAND.	
14221	R. P. Conant	Quality good. Dirty.
14210	H. C. Copeland	Quality excellent. Slightly dirty.
14211	H. C. Copeland	Quality excellent. Dirty.
14212	S. H. Doe	Quality good. Dirty.
14213	S. H. Doe	Quality fair. No dirt. Lawful.

* For explanation of quality and cleanliness see page 58.

MILK—Continued.

Station number.	NAME.	Results of Examination.*
14226	S. H. Doe	Quality good. Slightly dirty.
14223	C. E. Henderson	Quality excellent. Lawful.
14228	A. W. Lovejoy	Quality good. Dirty.
14217	A. T. Low	Quality excellent. Slightly dirty.
14218	A. T. Low	Quality good. Very dirty.
14224	S. G. Prescott	Quality excellent. Slightly dirty.
	ROCKPORT.	
14253	L. C. Dean	Quality excellent. Very slightly dirty.
14254	L. C. Dean	Quality excellent. Very slightly dirty.
14255	Fred Priest	Quality good. Slightly dirty.
14256	Fred Priest	Quality good. Dirty.
	ROCKVILLE.	
14282	L. L. Lamson	Quality good. No dirt. Lawful.
14283	L. L. Lamson	Quality good. No dirt. Lawful.
	SAINT ALBANS.	
14305	Wm. Southers	Quality excelle t. Slightly dirty.
	SANFORD.	
14439	W. P. Biggs	Quality excellent. Very slightly dirty.
14437	Walter Gowen	Quality good. Slightly dirty.
14438	Walter Gowen	Quality good. Dirty.
14434	H. S. Howes	Quality good. No dirt. Lawful.
14435	H. S. Howes	Quality good. Very slightly dirty.
14440	Robert Taylor	Quality good. Slightly dirty.
14441	Robert Taylor	Quality good. Slightly dirty.
14436	H. R. Welch	Quality good. Dirty.
	SOUTH PORTLAND.	
14101	L. W. Welt	Quality excellent. No dirt. Lawful.
	SPRINGVALE.	
14446	R. Bartlett	Quality good. No dirt. Lawful.
14442	A. P. Morrill	Quality good. No dirt. Lawful.
14443	A. P. Morrill	Quality good. No dirt. Lawful.
14447	C. S. Pierce	Quality good. No dirt. Lawful.

*For explanation of quality and cleanliness see page 58.

MILK—Continued.

Station number.	NAME.	Results of Examintion.*
14444	Herbert Pitts	Below standard in total solids. Watered. Very dirty. Unlawful.
14448	L. B. Trafton	Quality good. Slightly dirty.
14445	H. P. Webber	Quality fair. No dirt. Lawful.
	THOMASTON AND SOUTH THOMASTON.	
14215	Abraham Black	Quality good. Dirty.
14216	Abraham Black	Quality good. Extremely dirty.
14214	W. E. Graves	Quality good. Slightly dirty.
14275	Albert Hall	Quality good. Very slightly dirty.
14276	Albert Hall	Quality excellent. Very slightly dirty.
14227	Erick Harjula	Quality excellent. Slightly dirty.
14272	E. Lermond	Quality excellent. Dirty.
14273	E. Lermond	Quality excellent. Dirty.
14219	A. M. Mayo	Quality good. Dirty.
14220	A. M. Mayo	Quality excellent. No dirt. Lawful.
14280	Timothy Murphy	Quality excellent. Very slightly dirty.
14225	O. J. Pierce	Quality excellent. Slightly dirty.
14281	C. P. Redman	Quality excellent. Slightly dirty.
14222	R. H. Snow	Quality good. Very dirty.
14278	R. C. Wyllie	Quality excellent. Slightly dirty.
14279	R. C. Wyllie	Quality excellent. Very slightly dirty.
	WARREN.	
14229	Jos. Koski	Quality excellent. No dirt. Lawful.
	WESTBROOK.	
14509	I. M. Boothby	Quality excellent. Very slightly dirty.
14501	R. C. Boothby	Quality good. Slightly dirty.
14159	C. Champaine	Quality good. Dirty.
14504	C. Champaine	Quality excellent. No dirt. Lawful.
14485	C. E. Cobb	Quality good. Slightly dirty.
14496	Cressey & Graffam	Quality good. Slightly dirty.
14162	Marvin Deliount	Quality excellent. Slightly dirty.
14505	A. Dorion	Quality good. Slightly dirty.
14173	Marvin Dulcat	Quality good. No dirt. Lawful.
14169	L. Fortin	Quality good. No dirt. Lawful.
14511	L. Fortin	Quality excellent. Slightly dirty

* For explanation of quality and cleanliness see page 58.

MILK—Concluded.

Station number.	NAME.	Results of Examination.*
14160	Elie Gagnon	Quality fair. Dirty.
14493	Elie Gagnon	Quality good. Dirty.
14499	Haskell & Anderson	Slightly below standard in fat. Slightly dirty.
14164	W. T. Hawkes & Son	Quality excellent. No dirt. Lawful.
14486	W. T. Hawkes & Son	Quality excellent. Slightly dirty.
14502	Louis J. Hogan	Quality good. Very dirty.
14161	B. Huard	Quality excellent. Slightly dirty.
14490	B. Huard	Quality good. Dirty.
14497	Johnson & Bye	Below standard in fat. Dirty. Unlawful.
14167	E. R. Johnson	Quality excellent. Very dirty.
14507	Wm. W. Johnson	Quality excellent. Slightly dirty
14510	A. D. Laponiti	Quality excellent. Very dirty.
14492	Alfred Lorenzen	Quality excellent. Slightly dirty.
14165	L. H. Lowell	Quality good. No dirt. Lawful.
14166	L. H. Lowell	Quality good. Slightly dirty.
14487	L. H. Lowell	Quality good. Very dirty.
14500	A. A. Morrison & Co	Below standard in total solids and fat. Dirty. Unlawful.
14495	C. H. Nelson	Quality good. Dirty.
14174	People's Store	Quality good. Dirty.
14175	People's store	Quality good. Slightly dirty.
14494	People's Store	Slightly below standard in total solids. Slightly dirty.
14498	H. L. Pike	Quality good. Slightly dirty.
14105	John Sawyer	Quality good. No dirt. Lawful.
14489	W. P. Thompson	Quality excellent. Slightly dirty.
14508	A. F. Warren	Quality good. Dirty.
14168	West End Market	Quality excellent. Slightly dirty.
14503	Westbrook Grocery Co	Quality good. Dirty.
	WOODFORDS.	
14491	A. A. Cilley	Quality good. Slightly dirty.
14163	Tom Powers	Quality good. No dirt. Lawful.
14488	Tom Powers	Quality good. No dirt. Lawful.
14506	G. F. Roberts	Quality excellent. No dirt. Lawful.
14512	F. M. Staples	Quality excellent. Dirty.
14172	Joseph Therotte	Quality excellent. No dirt. Lawful.
14484	Joseph Therotte	Quality good. Slightly dirty.

* For explanation of quality and cleanliness see page 58.

June, 1915.

MAINE
AGRICULTURAL EXPERIMENT STATION,
ORONO, MAINE.
CHAS. D. WOODS, Director.

ANALYSTS.

James M. Bartlett
Royden L. Hammond
Elmer R. Tobey
Herman H. Hanson
Edward E. Sawyer
Hoyt D. Lucas

Official Inspections

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VINEGAR

The Commissioner of Agriculture is the executive of the law regulating the sale of foods in Maine. It is the duty of the Maine Agricultural Experiment Station to make the analyses of the samples collected by the Commissioner, and it is the duty of the Director to publish the results of the analyses of the samples of foods and such additional information as may seem advisable.

CONTENTS.

NOTE. All correspondence relative to the inspection laws should be addressed to the Bureau of Inspections, Department of Agriculture, Augusta, Maine.

A Study of the Conditions of Home making of Vinegar

Bulletin 258 of the New York Agricultural Experiment Station gives in detail the results of a study of the chemistry of home-made cider vinegar, which extended over a number of years. The following is based upon or directly quoted from that bulletin. Quotation marks are not used. The indirect quotations from the bulletin but are as much a part of that study as the direct quotations.

The sour taste of vinegar is due to acetic acid. Acetic acid is formed from dilute alcohol by the action of yeast. The flavor of cider vinegar is due to the apple solids in solution and to certain etherial bodies developed in the process of fermentation. The acid strength and the flavor of vinegar are dependent upon the quality of the cider and the methods of fermentation. Sugar is the most important constituent of apple juice from the standpoint of the vinegar maker. The quantity of sugar in apple juice is dependent upon the variety of apple and upon the stage of ripeness, unripe or over-ripe apples containing less sugar than ripe apples.

ALCOHOLIC FERMENTATION

Apple juice left exposed to the air is acted upon by yeast cells everywhere present, the sugar being changed into alcohol and carbon dioxide gas. Theoretically, 100 parts of sugar should yield about 51 parts of alcohol, but in actual practice losses are experienced, reducing the actual yield to 45 to 47 parts of alcohol. The fresh apple juice from sound apples contains no alcohol.

Under the ordinary conditions of a cellar temperature, most of the sugar is changed into alcohol in five or six months." The higher the temperature up to about 80 degrees Fahrenheit the more rapid the change of sugar to alcohol. Adding yeast to apple juice tends to hasten the alcoholic fermentation.

ACETIC FERMENTATION

Certain forms of bacteria act upon the alcohol of cider and convert it into acetic acid, the presence of which in sufficient quantity is the object of the maker of vinegar. The conditions most necessary for the acetic fermentation of cider are acetic bacteria, an abundant supply of air, and a temperature between 65 degrees F. and 85 degrees F. Theoretically, 100 parts of alcohol yield about 130 parts of acetic acid, but the actual yield is unusually below 120.

At cellar temperatures, the acetic fermentation takes place slowly, requiring about 18 months. The addition of vinegar containing "mother" to cider after the completion of the alcoholic fermentation increases the rapidity of the formation of acetic acid.

DECOMPOSITION OF VINEGAR

"Several different organisms have the power of decomposing dilute acetic acid and thus destroying the value of vinegar. These organisms work only in the presence of air. Accordingly, this destructive change in vinegar can be prevented by excluding air, when once the acetic acid has been formed. In practice, this can be accomplished by drawing off the clear vinegar, placing it in a clean barrel, filling it as full as possible and putting the bung in tight."

Legal standards for cider vinegar are usually based upon the percentage of acetic acid and cider vinegar solids. Where proper fruit is used for cider-making and where the conditions of fermentation are properly controlled, there should be no difficulty in making cider vinegar that contains above 4 per cent of acetic acid in 18 to 24 months.

PRODUCTION OF VINEGAR BELOW STANDARD

Several different conditions may cause the production of cider vinegar low in acetic acid, among the more common of which are: Poor apple juice. Conditions unfavorable to the necessary fermentation processes. Lack of proper care after acid is formed.

One should be able to produce about 50 to 55 parts by weight of acetic acid from each 100 parts of sugar. To make a vinegar carrying 4 per cent acetic acid requires about 8 per cent of sugar in the apple juice.

There are five different conditions under which apple juice may contain less than the amount of sugar indicated: The fruit may be unripe; the apple juice, normal at the start, may be watered; the juice may be made by treating the pomace with water, allowing to stand and pressing a second time; the apples may be badly decayed; apples may be used which normally contain, even when ripe, an insufficient amount of sugar. Analysis of apple juice shows that certain varieties of apples such as the Ben Davis and Gano may never contain, even when fully ripe, sugar enough to make lawful vinegar.

Among the conditions that are unfavorable to the necessary fermentation process are: dirty and decayed fruit; unclean barrels; too low temperature; lack of air, due to filling the barrel too full or stopping the bung-hole.

Far too often the apples used for vinegar-making are left lying on the ground until they become covered with soil and more or less decayed. Under such conditions, there is serious danger of getting into the apple juice organisms that will interfere with the regular alcoholic and acetic fermentations, particularly the latter, either by lessening the amount of those products or by producing undesirable flavors.

Barrels or casks are frequently used for vinegar-making which are not previously cleaned, no matter what their previous condition or use. Undesirable organisms may be brought into contact with the apple juice in this way.

Many, if not most, farmers place their barrels of apple juice at once in the cool temperature of a cellar, where it will usually require 6 months or more to complete the alcoholic fermentation. The material is left at the same temperature for the acetic fermentation which takes place with extreme slowness. Under such conditions it may require three years or more before the acetic fermentation is completed, and ordinarily the time is two years or more.

The acetic fermentation requires the presence of air, and this may be excluded by filling the barrel too full or by putting the bung in tight or by doing both at once. When the barrel is tightly stoppered before the formation of acid is completed, the fermentation soon ceases and the amount of acid does not increase further.

When the alcoholic fermentation is completed and the cider has become commercial cider vinegar of good quality, destructive fermentation of the acid may be encouraged by leaving the bung-hole open and the barrel only partially full.

Directions for Making Vinegar at Home

The following are the directions for making home-made cider vinegar, as given in Bulletin 258 of the New York Agricultural Experiment Station:

KIND OF APPLES TO USE

Only ripe apples should be used, possessing a sugar content of not less than 8.5 per cent. Most varieties of apples commonly available possess the requisite amount of sugar when ripe, but not when green. The apples should not be decayed or over-ripe, because the amount of sugar is lessened in such apples. The apples should be clean when gathered and if not, they should be made so by washing. The objection to dirt in the apple juice is the danger of introducing forms of fermentation that will interfere with the normal alcoholic and acetic fermentations which are desired. One objection raised to washing apples is the liability to remove the germs that cause the desired forms of fermentation. While in our own practice we have not met with such difficulty, it is preferable that the apples shall, if possible, be clean when gathered.

PREPARATION OF APPLE JUICE

In the grinding and pressing of the apples care should be taken to observe ordinary precautions of cleanliness. In many cases, it is the practice to add water to the apple pomace after pressing, let it stand awhile and press again. This treatment yields as additional amount of juice, which, however, does not contain the requisite amount of sugar to make good vinegar, providing the first pressing has been efficient. Avoid the use of juice made from second pressing.

PUTTING APPLE JUICE IN BARRELS

When practicable, it is a good plan to store the freshly pressed apple juice in some large receptacle and allow it to stand a few days, before putting it into barrels. In this way considerable solid matter held in suspension will settle before the liquid is placed in casks. The casks used should be well cleaned, thoroughly treated with live steam or boiling water, and should not be over two-thirds or three-fourths filled with apple juice. The bung should be left out, but a loose plug of cotton may be placed in the hole to decrease evaporation and prevent dirt falling in. The bung should be left out until 4.5 to 5.0 per cent of acetic acid has formed.

MANAGEMENT OF ALCOHOLIC FERMENTATION

When the freshly pressed apple juice is at once placed in ordinary cellars, where the temperature during winter does not go below 45 degrees or 50 degrees F., the alcoholic fermentation is complete in about six months, assuming that the work is begun in October or November; though 80 to 90 per cent of the alcohol is formed in half this time or less. By having the fermentation take place at a temperature of 65 degrees to 70 degrees F., the time can be considerably reduced; however it is not desirable to have the alcoholic fermentation take place much above 70 degrees F., since the loss of alcohol by evaporation is increased. By the addition of yeast to the fresh apple juice, the fermentation can be completed in three months or less, especially if the temperature is near 65 degrees or 70 degrees F. It is suggested that one Fleischmann's compressed yeast cake, or an equivalent, may be used for five gallons of apple juice, if one desires to use yeast. The yeast cake is stirred with a cup of water and after complete disintegration is mixed with the juice. Whatever form of yeast is used, it should be fresh. Vinegar or "mother" should never be added to apple juice.

MANAGEMENT OF ACETIC FERMENTATION

When the alcoholic fermentation is completed, it is well to draw off the clear portion of liquid, rinse out the cask, replace the clear liquid, add two or four quarts of good vinegar containing more ore less "mother" and place at a temperature of 65 degrees to 75 degrees F. The acetic fermentation occupies from 3 to 18 months or more, according to the conditions under which the fermentation is carried on. When the apple juice is stored in cool cellars and left there until it becomes vinegar of legal standard, it requires from 21 to 24 months or even more. When the alcoholic fermentation is allowed to take place in a cool cellar and the casks then removed to a warmer place, the time of vinegar formation may be reduced from that given above to 15 to 18 months. Where the alcoholic fermentation is hastened by the use of yeast and the acetic fermentation favored by the proper temperature and addition of a vinegar "starter", it is possible to produce good merchantable vinegar in casks in 6 to 12 months. In vinegar factories the formation of acetic acid is greatly hastened by the use of "generators", in which the alcoholic liquid is brought into intimate contact with a large supply of air. In the hands of the ordinary farmer, making only a few barrels of cider, these generators would probably not be found entirely practicable.

CARE OF CIDER VINEGAR

When the acetic fermentation has gone far enough to produce 4.5 to 5 per cent acetic acid, then the barrels should be made as full as possible and tightly corked, in order to prevent destructive fermentation of acetic acid and consequent deterioration of the vinegar.

VINEGAR DEFINED.

The word *vinegar* used alone always means pure apple cider vinegar without any additions and containing at least 4 per cent acetic acid.

The words *Cider Vinegar* by themselves always refer to pure apple cider vinegar as defined above.

Results of Inspection.

Without making himself known to the dealer, the inspectors bought, from time to time during the winter and spring of 1915, samples of vinegar on sale at retail in the State. In each instance the inspector asked for one quart of cider vinegar.

In the table on pages 78 to 80 the results of the examinations are given. Each sample was tested for the following: Net volume. Total acid. Total solids. Non-sugar solids. Ash in non-sugar solids. Total ash. Specific gavity. Dextrose in 100 cubic centimeters. The polariscope reading. Odor. Flavor. Odor of burning solids. Color.

The analytical data are not published as they would convey little or no meaning to the non-professional person. Vinegars that are normal cider vinegar are "passed" in the table. The adulterations found are stated in plain words. All results were promptly reported to the State Bureau of Inspections. The adulterated and misbranded cases were investigated and prosedcuted by the Bureau as directed by the law.

..*Wine vinegar* always means vinegar made from grape juice. There is practically no wine vinegar used in Maine. The so-called "white wine" vinegar is a distilled vinegar and not a wine vinegar.

Malt vinegar is made from barley malt. *Sugar vinegar* is made from cane sugar produtcs and *glucose vinegar* from starch sugar.

The above are undistilled vinegars made by fermentation.

Distilled vinegar is the product of fermetation of dilute distilled alcohol from any source.

Vinegar of any kind must contain at least *4 per cent acetic* acid to be up to the standard required by the pure food law.

The word *pure* cannot be legally used if a vinegar is not up to standard or contains any added foreign material.

In case a vinegar is colored by the addition of a solution of caramel (burnt sugar), the word "colored" will be construed as covering that fact. If any other kind of coloring material be used, the kind and amount per gallon must be stated.

Strictly pure apple cider vinegar containing not less than 4 per cent acetic acid does not require a label. All other kinds of vinegar must be plainly labeled, branded or tagged so as to show the exact character thereof.

VINEGAR

Table showing the results of examination of vinegar sold the inspector as cider vinegar in the winter and spring of 1915, arranged alphabetically by towns. Cider vinegar should be made from apple cider without the addition of water, color, or other foreign material. It should be racked so as to be clear and free from solid particles and contain not less than 4 per cent of acetic acid.

Station number.	NAME AND ADDRESS OF DEALER.	RESULTS OF EXAMINATION.
	BATH.	
14730	Bath Cooperative Assoc., E. J. Murphy, Mgr.	Passed.
14741	O. Briton	Passed.
14736	Cash Market, J. W. Moulton, Mgr	Passed.
14738	W. E. Chase & Co	Colored with caramel. Adulterated.
14745	W. M. Hagan	Passed.
14744	Herbert Hodgkins	Colored with caramel. Adulterated
14732	A. F. Larrabee	Passed.
14737	W. A. Lowell	Passed.
14739	W. R. Melrose	Passed.
14734	L. O. Perry	Dirty. Contained mother, and small particles of charcoal.
14733	S. C. Perry	Passed.
14740	O. F. Rullmann	Passed.
14743	G. A. Sanford & Co	Reduced with water. Adulterated
14728	S. Strout & Co	Passed.
14735	W. H. Swett	Dirty. Contained mother, and small particles of charcoal.
14731	G. W. Temple	Reduced with water. Adulterated
14742	Geo. F. Wallace	Passed.
14729	M. O. Wright	Passed.

Table showing results of examination of vinegar—Continued.

Station number.	Name and Address of Dealer.	Results of Examination.
	BIDDEFORD.	
14380	Andrews & Horrigan	Reduced with water. Adulterated
13993	Bibeau Bros	Reduced with water. Adulterated
13992	Gartland & Dunn	Reduced with water. Adulterated
13994	J. F. Hannaway	Reduced with water, Adulterated
	CAPE ELIZABETH.	
14339	Anderson Bros	Passed.
	FAIRFIELD.	
14005	David King	Below standard in acid. An incompletely fermented cider vinegar.
14006	G. A. Savage	Passed.
14004	Wm. Seltzer	A sugar vinegar. Misbranded.
	KENNEBUNK AND KENNEBUNKPORT	
14008	Geo. E. Cousins	Passed.
14009	Littlefield & Webber	Reduced with water. Adulterated
14007	E. L. Littlefield	Passed.
14010	W. B. Tobey	Cider vinegar. Short measure.
	NORRIDGEWOCK.	
13985	Brackett & Russell	Reduced with water. Adulterated
	OAKLAND.	
13984	Blake Bros	Reduced with water. Adulterated
13983	Arthur Oliver	Passed.
13986	F. W. Smith	Passed.
	PORTLAND.	
14361	B. Abrams	A sugar vinegar. Misbranded.
14331	W. S. Bailey	Passed.
14349	Noal Bernstein	Passed.
14330	Carl J. Blom	Reduced with water. Adulterated
14335	C. M. Bowker Co	Reduced with water. Adulterated
14362	William P. Carrol	Reduced with water. Adulterated
14334	E. H. Dingley	Reduced with water. Adulterated
14359	Mrs. John Donaghey	A colored, distilled vinegar. Misbranded.
14360	J. T. Dougherty	Passed.
14364	Greene & Barrett	Reduced with water. Adulterated
14358	Scott Heffler	Passed.

Table showing results of examination of vinegar—Continued.

Station Number.	Name and Address of Dealer.	Results of Examination.
14325	Charles W. Horton	Reduced with water or distilled vinegar, or both. Adulterated.
14346	C. S. Johnson	Passed.
14327	John D. Johnson	Reduced with water or distilled vinegar, or both. Adulterated.
14357	Solomon Johnson	Reduced with water. Adulterated
14345	Roswelg Jones	Mixed with distilled vinegar or reduced with water. Adulterated.
14355	C. E. Kelley	Reduced with water. Adulterated
14333	R. M. King	Reduced with water. Adulterated.
14329	Albert D. Lovell	Reduced with water and colored with caramel. Adulterated and misbranded.
14356	Charles Maloney	Passed.
14328	J. A. Moreshead	Mixed with distilled vinegar. Adulterated.
14365	Geo. W. Parker & Co	Reduced with water. Adulterated
14363	Charles E. Parker	Passed.
14326	J. Saunders & Son	Reduced with water or distilled vinegar, or both. Adulterated.
14332	Six Links Market, Sumner Johnson, Mgr	Passed.
14366	J. L. Waite	Reduced with water. Adulterated
	SACO.	
13991	Casseboom & Thompson	Cider vinegar. Short measure.
13990	Edwin W. Fay	Passed.
13989	R. H. Merrow	Passed.
	SKOWHEGAN.	
13987	C. W. Day	Passed.
13988	Jewett's Market	Passed.
	SOUTH PORTLAND.	
14338	F. E. Anderson & Co	Passed.
14337	J. J. Campbell	Cider vinegar of poor quality.
14341	H. W. Dunton	Passed.
14340	A. C. Lailer	Passed.
14336	F. W. Richardson	Passed.
	SPRINGVALE.	
14011	N. O. Brooks & Son	Passed.
14012	Rowe & Bartlett	Reduced with water and reinforced with distilled vinegar. Adulterated.

Table showing results of examination of vinegar—Concluded.

Station number.	Name and Address of Dealer.	Results of Examination.
	WATERVILLE.	
13995	E. F. Cote	Passed.
13997	E. L. Craig	Passed.
14002	Arthur Daviau	Reduced with water. Adulterated
14003	E. W. Lambert	Reduced with water. Adulterated
13998	F. E. McCallum	Reduced with water. Adulterated
14001	John P. Pillott	Cider vinegar incompletely fermented. Short measure.
13999	Chas. Pomerleau	Passed.
14000	Reny & Veilleux	Reduced with water. Adulterated
13996	S. E. Whitcomb & Co	Reduced with water. Adulterated Short measure.
	WESTBROOK.	
14348	R. C. Boothby	Passed.
14344	Chrisen & Graffam	Reduced with water. Adulterated
14347	Elie Gagnon	Reduced with water. Adulterated
14342	Haskell & Anderson	Passed.
14343	Johnson & Bye	Reduced with water. Adulterated

July, 1915.

MAINE
AGRICULTURAL EXPERIMENT STATION
ORONO, MAINE.

ANALYSTS.

James M. Bartlett
Royden L. Hammond
Elmer R. Tobey
Herman H. Hanson
Edward E. Sawyer
Walter H. Rogers

Official Inspections

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CREAM AND MILK.

The Commissioner of Agriculture is the executive of the law regulating the sale of milk and cream in Maine. It is the duty of the Maine Agricultural Experiment Station to make the analyses of the samples collected by the Commissioner, and it is the duty of the Director to publish the results of the analyses of the samples of milk and cream, together with the names of the persons from whom the samples were obtained, and such additional information as may seem advisable.

NOTE. All correspondence relative to the inspection laws should be addressed to the Bureau of Inspections, Department of Agriculture, Augusta, Maine.

REQUIREMENTS OF LAW REGULATING SALE.

In order to be lawfully sold in Maine milk and cream must be of good standard quality, free from adulteration or the addition of water or any foreign substance. The cows from which the milk is drawn must be free from disease. The cans and other utensils must be clean and in a sanitary condition. Milk from which any of the cream has been removed cannot be sold as milk but may be sold as skim milk. Cream must contain not less than 18 per cent milk fat. Milk must contain not less than 11.75 per cent of milk solids and not less than 3.25 per cent of milk fat. All dairy products from the time they are produced until they reach the consumer must be protected from filth, flies, dust or other contamination, or other unclean, unhealthful or unsanitary conditions. A lawful gallon of milk contains 231 cubic inches and all sub-divisions of the gallon in the same proportion. Bottles used for the distribution of milk must be sealed by the State, town, or city sealer of weights and measures.

RESULTS OF EXAMINATION.

The results of examination are given in tabular form in the pages that follow.

In the column under "Remarks" the terms used have the meaning as follows: The terms "excellent," "good," "fair," refer to the fat content in milk that is up to the standard in milk solids.

"Quality excellent" means more than 4.5 per cent milk fat.

"Quality good" means between 3.5 and 4.5 per cent milk fat.

"Quality fair" means between 3.25 and 3.50 per cent milk fat.

"Below standard" refers to the fat or the solids as stated in table.

"No dirt" milk contains no visible dirt.

"Very slightly dirty" milk contains at least one particle of visible dirt.

"Slightly dirty" milk contains several particles of visible dirt.

"Dirty" milk has quite a large number of particles of visible dirt.

"Very dirty" milk has a large amount of visible dirt.

"Lawful" milk is free from visible dirt, and is up to, or above, the minimum requirements for milk solids and milk fat.

CREAM.

Table showing the results of the examination of samples of cream collected in April, May and June, 1915.

Station number.	Name and Address.	Milk fat, per cent.	Remarks.*
15081	E. Locke, Augusta	31.0	No dirt. Lawful.
15079	Merrill Brothers, Augusta	35.0	Very dirty.
15083	Webber & Hewitt, Augusta	30.0	No dirt. Lawful.
15085	L. S. Young, Augusta	34.0	No dirt. Lawful.
14707	Charles Hillman, Bangor	24.0	Dirty.
14720	Maine Creamery Co., Bangor	26.0	Very slightly dirty.
14675	O'Connell Bros., Bangor	34.0	No dirt. Lawful.
14672	M. F. Wilson, Bangor	31.0	No dirt. Lawful.
14663	F. M. Leathers, Brewer	39.0	No dirt. Lawful.
15053	B. F. Conant, Freeport	24.0	Slightly dirty.
15054	C. T. Dillingham, Freeport	24.0	No dirt. Lawful.
15055	C. T. Dillingham, Freeport	26.5	No dirt. Lawful.
15069	Brann's Market, Gardiner	34.0	No dirt. Lawful.
14765	E. A. Gillin Co., Houlton	26.5	Slightly dirty.
14764	Knox Bros., Houlton	28.0	Very slightly dirty.
14758	McGary Bros., Houlton	21.0	Slightly dirty.
14749	J. E. Robinson, Houlton	21.0	No dirt. Lawful.
14767	Sincock Co., Houlton	29.5	No dirt. Lawful.
14678	W. L. Hillier, Orrington	29.0	No dirt. Lawful.
14792	R. H. McDonald, Presque Isle	21.0	No dirt. Lawful.
14790	McKay & Barker, Presque Isle	28.5	No dirt. Lawful.
15006	Joseph T. Dougherty, Portland	35.0	Slightly dirty.
14983	C. W. F. Goding, Portland	35.0	No dirt. Lawful.
14987	Chas. W. Horton, Portland	29.0	No dirt. Lawful.
14991	Ernest L. Landry, Portland	35.5	No dirt. Lawful.
14875	L. A. Mercier Co., Portland	34.5	No dirt. Lawful.
14842	Turner Center Dairy, Portland	23.0	Slightly dirty.
14863	Turner Center Creamery, Portland	34.0	Very slightly dirty.
14897	Bert Clifford, Waterville	22.0	No dirt. Lawful.

* For explanation of cleanliness see page 82.

CREAM—Continued.

Station number.	Name and Address.	Milk fat, per cent.	Remarks.*
14901	Wm. Glidden, Waterville	25.0	Slightly dirty.
14889	E. C. Mathews, Waterville	22.0	No dirt. Lawful.
14886	Warren L. Nye, Waterville	29.5	No dirt. Lawful.
14903	W. F. Rhoades, Waterville	11.0	Below standard. Very dirty. Unlawful.
14941	F. H. Freese, Woodfords	30.5	Very slightly dirty.
14926	Geo. H. Philbrook, Woodfords	32.0	No dirt. Lawful.
14923	M. Volente, Woodfords	31.0	No dirt. Lawful.
	Heavy Cream. No Standard.		
14644	G. F. Butman, Bangor	35.0	No dirt.
14717	G. W. & C. S. Leighton, Bangor	42.0	No dirt.
14722	Maine Creamery, Bangor	39.0	Slightly dirty.
14677	D. J. McGraw, Bangor	30.0	No dirt.
14620	C. H. Morrison, Bangor	33.0	Very slightly dirty.
14682	F. L. Peavey, Bangor	31.0	No dirt.
14638	F. W. Savage & Son, Bangor	30.0	Slightly dirty.
14716	Staples & Griffin, Bangor	40.0	No dirt.
14718	Townsend's Cash Store, Bangor	43.0	Slightly dirty.
14670	W. F. White, Bangor	33.0	No dirt.
14683	Earl W. Wilde, Bangor	42.0	No dirt.
14673	M. F. Wilson, Bangor	35.0	No dirt.
14680	C. F. Winchester, Bangor	31.0	No dirt.
14700	Danforth Bros., Brewer	38.0	Slightly dirty.
14723	Kenney & McMahon, Brewer	39.0	No dirt.
14646	L. L. Lewis, Brewer	39.0	Very slightly dirty.
14702	F. B. Marsh, Brewer	38.0	Very slightly dirty.
14698	Daniel Rooney, Brewer	39.0	Very slightly dirty.
14769	Caribou Public Market, Caribou	22.0	No dirt. Poor for heavy cream.
14773	C. C. Gammon, Caribou	28.0	No dirt.
14771	C. P. Hussey, Caribou	24.0	No dirt. Poor for heavy cream.
14777	Mercier & Co., Caribou	28.5	No dirt.
14770	R. T. Parsons, Caribou	19.0	No dirt. Poor for heavy cream.
14768	R. R. Ryder, Caribou	25.0	No dirt. Poor for heavy cream.
14774	Scates & Co., Caribou	29.0	No dirt.

* For explanation of cleanliness see page 82.

CREAM—Continued.

Station number.	Name and Address.	Station number.	Remarks.*
14775	Scates & Co., Caribou	19.0	No dirt. Poor for heavy cream.
14779	Shaw & Mitton, Caribou	23.0	No dirt. Poor for heavy cream.
14772	Tornquist Brothers, Caribou	22.5	No dirt. Poor for heavy cream.
15070	Clarke's Market, Gardiner	45.0	No dirt.
15074	A. W. Cunningham & Co., Gardiner	38.0	No dirt.
15073	Manson's Market, Gardiner	45.0	No dirt.
14652	G. H. McKay, East Orrington	30.0	No dirt.
14611	E. T. Carver, Hampden	36.0	Slightly dirty.
14754	Cottle Bros., Houlton	35.5	No dirt.
14748	Hallett & McKeen Co., Houlton	34.0	No dirt.
14751	Albert E. Mooers, Houlton	34.0	No dirt.
15008	Chas. F. Barber, Portland	46.0	Slightly dirty.
14917	Sara Blumenthal, Portland	21.0	No dirt. Poor for heavy cream.
14872	L. B. Chipman, Portland	44.0	No dirt.
14874	L. B. Chipman, Portland	46.0	No dirt.
14914	A. Cohen, Portland	21.0	No dirt. Poor for heavy cream.
14838	Conwall Cash Market, Portland	43.0	Slightly dirty.
14985	Conway Grocery Co., Portland	45.0	No dirt.
15005	Joseph T. Dougherty, Portland	48.0	No dirt.
14884	A. B. Drew, Portland	43.0	No dirt.
14862	W. S. Dunn, Portland	46.0	Very slightly dirty.
14982	C. W. F. Goding, Portland	42.0	No dirt.
15003	J. F. Hoffman, Portland	33.0	Very slightly dirty.
14819	Home Dairy Co., Portland	35.0	No dirt.
14879	B. Huberman, Portland	34.0	No dirt.
14950	Littlefield & Co., Portland	44.0	No dirt.
14993	James J. McCartney, Portland	47.0	Very slightly dirty.
14876	L. A. Mercier Co., Portland	44.0	Very slightly dirty.
14910	Park Fruit Store, Portland	34.0	No dirt.
14919	Geo. W. Parker, Portland	42.0	No dirt.
14870	C. J. Pennell, Portland	44.0	Slightly dirty.
14957	R. R. Reed, Portland	32.0	Very slightly dirty.
15029	M. L. Richards, Portland	47.0	No dirt.

* For explanation of cleanliness see page 82.

CREAM—Concluded.

Milk fat, per cent.	Name and Address.	Milk fat, per cent.	Remarks.*
14868	Geo. C. Shaw Co., Portland	38.0	No dirt.
14960	Frank A. Stephens & Sons, Portland	45.0	No dirt.
14952	C. T. Swett Co., Portland	46.0	No dirt.
14841	Turner Center Dairy, Portland	41.0	No dirt.
15027	Tuttle Bros., Portland	42.0	No dirt.
14881	J. L. Waite, Portland	47.0	No dirt.
14866	W. L. Wilson, Portland	45.0	No dirt.
14909	W. L. Wilson & Co., Portland	45.0	No dirt.
15025	York & Co., Portland	47.0	No dirt.
14788	Max X. Beaulieu, Presque Isle	28.5	No dirt.
14789	Max X. Beaulieu, Presque Isle	29.0	No dirt.
14791	R. H. McDonald, Presque Isle	27.5	No dirt.
15786	McEachern & Tribou, Presque Isle	25.0	No dirt. Poor for heavy cream.
14787	McEachern & Tribou, Presque Isle	25.0	No dirt. Poor for heavy cream.
14696	M. F. Ayer, South Brewer	36.0	Slightly dirty.
14661	C. E. Baldwin, South Brewer	38.0	No dirt.
14692	S. L. Herrick Co., South Brewer	31.0	Slightly dirty.
14693	F. W. Wentworth, South Brewer	29.0	Slightly dirty.
14898	Bert Clifford, Waterville	33.0	No dirt.
14894	L. M. Emery, Winslow	44.0	Slightly dirty.
14935	W. S. Bailey, Woodfords	42.0	Very slightly dirty.
15016	C. M. Bowker Co., Woodfords	37.0	No dirt.
15014	N. J. Cobb & Son, Woodfords	37.0	No dirt.
14929	A. J. Curtis & Co., Woodfords	32.0	No dirt.
15022	Fred B. Estes, Woodfords	47.0	No dirt.
14936	S. W. Johnson, Woodfords	42.0	No dirt.
14939	E. F. Ridlon, Woodfords	30.5	No dirt.
15018	L. P. Senter & Co., Woodfords	47.0	No dirt.
15020	L. P. Senter & Co., Woodfords	34.0	No dirt.
14924	M. Volente, Woodfords	49.0	No dirt.
15012	Woodfords Cash Market, Woodfords	45.0	No dirt.

* For explanation of cleanliness see page 82.

MILK.

Table showing the results of the examination of samples of milk collected in April, May and June, 1915.

Station number.	Name and Address.	Results of Examination.*
	AUBURN.	
14578	Dumont Bros.	Quality fair. Slightly dirty.
14579	Dumont Bros.	Quality good. Very dirty.
14583	E. G. Learn.	Quality good. Very slightly dirty.
14580	N. Neblond.	Quality excellent. Dirty.
14581	N. Neblond.	Quality excellent. Dirty.
14589	Small & Lane.	Quality excellent. Dirty.
14590	Small & Lane.	Quality excellent. Dirty.
14592	L. C. Tabor.	Quality excellent. Dirty.
14574	Turner Center Dairying Association.	Quality good. Slightly dirty.
14588	L. O. Varnum.	Quality good. No dirt. Lawful.
	AUGUSTA.	
15080	E. Locke.	Quality excellent. No dirt. Lawful.
15078	Merrill Brothers.	Quality excellent. Very slightly dirty.
15082	Webber & Hewitt.	Quality good. No dirt. Lawful.
15084	L. S. Young.	Quality excellent. No dirt. Lawful.
	BANGOR AND EAST BANGOR.	
14612	E. P. Barnes.	Quality excellent. Dirty.
14613	E. P. Barnes.	Quality good. No dirt. Lawful.
14626	R. J. Chandler.	Quality good. No dirt. Lawful.
14627	R. J. Chandler.	Quality good. No dirt. Lawful.
14642	T. A. Constantine.	Quality good. Very slightly dirty.
14643	T. A. Constantine.	Quality good. Dirty.
14621	F. R. Fuller.	Quality good. Slightly dirty.
14622	F. R. Fuller.	Quality excellent. No dirt. Lawful.
14665	W. L. Grant.	Quality good. No dirt. Lawful.
14666	W. L. Grant.	Quality fair. No dirt. Lawful.
14628	G. H. Hunt & Son.	Quality good. No dirt. Lawful.
14625	T. T. Lewis.	Quality good. Slightly dirty.
14721	Maine Creamery.	Quality excellent. Very slightly dirty.
14676	D. J. McGraw.	Quality excellent. Very slightly dirty.

* For explanation of quality and cleanliness see page 82.

MILK—Continued.

Station number.	NAME AND ADDRESS.	RESULTS OF EXAMINATION.*
14710	A. A. Morrison	Quality good. No dirt. Lawful.
14618	C. H. Morrison	Quality good. Slightly dirty.
14619	C. H. Morrison	Quality good. Slightly dirty.
14655	F. L. Mower	Quality good. No dirt. Lawful.
14656	F. L. Mower	Below standard in total solids and fat. No dirt. Unlawful.
14674	O'Connell Bros	Below standard in total solids and fat. No dirt. Unlawful.
14681	F. L. Peavey	Quality excellent. Very slightly dirty.
14671	C. H. Peterson	Quality excellent. Very slightly dirty.
14713	W. F. Richards	Quality good. Very dirty.
14639	F. W. Savage & Son	Quality good. Very slightly dirty.
14719	Townsend's Cash Store	Quality fair. Slightly dirty.
14669	W. F. White	Quality good. Dirty.
14684	Earl W. Wilde	Collected by the inspector as milk. Analysis shows it to be a cream below lawful standard strength. Dirty.
14679	C. F. Winchester	Quality good. No dirt. Lawful.
14623	Walter Wright	Quality fair. Slightly dirty.
14624	Walter Wright	Quality good. Slightly dirty.
	BRADLEY.	
14964	W. S. Carney	Quality good. No dirt. Lawful.
14632	Levi Knapp	Quality good. Not examined for dirt.
14635	Welch	Quality good. Not examined for dirt.
	BREWER AND SOUTH BREWER.	
14659	C. E. Baldwin	Quality good. No dirt. Lawful.
14660	C. E. Baldwin	Quality good. No dirt. Lawful.
14725	J. P. Crawford	Quality good. Very slightly dirty.
14726	J. P. Crawford	Quality fair. Very dirty.
14701	Danforth Bros	Quality excellent. No dirt. Lawful.
14616	H. J. Dougherty	Quality good. Dirty.
14617	H. J. Dougherty	Quality good. Very dirty.
14657	C. W. George	Quality excellent. No dirt. Lawful.
14658	C. W. George	Quality good. No dirt. Lawful.
14687	Ralph Getchell	Quality good. No dirt. Lawful.
14688	Ralph Getchell	Quality good. No dirt. Lawful.
14667	J. L. Harlow	Quality excellent. No dirt. Lawful.

* For explanation of quality and cleanliness see page 82.

MILK—Continued.

Station number.	Name and Address.	Results of Examination.*
14668	J. L. Harlow	Quality good. Very slightly dirty.
14724	Kenney & McMahon	Quality excellent. Very slightly dirty.
14695	F. W. Kyer & Co	Quality good. Slightly dirty.
14662	F. M. Leathers	Quality good. Very slightly dirty.
14664	F. M. Leathers	Quality good. No dirt. Lawful.
14645	L. L. Lewis	Quality good. Slightly dirty.
14689	A. L. Little	Quality good. Slightly dirty.
14690	A. L. Little	Quality good. No dirt. Lawful.
14691	A. L. Little	Quality good. Slightly dirty.
14703	F. B. Marsh	Quality good. Slightly dirty.
14640	S. F. Murray & Son	Quality good. Very slightly dirty.
14641	S. F. Murray & Son	Quality good. Slightly dirty.
14705	M. H. Perkins	Below standard in total solids and fat. No dirt. Unlawful.
14711	L. L. Robbins	Quality good. No dirt. Lawful.
14712	L. L. Robbins	Quality good. Very slightly dirty.
14697	Daniel Rooney	Quality good. Slightly dirty.
14706	B. N. Rowe	Quality excellent. No dirt. Lawful.
14648	L. H. Smith	Quality good. Slightly dirty.
14649	L. H. Smith	Quality good. Slightly dirty.
14653	L. H. Smith	Quality good. No dirt. Lawful.
14654	L. H. Smith	Quality good. No dirt. Lawful.
14704	R. W. Thompson	Quality good. No dirt. Lawful.
14694	F. W. Wentworth	Quality good. No dirt. Lawful.
	CARIBOU.	
14778	Mercier Brothers	Quality excellent. Very slightly dirty.
14776	Scates & Co	Quality good. Slightly dirty.
	FALMOUTH AND WEST FALMOUTH.	
14852	E. R. Leighton	Quality good. No dirt. Lawful.
14853	E. R. Leighton	Quality excellent. No dirt. Lawful.
14848	Noyes Milk Co	Quality good. No dirt. Lawful.
14849	E. N. Wilson	Quality good. No dirt. Lawful.
14851	Wilson & Roberts	Quality good. No dirt. Lawful.

* For explanation of quality and cleanliness see page 82.

MILK—Continued.

Station number.	Name and Address.	Results of Examination.*
	Freeport.	
15052	B. F. Conant	Quality excellent. Slightly dirty.
15057	F. W. Libbey	Quality excellent. No dirt. Lawful.
15058	F. R. Lord	Quality excellent. No dirt. Lawful.
15059	Mrs. C. C. Luce	Quality excellent. Slightly dirty.
15056	F. G. True	Quality good. Very slightly dirty.
	Gardiner.	
15071	H. J. Bowie	Quality good. No dirt. Lawful.
15072	H. J. Bowie	Quality good. Very slightly dirty.
15076	A. Hastings & Son	Quality excellent. No dirt. Lawful.
15077	A. Hastings & Son	Quality good. No dirt. Lawful.
15066	S. Jones & Son	Quality excellent. No dirt. Lawful.
15067	S. Jones & Son	Quality good. No dirt. Lawful.
15068	C. H. Moran	Below standard in total solids and fat. Very slightly dirty. Unlawful.
15075	Willey & Davis	Collected for milk. On analysis is shown to be light cream. No dirt.
	Glenburn.	
14965	Rideout	Below standard in total solids and fat. No dirt. Unlawful.
	Great Works.	
14962	Tom Morrow	Quality good. Very slightly dirty.
	Hampden.	
14610	E. T. Carver	Quality good. Dirty.
14606	E. G. Patterson	Quality good. Slightly dirty.
14607	E. G. Patterson	Quality good. Dirty.
14714	H. L. Cole & Sons	Quality excellent. Dirty.
14608	John H. Perry	Quality good. Slightly dirty.
14609	John H. Perry	Quality good. Slightly dirty.
14614	J. E. Perry	Quality good. Slightly dirty.
14615	J. E. Perry	Quality good. Slightly dirty.
14708	E. E. Ward	Quality fair. No dirt. Lawful.
14709	E. E. Ward	Quality good. Very slightly dirty.
	Houlton.	
14755	B. A. Brewer	Quality good. No dirt. Lawful.
14756	B. A. Brewer	Quality good. No dirt. Lawful.

* For explanation of quality and cleanliness see page 82.

MILK—Continued.

Station number.	Name and Address.	Results of Examination.*
14752	Cottle Brothers	Quality excellent. No dirt. Lawful.
14753	Cottle Brothers	Quality excellent. Dirty.
14747	Hallett & McKeen Co	Quality good. No dirt. Lawful.
14760	Harkins Bros	Quality good. No dirt. Lawful.
14762	Harkins Bros	Quality good. Very slightly dirty.
14759	McGary Bros	Quality excellent. Slightly dirty.
14757	R. P. McNally	Quality good. No dirt. Lawful.
14750	Albert E. Mooers	Quality excellent. No dirt. Lawful.
14763	W. J. Scott	Quality good. Dirty.
14766	Sincock Co	Quality excellent. Dirty.
14761	O. L. Tompson	Quality excellent. No dirt. Lawful.
	Lewiston.	
14575	Lewis Cassavant	Quality good. Dirty.
14576	Lewis Cassavant	Quality good. Dirty.
14591	L. M. Donnell	Quality excellent. Slightly dirty.
14584	M. M. Goff	Quality good. Slightly dirty.
14585	M. M. Goff	Quality good. Slightly dirty.
14573	I. N. LeClair	Below standard in total solids and fat. Slightly dirty. Unlawful.
14577	C. A. Stevens	Quality good. Dirty.
14586	H. O. Wood	Quality good. Very slightly dirty.
14587	H. O. Wood	Quality good. Very slightly dirty.
14582	D. S. Woodward	Quality good. Very slightly dirty.
	Old Town.	
14968	Frank Brooks	Quality good. Very slightly dirty.
14966	T. F. Monahan	Quality good. No dirt. Lawful.
14967	T. F. Monahan	Quality excellent. Slightly dirty.
14631	F. A. Potter	Quality good. Not examined for dirt.
14633	F. A. Potter	Quality excellent. Not examined for dirt.
14969	P. H. Richards	Quality fair. No dirt. Lawful.
14963	M. St. Marie	Quality good. Very slightly dirty.
	Orrington and East Orrington.	
14629	C. E. Baldwin	Quality good. No dirt. Lawful.
14630	C. E. Baldwin	Quality good. Slightly dirty.

* For explanation of quality and cleanliness see page 82.

MILK—Continued.

Station number.	Name and Address.	Results of Examination.*
14715	C. E. Baldwin	Quality good. No dirt. Lawful.
14650	G. H. McKay	Quality good. Very slightly dirty.
14651	G. H. McKay	Quality good. Very slightly dirty.
14699	H. J. Smith	Quality fair. No dirt. Lawful.
	Portland and South Portland.	
14995	P. Bannigan	Quality good. Very slightly dirty.
14996	P. Bannigan	Quality good. No dirt. Lawful.
15007	Charles F. Barber	Quality good. Slightly dirty.
14970	W. F. Bennett	Below standard in total solids. No dirt. Unlawful.
14915	Sara Blumenthal	Quality good. No dirt. Lawful.
14916	Sara Blumenthal	Quality good. Very slightly dirty.
14954	M. Brownstone	Quality good. Very slightly dirty.
14812	L. M. Bryant	Quality good. Very slightly dirty.
14978	W. A. Bryant	Quality good. No dirt. Lawful.
14979	W. A. Bryant	Quality good. No dirt. Lawful.
14811	J. P. Buckley	Quality good. No dirt. Lawful.
14912	Callas Bros	Quality fair. Very slightly dirty.
14871	L. B. Chipman	Quality fair. Very slightly dirty.
14873	L. B. Chipman	Quality good. Very slightly dirty.
14997	Carl P. Christianson	Quality good. Dirty.
14998	Carl P. Christianson	Quality good. Dirty.
14823	G. G. Cilley	Quality good. No dirt. Lawful.
14913	A. Cohen	Quality good. Very slightly dirty.
14944	Bernard Cohen	Quality good. Very slightly dirty.
14921	Mrs. Millie Collins	Quality good. No dirt. Lawful.
14955	J. J. Connolly	Quality good. Slightly dirty.
14984	Conway Grocery Co	Below standard in total solids. No dirt. Unlawful.
14976	Geo. W. Coombs	Quality fair. Very slightly dirty.
14837	Conwall Cash Market	Quality good. Dirty.
14859	H. F. Cotton	Quality good. No dirt. Lawful.
14821	Neal W. Cox	Quality excellent. Very slightly dirty.
15004	Joseph T. Dougherty	Quality good. Very slightly dirty.
14860	W. S. Dunn	Quality fair. Very slightly dirty.

* For explanation of quality and cleanliness see page 82.

MILK—Continued.

Station number.	Name and Address.	Results of Examination.*
14861	W. S. Dunn	Quality good. Dirty.
14953	J. Elovitch	Quality good. Slightly dirty.
14804	C. R. Flint	Quality good. Slightly dirty.
14980	C. W. F. Goding	Quality good. No dirt. Lawful.
14981	C. W. F. Goding	Quality good. Very slightly dirty.
15002	J. F. Hoffman	Quality good. Very slightly dirty.
14817	Home Dairy Co.	Quality fair. No dirt. Lawful.
14818	Home Dairy Co.	Quality good. No dirt. Lawful.
14986	Chas. W. Horton	Quality good. Very slightly dirty.
14878	B. Huberman	Quality good. Slightly dirty.
14805	M. B. Hutchings	Quality fair. Very slightly dirty.
14920	Mrs. A. Isrealson	Quality good. No dirt. Lawful.
14820	F. A. Johnson	Quality good. Very slightly dirty.
14829	J. G. Johnson	Quality fair. Very slightly dirty.
14945	D. Josselson	Quality good. No dirt. Lawful.
15000	Karlin & Fox	Quality good. Very slightly dirty.
14990	Ernest L. Landry	Quality good. Very slightly dirty.
14994	Virginia Landry	Quality good. Very slightly dirty.
14810	A. B. Lawson	Quality fair. No dirt. Lawful.
14822	A. C. Leadbetter	Quality good. No dirt. Lawful.
14840	M. P. Leighton	Quality good. No dirt. Lawful.
14949	Littlefield & Co	Quality good. Very slightly dirty.
14808	Maine Dairy	Quality good. Very slightly dirty.
14992	James J. McCartney	Quality good. Slightly dirty.
14877	L. A. Mercier Co.	Quality good. Slightly dirty.
14858	C. Moreland	Quality good. No dirt. Lawful.
14947	B.Napelontanio	Quality good. Very slightly dirty.
14999	John J. Nissen	Quality good. Very slightly dirty.
14948	F. D. Orlandella	Quality good. Very slightly dirty.
14911	Park Fruit Store	Quality good. Very slightly dirty.
14918	Geo. W. Parker	Quality good. No dirt. Lawful.
14869	C. J. Pennell	Quality fair. No dirt. Lawful.
14943	Mrs. L. Perlman	Quality good. No dirt. Lawful.
15001	B. Perlmutter	Quality good. Slightly dirty.

* For explanation of quality and cleanliness see page 82.

MILK—Continued.

Station number.	Name and Address.	Results of Examination.*
14825	E. Perry	Quality good. Very slightly dirty.
14857	L. C. Peterson	Quality excellent. No dirt. Lawful.
14835	T. R. Phinney	Quality good. Very slightly dirty.
14833	F. W. & A. H. Pillsbury	Quality good. Very slightly dirty.
14807	W. O. Putman	Quality fair. No dirt. Lawful.
14816	W. O. Putman	Quality good. No dirt. Lawful.
14974	W. O. Putman	Quality fair. No dirt. Lawful.
14975	W. O. Putman	Quality fair. No dirt. Lawful.
14989	John Quinn	Quality good. Extremely dirty.
14832	E. W. Randall	Quality good. Slightly dirty.
14946	A. Rapaport	Quality good. Slightly dirty.
14956	R. R. Reed	Quality good. No dirt. Lawful.
15028	M. L. Richards	Quality good. Very slightly dirty.
14831	J. H. Rines	Quality excellent. Slightly dirty.
14836	G. E. Roberts	Quality excellent. Very dirty.
14809	Rowe Bros	Quality fair. No dirt. Lawful.
14815	Rowe Bros	Quality fair. No dirt. Lawful.
14826	P. W. Rowe	Quality good. Slightly dirty.
14882	D. Rubinoff	Quality good. Dirty.
14973	J. P. Shattuck	Quality good. No dirt. Lawful.
14854	A. W. Shaw	Quality good. No dirt. Lawful.
14867	Geo. C. Shaw Co	Quality fair. No dirt. Lawful.
14824	J. E. Skillin	Below standard in total solids. No dirt. Unlawful.
14827	A. E. Small	Below standard in total solids. No dirt. Unlawful.
14959	Frank A. Stephens & Son	Quality good. Very slightly dirty.
14814	R. O. Stockman	Quality good. No dirt. Lawful.
14951	C. T. Swett Co	Quality good. No dirt. Lawful.
14971	N. A. True	Below standard in total solids. No dirt. Unlawful.
14972	N. A. True	Below standard in total solids. No dirt. Unlawful.
14806	Geo. E. Tupper	Quality good. No dirt. Lawful.
14843	Turner Center Dairy	Quality good. No dirt. Lawful.
15026	Tuttle Bros	Quality good. No dirt. Lawful.
14834	C. C. Tuttle	Quality good. Very slightly dirty.
15030	F. H. Verrill	Quality good. Slightly dirty.
14880	J. L. Waite	Below standard in total solids and fat. No dirt. Unlawful.

* For explanation of quality and cleanliness see page 82.

MILK—Continued.

Station number.	Name and Address.	Results of Examination.*
14844	L. W. Welt	Quality good. No dirt. Lawful.
14846	L. W. Welt	Quality good. No dirt. Lawful.
14813	Carl Wilson	Below standard in total solids. No dirt. Unlawful.
14977	E. S. Wilson	Quality good. No dirt. Lawful.
14865	W. L. Wilson	Quality good. No dirt. Lawful.
14908	W. L. Wilson & Co	Quality good. No dirt. Lawful.
15024	York & Co	Quality fair. Slightly dirty.
14958	J. Zabarian	Quality good. Very slightly dirty.
	Presque Isle.	
14780	John Clark	Quality excellent. Very slightly dirty.
14784	Harry Good	Quality good. Dirty.
14785	Harry Good	Quality good. Very slightly dirty.
14781	J. S. Kempton	Quality good. No dirt. Lawful.
14782	J. S. Kempton	Quality good. No dirt. Lawful.
14783	J. S. Kempton	Quality good. No dirt. Lawful.
	Stillwater.	
14636	M. L. Rogers	Quality good. Not examined for dirt.
14634	R. L. Weymouth	Quality good. Not examined for dirt.
	Waterville.	
14895	Bert Clifford	Quality excellent. Dirty.
14896	Bert Clifford	Quality good. Dirty.
14900	Wm. Glidden	Quality good. No dirt. Lawful.
14904	Hallowell Grocery Co	Quality good. Very dirty.
14887	E. C. Mathews	Quality good. No dirt. Lawful.
14888	E. C. Mathews	Quality good. No dirt. Lawful.
14885	Warren L. Nye	Below standard in total solids. Watered. Very dirty. Unlawful.
14899	J. C. Picard	Quality good. Dirty.
14890	Pine Cone Dairy	Quality excellent. Slightly dirty.
14891	Pine Cone Dairy	Quality good. Slightly dirty.
14902	W. L. Rhoades	Quality excellent. Dirty.
	Westbrook.	
14845	L. P. Knight	Quality good. No dirt. Lawful.
	Winslow.	
14892	L. M. Emery	Quality excellent. No dirt. Lawful.
14893	L. M. Emery	Quality excellent. Very slightly dirty.

* For explanation of quality and cleanliness see page 82.

MILK—Concluded.

Station number.	Name and Address.	Results of Examination.*
	Woodfords.	
14830	W. F. Babb & Sons	Quality good. Very slightly dirty.
14934	W. S. Bailey	Quality good. No dirt. Lawful.
15015	C. M. Bowker Co	Quality good. Slightly dirty.
15013	N. H. Cobb & Son	Quality good. Slightly dirty.
14933	H.E. Cook	Quality fair. No dirt. Lawful.
14928	A. J. Curtis & Co	Quality good. No dirt. Lawful.
15021	Fred B. Estes	Quality good. Very slightly dirty.
14940	F. H. Freese	Quality good. No dirt. Lawful.
14855	J. S. Gordon	Quality good. Very slightly dirty.
14856	J. S. Gordon	Quality good. No dirt. Lawful.
14937	S. W. Johnson	Quality good. No dirt. Lawful.
15023	Chas. A. Keen	Quality good. Slightly dirty.
14931	Hans Kair	Quality good. No dirt. Lawful.
14932	M. P. Kittredge	Quality good. No dirt. Lawful.
14850	Roland Leighton	Quality fair. No dirt. Lawful.
14927	W. J. Lucas	Quality good. Very slightly dirty.
14847	J. McDonald	Quality good. No dirt. Lawful.
14839	L. H. Milliken	Quality excellent. Slightly dirty.
14925	Geo. H. Philbrook	Quality good. No dirt. Lawful.
14938	E. F. Ridley	Quality good. No dirt. Lawful.
14828	J. R. Sawyer	Quality good. Very slightly dirty.
15017	L. P. Senter & Co	Quality good. No dirt. Lawful.
15019	L. P. Senter & Co	Quality good. No dirt. Lawful.
14930	Geo. Serafino	Quality good. No dirt. Lawful.
14922	M. Volente	Quality good. No dirt. Lawful.
15011	Woodfords Cash Market	Quality good. No dirt. Lawful.
	Yarmouth.	
15062	C. C. Barber	Quality excellent. No dirt. Lawful.
15065	F. C. Burnham	Quality good. Slightly dirty.
15063	L. J. Lombard	Quality good. No dirt. Lawful.
15064	L. J. Lombard	Quality good. No dirt. Lawful.
15060	F. G. Simonton	Quality good. No dirt. Lawful.
15061	F. G. Simonton	Quality excellent. No dirt. Lawful.

* For explanation of quality and cleanliness see page 82.

STATEMENT BY THE EXECUTIVE OF THE LAW.

A. M. G. SOULE, CHIEF BUREAU OF INSPECTIONS.

The following notes on the cream and milk conditions as found in Maine are written by Mr. Clifford W Wescott, who has acted as Dairy Inspector during the quarter covered by this report.

DAIRY INSPECTION.

The inspection work carried on during the past three months has revealed very few cases of understandard or adulterated milk and cream. This fact is pleasing to the Bureau of Inspection as we see that the milk situation in the State of Maine has greatly improved in recent years. This improvement has been largely brought about by the instructive and suggestive manner of inspection. The producers, as a rule, are glad to coöperate with this Department and are willing to accept any reasonable suggestions made. However, the producer can not be expected to lay out a large amount of money that he may produce higher quality milk unless he is to receive his reward in the way of a higher price for his product.

The prices of milk here in Maine are comparatively low, therefore, it is our duty to protect the producer of this low priced milk, as well as the consumer of it. That is, this bureau cannot condemn a man's dairy, if his conditions are not too bad, when he is receiving practically the cost price of production. It is to be encouraged, however, that the consumer coöperate with the producer and pay him a better price for a better product. We feel sure that the large number of producers would gladly build sanitary milk houses and install sanitary equipment if a higher price for their product would warrant their doing so. One way of bringing about this result, automatically, is for the consumer to cease to patronize producers or dealers whose products have been shown to be adulterated or extremely dirty. There is no excuse for adulterated milk and the cleanliness of milk depends entirely upon the conditions under which it is produced.

CLEAN MILK PRODUCTION.

If milk could be drawn direct from the cow into sterile bottles without its passing through air it would be practically free from bacteria. This, however, is impossible and impracticable. It is very evident, therefore, that milk becomes contaminated after it is drawn. Although bacteria are too minute to be seen with the naked eye, we really mean bacterial infection when we speak of filthy milk. Whenever any amount of sediment is seen at the bottom of a milk bottle it is enough to say that there are many bacteria in such milk, for dirt and bacteria go hand in hand. Every speck of dirt, every particle of dust, every piece of hair and every insect that falls into the milk carries with it several thousand bacteria.

The bacteria content of milk depends upon various factors of which the following are most important:

Dirty or unhealthy cows.

Dirty stables.

Dirty of unhealthy persons employed in handling cows and milk.

Dirty utensils.

Dirty surroundings of milk after being drawn.

Keeping milk at high temperature.

DIRTY OR UNHEALTHY COWS.

When cows are not properly cleaned every day a great amount of loose hair and coarse dirt accumulates on their bodies, and every piece of hair or dirt that falls into the milk pail carries with it a large number of bacteria. It is true that the hair and large particles of dirt may be removed by the strainers, but the bacteria have been washed from them and it is impossible to remove them by straining.

DIRTY STABLES.

Dirty stables, by which is meant, stables not properly cared for, having dirty floors, walls, and ceilings, favor the contamination of milk. The walls and ceilings of stables should be made of matched lumber so that they are tight. They should be frequently cleaned and white washed. When this is done the amount of floating dust in the stable is reduced to a minimum. Dust and bacteria are closely associated. Hay or other dry fodders causing dust should not be fed until after milking.

DIRTY EMPLOYEES.

All persons employed to take care of the cows or the milk should be dressed in clean suits made of some hard material that will not collect dust and dirt. The hands of the milker should be thoroughly washed and dried before milking. He should be furnished with a clean white jacket which will not collect dust and which will show dirt easily if it does accumulate.

DIRTY UTENSILS.

Great care should be used to keep milk pails, strainers and milk cans clean. Cracks and joints in pails and cans form a very good hiding place for dirt and hence bacteria. It is well to flush all joints and seams with solder before using a new pail or can. Some form of narrow top pail should be used. They decrease the amount of surface open to dust particles in the air and hair of the cow. The form of narrow top pail that has a strainer attached is not considered sanitary, because all hair and dirt that falls on the strainer is thoroughly washed by the milk that follows. Even if the hair and dirt are not washed through the strainer into the milk, the bacteria from them are. Strainers should be thoroughly cleaned and scalded after being used and as soon as they become soiled and filled with hair should be thrown away. Pails and cans should be cleaned after being used and should be scalded with boiling water or live steam before being used again.

DIRTY SURROUNDINGS.

Even when milk has been drawn in accordance with the previous precautions, it is very easily contaminated if kept at any length of time where it is not clean. Hence, as soon as one cow is thoroughly milked the milk should be removed from the stable at once to a clean milk room where it should be immediately strained.

KEEPING MILK AT HIGH TEMPERATURE.

The keeping quality of milk depends to a large extent upon the growth of bacteria after it is drawn. Warm milk forms an excellent medium for the growth and development of bacteria. Therefore, it is important that milk should be thoroughly cooled while the bacteria content is low. Cooling should be accomplished immediately after straining, by running it over a cooler filled with cold spring water or ice. If a cooler is not at hand the cooling can be done by setting cans of milk in ice water. If this method is employed the milk should be stirred from time to time to insure that it is cool. If a cooler is used it should be placed in as pure an atmosphere as possible to prevent contamination. The temperature of new milk should be reduced to at least 60° F. in order to retard the growth of bacteria commonly found in milk. It is not only essential to reduce milk to this temperature, but also to hold it at this low temperature until delivered to the consumer.

After milk has been delivered it belongs to the consumer and even if it has been produced under the best of conditions, its keeping quality from then on depends largely upon its treatment by the consumer. Milk should not be left on the door steps where the sun will raise its temperature to the point where bacterial growth is greatest, from 70° to 90° F. This high temperature may even sour milk in a few hours. The milk should be removed from the sun at once and placed in a refrigerator where its low temperature may be maintained.

August, 1915

MAINE
AGRICULTURAL EXPERIMENT STATION,
ORONO, MAINE.
CHAS. D. WOODS, Director.

ANALYSTS.

James M. Bartlett — **Herman H. Hanson**
Royden L. Hammond — **Edward E. Sawyer**
Elmer R. Tobey — **Walter H. Rogers**

Official Inspections

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FEEDING STUFFS INSPECTION

The Commissioner of Agriculture is the executive of the law regulating the sale of feeding stuffs in Maine. It is the duty of the Maine Agricultural Experiment Station to make the analyses of the samples collected by the Commissioner, and it is the duty of the Director to publish the results of the analyses of the samples of feeding stuffs, and such additional information as may seem advisable.

CONTENTS.

NOTE. All correspondence relative to the inspection laws should be addressed to the Bureau of Inspections, Department of Agriculture, Augusta, Maine.

REFERENCE LIST OF FEEDING STUFFS REGISTERED IN 1914-15.

The first page number refers to the tabulated reports and the second number to the page on which the results are discussed.

REGISTRATION AND RESULTS OF INSPECTION.

The following pages contain the report of the analyses of commercial feeding stuffs made since the publication of Official Inspections 60. The tabular matter and the discussion of the results of inspection were prepared by Harry M. Woods, Feeding Stuffs Inspector under the Commissioner of Agriculture.

There are reported in all 951 samples, including all received up to July 1, 1915. Three hundred and six of the samples were submitted by dealers manufacturers and consumers; 645 were drawn by the inspectors of the Department of Agriculture. In the course of their work the inspectors covered the entire state with the exception of the extreme northern and eastern parts. Practically all stores buying feed directly from out-of-state points were visited at least once, most of them twice, and some of the larger wholesale places, three or more times.

A reference to the tabular report of feeding stuffs by brands will show that a different method of reporting the results of the analyses has been adopted than that used in previous years. Instead of the columns showing the guaranteed and found percentages of protein, fat and fiber on each sample, two columns only will be found. In the left hand column is the name of the brand, the manufacturer, the list of ingredients, the maximum percentage of crude fiber, and the minimum percentages of fat and protein, as guaranteed by the manufacturer or shipper in the certificate of registration filed with the Commissioner of Agriculture. In the right hand column is a general discussion not of each individual sample, but of the findings in regard to each brand of feed as a whole. A reference to the tabular pages will show the method of treatment better than a description here. This method gives the information for which a reader of these reports is looking in a form which it is thought can be much more readily and fully taken in than when it is necessary for him to go over the detailed reports of each sample of each brand and make a similar summary for himself. The only information which could be obtained from the former method of treatment which is not present in the report this year is the amount that the samples found lawful exceeded their guarantees. This amount of over-run is not important from the standpoint of the purpose of the law and the statement of it is very apt to be misleading to the consumer and may frequently be unfair to manufacturers.

For the intent of the law clearly is that samples shall be analyzed for the purpose of determining whether they are in accord with their guarantees. To state that they have been found so is to state the result of the analysis. To publish results showing that two samples of a given brand were both up to guaranty and none were below is to indicate that a feeder may buy that brand with pretty fair assurance that he will get what is guaranteed. To show that those two samples both happened to be 2 per cent or so higher than their guarantees frequently tends to mislead him. For the fact that two samples both ran high, is no indication that the goods of that brand which he buys from a different lot will do equally well. *No matter how high some single sample may test, the only analysis that a buyer has any right or reason to expect from a feed is that guaranteed by the maker on the label.*

If, however, some brand of feed *uniformly* runs as much as 2 per cent above its guaranty, the manufacturer is not living up to the spirit of the feeding stuffs law in placing so low a guaranty upon his goods. For it is clearly the intent of the law that feeds shall carry guarantees indicative of their value; and to be so the guarantees should be as high as possible without making it likely that some lots will run below them. And if in publishing the exact percentages of protein, etc., found in each individual sample, the Experiment Station helps such a manufacturer to prove to customers that his feed is as good as another with an honest guaranty which means something. it is throwing all its weight against the man who is living up to the spirit of the law in favor of the man who is trying to keep within the letter of the law while evading its spirit.

It may also happen that two brands of feed of the same sort with the same guarantees and *on the average* about the same analysis are shipped by different manufacturers. The samples examined may give considerably better results in the case of one than of the other; whereas if other cars of each brand had happened to be the ones sampled the one making the poorer showing might have shown up as well as the other did and vice versa. A man assuming on the basis of one or two analyses that one of those feeds was decidedly superior to the other would obviously be as unfair to the manufacturer of the latter as to himself. To repeat, *the only analysis that a buyer can safely go by is the minimum (in the case of fiber, maximum) guaranteed on the label of the feed he is buying.* Anything tending to make him think that he is likely to get more than that is misleading. The object of the analyses made under the law is to make it as sure as possible that he will get that analysis.

That the possibility of a man's being misled by the numerical results of analyses is not merely theoretical is shown by the fact that one manufacturer of feed was apparently misled in that very way last year. In the last "Official Inspections" relating to feeding stuffs, two samples of a certain feed were reported. The feed in question was at that time guaranteed to carry 15 per cent protein. The two samples examined both happened to be from cars that were above the average and both tested nearly 17 per cent protein. Apparently on the strength of those analyses, the manufacturer raised the protein guaranty to 16.50 per cent. The result was that the goods of that brand examined this season were all found considerably below guaranty in protein and cases are now pending against that manufacturer under the United States law for the interstate shipment of misbranded goods. Feeders would certainly be fully as likely to be misled by such results as a manufacturer, whose business it is to know about feeding stuffs.

It should be constantly borne in mind that the guarantees required by the law are not average, but in the case of protein and fat, minimum, and in the case of fiber maximum percentages. That is, if some lots are deficient, the fact that other lots exceed their guarantees does not neutralize it; it is the intent of the law that guarantees be so fixed that *all* goods of that brand will be in accord with them. Buyers should not allow themselves to be deceived by the practice of some manufacturers who use two figures in their guarantees, making their claims in such forms as "Protein 10 to 13 per cent." The upper figure is absolutely without meaning; the only percentage guaranteed is that represented by the lower figure. In other words, goods bearing the statement above are no more likely to carry 13 per cent protein than those with a simple statement of "Protein 10 per cent." While a case probably could not be maintained under the law, there is little doubt that the purpose of manufacturers using this "sliding scale" system is to thereby deceive and mislead the purchaser by guaranteeing one thing to him and endeavoring to make him believe that he is getting something better.

Besides the detailed discussion by brands in the tabular pages, a general discussion of each of the different sorts of feeding stuffs will also be found. On the inside of the front cover is a double index referring to both the general and the detailed discussion of each class of feeds.

DESCRIPTION OF TABLES.

In the left hand column of the tables will be found listed the name of each brand of feeding stuff registered in Maine in 1914 or 1915, the name of the manufacturer, the list of ingredients, and the guaranteed analysis as given on the certificate of registration filed with the Commissioner of Agriculture. Unregistered brands of which samples have been examined are also included in the list. The feeds are grouped into classes and in those classes the names of the manufacturers are arranged alphabetically. In the right hand column the results of the examination of the samples of each brand are discussed. The number of samples examined, how many were in accord with guaranty, how many were not in accord and in what respects, the number of weed seeds found (if samples were examined for weed seeds), and any other informtion that has a bearing on the lawful sale of the goods, are given for each brand. In the discussion, when a sample is spoken of as 'slightly" below (in the case of fiber, above) guaranty, it means that the deviation from guaranty was so small that another sample from the same lot of goods might be found in accord. The significance of a "slight" deviation depends to a considerable extent upon the findings in regard to the other constituents of the same sample and other samples of the same brand. In the weed seed enumeration, a "few" means from two to eight in a half pint sample; "some" means eight to fifteen; "many" not more than seventy-five; and "very many" means up to two per cent of weed seeds. When practicable, the weed seeds found in the samples are given in detail; when the varieties are too numerous for a detailed statement, the quantity found is given.

Included in the list of brands in the tables are all the feeds that have been registered in the State, whether samples of them have been obtained or not. As the feeding season covers parts of two years, both 1914 and 1915 registrations are included in the list. Most of the feeds listed were registered both years, but some for only one of them. If the list is used as a reference to find whether a given brand is registered, it should not be assumed that the sale of a feed registered *only in 1914* is now lawful. The list of 1915 registrations includes all brands registered up to July 1.

In some cases where goods have been registered in both 1914 and 1915, the guarantees filed in the registration certificates for the two years differ. Some of these changes are because it has been found that the goods would not run up to the guarantees claimed. On the whole, the guarantees filed for 1915 are more rational and in keeping with the goods they represent than the 1914 figures. When the guarantees for the two years have differed and all the samples obtained by the inspectors have carried the 1915 guarantees, the 1914 figures have sometimes been left out of the table to avoid confusion. When no samples were obtained, and in some cases when they were, both sets of figures are given and mention is made of the guarantees carried by the goods sampled. In other cases, when goods with both sets of guarantees were sampled and the discussion seemed likely to be confusing, the certificates as filed for the two years have been treated as representing two separate brands.

Several lots of feeds, the labels on which did not agree with the filed certificates of registration, are referred to as "misbranded." The law explicitly states that a commercial feeding stuff "shall be deemed to be misbranded, if the printed statements required by section four to be affixed to the package differ from the statements required by section five," the latter being the section requiring the filing of the registration certificate. The attention of manufacturers filling out certificate blanks is called to this necessity of agreement between the certificate and the labels by the statement in the certificate,—to which they affix their legal signature—"And we do further certify that the above statement accurately corresponds to the facts set forth in the printed statement affixed to the packages of the above named brand of feeding stuff." It is encouraging to be able to state, however, that the cases of discrepancies between certificates and labels are becoming less frequent each year.

Two classes of samples are reported in the tables,— official samples and dealers' samples. The former are the samples drawn by the duly authorized inspectors of the Department of Agriculture. The latter include all samples submitted by dealers, consumers, and manufacturers. The general name of dealers' samples is used for them because it is from dealers that all but a few of them are received. Anyone desiring to submit samples for free analysis MUST take those samples in accordance with the directions issued by the Department of Agriculture; copies of those directions may be obtained on application to the Commissioner of Agriculture, Augusta, Maine. All the samples received are examined for protein, the most important constituent from the standpoint of the Maine feeder. At least one official sample of each brand is also examined for fiber and fat. Many of the official samples were examined for weed seeds.

Because deficient samples are reported in this bulletin should not be taken to mean that the cases have been passed. All discrepancies between guarantees and analyses are reported to the Commissioner of Agriculture for appropriate action; serious discrepancies in goods shipped from other states are reported to the Federal authorities for action under the United States law.

COTTONSEED BY-PRODUCTS.

Cotton Seed Meal is a product of the cotton seed only, composed principally of the kernel, with such portion of the hull as is necessary in the manufacture of oil, provided that nothing shall be recognized as cotton seed meal that does not conform to the foregoing definition and that does not contain at least thirty-six (36) per cent protein.

Choice Cotton Seed Meal must be finely ground, not necessarily bolted, perfectly sound and sweet in odor, yellow, free from excess of lint, and must contain at least forty-one (41) per cent of protein.

Prime Cotton Seed Meal must be finely ground, not necessarily bolted, of sweet odor, reasonably bright in color,—yellow, not brown or reddish,—free from excess of lint, and must contain at least thirty-eight and six-tenths (38.6) per cent of protein.

Good Cotton Seed Meal must be finely ground, not necessarily bolted, of sweet odor, reasonably bright in color and must contain at least thirty-six (36) per cent of protein.

Cotton Seed Feed is a mixture of cotton seed meal and cotton seed hulls containing less than 36 per cent of protein.

The division of cotton seed meals into the recognized grades of choice, prime, and good has little bearing on the cotton seed situation in Maine, for most of the shippers sending meal into this State evade the necessity of living up to the definitions of the various grades by selling on the basis of the protein content only, and with few exceptions neither labeling nor invoicing as choice, prime or good. In other words, they can, and do, ship meal as 41 per cent meal which, through being off in color, for instance, might not classify as choice; for while choice meal carries 41 per cent protein, 41 per cent meal is not necessarily choice.

Most of the cotton seed shippers have two brands—not choice and prime, but analagous to those two grades—guaranteed about 41 per cent and about 38½ per cent respectively. In case a sample of cottonseed meal guaranteed 41 per cent. protein is examined and found to carry less than that amount, the dealer handling the meal is notified that its sale in Maine under that brand and guaranty is unlawful. This, of course, leaves him with a supply of the goods on hand to dispose of in some way. Occasionally, if the car has not yet been unloaded, the goods are reshipped out of the State. More frequently at the request of the dealer or the shipper or both, the dealer is allowed to sell the remainder of the lot provided he will remove the 41 per cent tags and replace them with tags of the shipper's lower grade meal. Similar arrangements for retagging 38 1-2 per cent meal found below that guaranty have also been made. It is to take care of such cases that the meals guaranteed about 35 or 36 per cent protein have been registered. *This retagging is allowed only to enable the dealer to lawfully dispose of goods left on his hands, and in no way has it any bearing on* *any case brought against him for the previous unlawful sale of the goods incorrectly tagged or on any case brought against the shipper under the United States law for the inter-state shipment of misbranded goods.*

One reason for the division of cotton seed meal into grades, and particularly for including the protein content in the definitions of those grades is that cotton seed meal is the most variable and unreliable in its protein content of any of the common feeding stuffs. The findings in regard to the samples of cotton seed meal examined during the past season are discussed in detail elsewhere in this bulletin. A reference to those tables will show that while a majority of the samples examined have been in accord with their guarantees in protein, there is no brand of which any considerable number of samples has been obtained of which some samples have not been found more or less deficient. One reason for the variation in different cars of the same brand of cotton seed meal is that nearly all of the shippers are jobbers who buy meal at various mills and have it all shipped under their brand and name. Some brands, of course, make a better showing than others, and more meals claiming to carry at least 41 per cent protein have fallen below their guaranty than those claiming 38 or 39 per cent. This should not be interpreted to mean that the 41 per cent meals are not as a rule better than the lower grade meals; for while the latter less frequently fall below their guaranty, that guaranty is lower; and the higher grade meals, even though falling short of 41 per cent, usually carry more protein than those claiming the smaller amount. There is no way, however, for a dealer or consumer to be sure that he is getting the guaranteed percentage of protein in cotton seed meal without a chemical analysis of each individual carload. Free analyses of feeding stuffs are made for any resident of the state who will submit to the Department of Agriculture samples *taken in accordance with the directions issued by that department.* Copies of these directions may be had on application to the Commissioner of Agriculture, Augusta, Maine. Samples for free analysis *must* be taken in accordance with these directions. Dealers who wish to fully protect their customers and consumers who wish to protect their own interests should have samples of all cotton seed meal purchased by them examined.

Some cotton seed meal is shipped with a minimum guaranty of 38.62 per cent protein on the package, but with a verbal understanding between the shippers and the buyers that the meal carries 41 per cent protein and that the shippers will make good any shortage on that basis. It is the claim of such shippers that they do this to protect themselves from unintentionally infringing the law and that their meals fall below 41 per cent no more frequently than those carrying an honest 41 per cent guaranty. In the case of one brand shipped under such an arrangement, only a little over one third of the samples examined this season carried 41 per cent protein. In the case of another brand (but one of which only a very few samples were obtained) no samples carried 41 per cent protein. Not one of the common brands carrying a straight 41 per cent claim had less than 60 per cent of its samples up to guaranty. Buyers of cotton seed meal should remember that a verbal claim is not a guaranty and that only the legal minimum guaranty on the package can be recognized as binding on the shipper.

In fat content, practically all the samples examined were in accord with guaranty. The only one that fell below was not unusually low in fat, but fell below because it carried an abnormally high fat guaranty. In the case of fiber, however, the showing is very bad. Of course, several of the samples which were examined for fiber were those which had been found deficient in protein. In the case of such samples, an excess of fiber is to be expected, for in general, the same causes that tend to decrease the protein content tend to increase the fiber. But even of the samples which were up to guaranty in protein, the ones that are in accord with the guaranty in fiber are the rare exceptions rather than the rule. A reference to the reports of the analyses made in previous years will show that this situation is not a new one. In general, the cotton seed meals claiming to carry 41 per cent protein guarantee not over 10 per cent fiber and those claiming 38 per cent protein, 12 per cent fiber. It would appear as if the shippers ought to increase these figures to 12 and 14 per cent respectively or else take care to get less hulls into the meal.

No samples of cotton seed feeds were submitted by dealers. Only two lots of goods of this class were found by inspectors. Both of these had been in the dealers' hands so long that they had been sampled by inspectors in previous seasons. The apparent scarcity of this class of feeds and their slow sale seem to indicate that Maine feeders are fully alive to their relatively low feeding value in proportion to the price at which they are sold.

FLAX SEED BY-PRODUCTS.

Linseed Meal is the ground residue after extraction of part of the oil from ground flax seed. In old process meal the oil is extracted by pressure; in new process meal, by naptha.

Linseed Meal is an excellent high protein feed, but a comparatively small amount of it is used in Maine. Inspectors were unable to obtain samples of more than half the brands registered, but those examined make an excellent showing. With the exception of one sample very slightly low in fat, and another very slightly high in fiber, all were strictly in accord with their guarantees. A few of the samples were examined for weed seeds. None were found.

STARCH FACTORY AND SIMILAR BY-PRODUCTS.

The starch factory by-products are what are commonly called Gluten Meals and Gluten Feeds. That name is not used for them in the heading above because there is also a brand of distillers grains sold in Maine under the name of "Gluten Feed." Neither starch factory by-products nor distillers grains have any real right to the name, as neither contain gluten. The makers of the distillers grains in question appear to have as much right to it as the starch factories and to have used it for practically as long a time.

Gluten Meal (so-called) is that part of commercial shelled corn that remains after the separation of the larger part of the starch, the germ, and the bran by the processes employed in the manufacture of corn starch and glucose.

Gluten Feed (so-called) is that part of commercial shelled corn that remains after the separation of the larger part of the starch and the germ, by the processes employed in the manufacture of corn starch and glucose. (Note that the difference between the meal and the feed is that the latter contains the corn bran, the feeding value of which is very small).

With the exception of two samples that were deficient in fat,—an almost negligible component in this class of feeds—all the "gluten" feeds and meals examined have been found fully in accord with their guarantees. A few of the samples were examined for weed seeds. None were found.

BREWERY AND DISTILLERY BY-PRODUCTS.

Brewers Dried Grains is the dried residue from cereals obtained after "mashing and sparging" the malt.

Distillers Dried Grains is the dried residue from cereals obtained in the manufacture of alcohol and distilled liquors.

Little comment beyond what appears in the tables is necessary on the samples of brewers and distillers grains examined this season. Of ten samples examined, two were deficient in protein,— one so slightly that the deficiency is negligible—and one was high in fiber. No weed seeds were found in any of the distillers grains; both the samples of the one brand of brewers grains registered carried a few.

SUGAR BEET BY-PRODUCTS.

Dried Beet Pulp is the residue of sugar beets after the extraction of sugar.

Only two brands of beet pulp are registered in Maine. One of these, however, and perhaps the other, represents the product of a number of factories, though all shipped under one brand and name. The samples examined were all strictly in accord with guaranty.

The shippers of dried beet pulp claim for it, particularly in the absence of succulent feeds, a feeding value somewhat analagous to that of succulent feeds. If dried beet pulp has value as a feed proportionate to the price at which it is usually sold, it is for some such reason; on the basis of its analysis, its feeding value is low. If any exact feeding experiments on this question have been made, they have not come to the attention of this Experiment Station. The claim appears doubtful.

WHEAT BY-PRODUCTS.

Wheat Bran is the coarse outer coating of the wheat berry.

Standard Middlings or Shorts is the fine particles of the outer bran as well as the inner or "bee-wing" bran separated from the wheat bran and white middlings.

White Middlings or Flour Middlings is that part of the offal of wheat intermediate between standard middlings and red dog.

Red Dog is a low grade wheat flour containing the finer particles of bran.

Mixed Feed is a mixture of the by-products from the milling of the wheat berry.

Screenings is the smaller imperfect grains, weed seeds and other foreign materials, having feeding value, separated in cleaning the grains.

With the large number of brands of wheat feeds that are examined a considerable variation in the findings is to be expected. The goods of most mills have carried reasonable guarantees and run very closely in accord with them. A few shippers have put abnormally high (in the case of fiber, low) guarantees on their products and the goods have been found deficient. It will be noted that a number of these manufacturers have changed their guarantees on their 1915 goods and come down to a reasonable figure. A few brands carrying guarantees that wheat feeds of their class should reasonably be expected to come up to have been found deficient, but they are the exception. On the whole the situation in wheat feeds is very satisfactory.

ADULTERATED WHEAT FEEDS.

A few feeds composed of wheat feeds plus foreign matter—usually ground corn cobs—are still sold in Maine. No one need buy them unwittingly as their composition is plainly indicated on the label. To judge by the amount of them found by inspectors, however, their use in the State is decreasing every year. Feeders who have previously used them because they were "cheaper" than straight wheat feeds are apparently waking up to the fact that ground corn cobs are an expensive feed at almost any price. These feeds are usually sold by dealers at only a slight reduction from the price of pure wheat feeds. That the dealers who carry them are aware that they are poor value for the money is evidenced by the fact that they nearly always apologize to the inspectors for having such goods on hand, saying that they "have to carry them because some of their customers demand them." Probably the fact that the margin of profit is greater than in the case of pure wheat feeds has something to do with it also. Three brands of goods of this class were registered this season. Sterling Feed was found at perhaps a dozen stores; Bluegrass Feed at only two; no Holstein Feed was found. The samples examined were not all in accord with even the low protein and high fiber guarantees that they carried.

CORN AND OATS GROUND TOGETHER.

Corn and Oats ground together are what their name indicates and require no definition. Some of the feeds listed under this heading are called "chop" or "chop feeds" by the makers. A chop feed may contain by-products as well as the straight grains, but only those are listed in this class which claim to be pure corn and oat feeds. Chop feeds containing oat hulls or other by-products are listed with the feeds utilizing those by-products.

A few of the feeds of this class are shipped into Maine by manufacturers in other states, but, as the list in the tables shows, most of them are the product of local grist mills. The only sample found low in protein carried a guaranty of 11 per cent, too high a figure for this class of feeds. The makers of this brand have changed their guaranty and now claim only 10 per cent. protein, the guaranty on the majority of the feeds of this class.

Most of the brands of corn and oat feeds carry a fiber garanty of 5 per cent or higher. One sample with a guaranty of 4 per cent fiber ran considerably over that figure, which is too low for this class of feeds. While some samples with a guaranty lower than 5 per cent in fiber were in accord with guaranty and the only sample with a 5 per cent guaranty that overran that amount was one which, as noted in the table, may not have fairly represented the goods, 6 per cent is a safer fiber guaranty for feeds of this class. Only the two samples mentioned over-ran their fiber guarantees.

The fat guarantees on most of the corn and oat feeds examined appear too high. The majority of them are guaranteed to carry 5 per cent fat, some claim only 4 per cent, and one only 3 1-2 per cent. From the showing made by the samples examined, the latter would appear to be the safer figure. Of 11 samples examined, only 3 were up to guaranty in fat. One of those 3 was the sample previously mentioned as guaranteed 3 1-2 per cent; another was guaranteed 4 per cent; and the third, 5 per cent. Four of the 8 samples below guaranty were guaranteed 4 per cent; four of them were guaranteed 5 per cent. The fat content of this class of feeds has been found lower than last year. Of the samples examined in 1913-14, the highest in fat tested 5.42 per cent, the lowest 4.08 per cent, and the average was 4.56 per cent. This year the highest sample tested 5.45 per cent, the lowest only 2.83 per cent, and the average was 4.06 per cent, or lower than last year's lowest sample. Of course, the chances for getting a representative sample of some of these brands were not of the best, owing to the difficulty of sampling goods in bulk in bins, but the chances were the same as in previous years. Good corn and good oats both carry on the average about 5 per cent of fat. The findings on the corn and oat feeds examined appear to indicate that all the mills do not use the best quality corn and oats in these feeds.

HOMINY FEEDS.

Hominy Feed or Hominy Meal is a mixture of the bran coating, the germ and a part of the starchy portion of the corn kernel obtained in the manufacture of hominy grits for human consumption.

With the exception of the one sample of hominy feed manufactured by the Mystic Milling Co., which was deficient in protein and fat, and high in fiber, the feeds of this class which have been examined have been very closely in accord with guarantees. No other samples were deficient in protein and the one deficiency in fat and the two over-runs in fiber were slight. Several of the samples were examined for weed seeds; none were found.

FEEDS UTILIZING CORN AND OAT BY-PRODUCTS.

Protein under 15 per cent.

Corn Feed Meal is the siftings obtained in the manufacture of cracked corn and table meal made from the whole grain.

Not being "the unmixed meal made directly from the entire grain," it is a commercial feeding stuff within the meaning of the law regulating the sale of commercial feeding stuffs in Maine and requires registration and labeling as provided by that law.

A few of the feeds listed under the heading above are either corn feed meal or compounded feeds composed in part of corn feed meal. The majority of them, however, are feeds composed in whole or in part of oatmeal mill or clipped oat by-products.

Oat Shorts or Oat Middlings is the starchy portion of the oat groats (the kernel of the oat berry with the hulls removed) obtained in the milling of rolled oats.

Oat Hulls is the outer covering of the oat grain.

Clipped Oat Refuse is the resultant by-product obtained in the manufacture of clipped oats. It may contain light chaffy material broken from the ends of the hulls, empty hulls, light immature oats and dust. It must not contain an excessive amount of oat hulls.

While one feed listed in this class, of which more will be said later, is a straight oatmeal mill by-product without any reinforcement, the majority of them are compounded feeds in which other products of higher feeding value are mixed with the oat by-products to make the whole more attractive to the stock and the feeder. Their feeding value varies greatly with the kind and amount of other feeds mixed with the oat refuse, and whether they can be profitably fed depends to a considerable extent upon the price for which they are sold. On the whole, it takes a pretty shrewd feeder to buy and feed oat hulls profitably. Any user of this class of feeds should give careful consideration to their analysis, their selling price, and the results he obtains in feeding them. Some of them would be expensive at almost any price.

The straight oatmeal refuse before referred to, for instance, is guaranteed to carry 5.25 per cent protein, 2.5 per cent fat, and 28 per cent crude fiber. The samples examined ran very close to those figures. The average of 126 analyses of hay from mixed grasses is exactly the same as this in fat, practically the same in fiber and over 2 per cent higher in protein. It is doubtful if any of the feeders who bought this feed because it was "cheap" would have paid the same price per ton for hay to haul themselves, and thought they were getting a particularly good bargain.

While a good many brands of feed coming under this heading are registered, those of which any considerable amount is sold in the State are comparatively few.. A number of the brands were not found by inspectors at all during the season. Those that were examined carried rather low protein and fat, and high fiber guarantees, but—with the exception of two "stock feeds" which make a very bad showing—were pretty well in accord with them.

A number of the molasses feeds, which are listed separately, might well be included in this class.

MOLASSES FEEDS.

Feeds containing molasses are grouped together in this report for two reasons:—Because they are usually spoken of and thought of as a separate class of feeds; and because, while the addition of molasses to any sort of feed would bring it into this class, in practice the molasses feeds are all quite similar in composition. For the most part, they are made up of by-products from the milling of various sorts of grains,—oat hulls, wheat screenings and the like,—reinforced with higher grade feeds sufficient to give the whole a fair to medium feeding value, and the molasses is added to make them more palatable and attractive to the stock, and so more attractive to the feeder, than they would be without the sweetening to hide their coarseness. What has just been said about the use of the corn and oat by-product feeds applies equally to the molasses feeds.

But because the latter vary much more in composition, their feeding value also varies more. For this reason, two divisions of the molasses feeds have been made in the table:—Those carrying less than 15 per cent protein; and those carrying more. The feeds in the latter division are more comparable to the miscellaneous compounded feeds with over 15 per cent protein than to the corn and oat by-product feeds. For the most part, like all the compounded feeds, the molasses feeds have run pretty well to their guarantees.

Two feeds in this class require separate consideration. They are composed of molasses and dried sphagnum moss. The sphagnum moss is used simply as a filler to hold the molasses; it has practically no feeding value. It is claimed for these feeds that they give the feeder desiring to use it, molasses in a form more convenient to handle than the liquid. Any claims that they will do anything that ordinary feed molasses will not do are unfounded. Whether they are more convenient to handle is a matter of personal opinion. The feeder planning to use them should compare their price with that of feed molasses. The wet and sticky condition of these goods makes it practically impossible to get a fair sample of them. While a sample of each of the two brands registered was examined, the results are for this reason of little significance. Their analysis is not of great importance, as aside from ordinary beneficial effects of molasses, their feeding value is practically nothing. Under the law, the percentage of protein in a feed is obtained by multiplying the percentage of nitrogen it carries by 6 1-4. Ordinarily, this is a fair index of the protein content. In the case of these two feeds, both the moss and the molasses contain small amounts of nitrogen, but practically no true protein is present.

MISCELLANEOUS COMPOUNDED FEEDS.

Protein over 15 per cent.

This class includes the so-called balanced rations, calf meals and the like. Some of them are manufactured partly to utilize higher grade by-products such as distillers grains and the like. One of them contains oat hulls, but is the exception; it is put into this class, and not with the other oat by-product feeds because of its higher protein guaranty. Practically all of these feeds are excellent for the purposes for which they are intended; the question in regard to their use is one of price. For the price paid for the mixing is, in most cases, altogether too high; in other words, the feeder can usually buy the component feeds and mix them himself a good deal cheaper than he can buy the prepared feed. For the small user who does not want to be bothered with mixing his own feed, their use is defensible. The user of any considerable amount of feed ought to understand feeding problems well enough to mix a feed at home at considerably less cost, which would give him practically as good results.

For the most part, the feeds of this class are in accord with their guarantees; such variations as have been found, have been usually a slight overrun in fiber. The only brand that fell seriously below in protein, was guaranteed in good faith,—but in error,—by the maker on the basis of a single analysis, with no allowance for the inevitable variation in different lots.

COMPOUNDED POULTRY FEEDS.

The feeds coming under this heading are so varied in kind and composition that a general discussion is not easy. They may be roughly divided into scratch feeds,—of various degrees of fineness, from those intended for baby chicks to those intended for mature hens,— and "dry mashes"—for young chicks, mature hens, etc. In the case of the scratching feeds for young chicks, the difficulty of obtaining the ingredients and the bother of mixing small lots may make their use advisable. In the case of the other feeds, the remarks previously made concerning the use of the miscellaneous compounded feeds apply. Figure the cost of the ingredients and then of the mixed product in the case of some of the dry mashes, and if you have never given the subject consideration before, the results will be surprising.

The scratch feeds all carry about the same guarantees and run fairly well in accord with them. A careful study of the list of ingredients and an examination of the feed with the naked eye or a microscope is more profitable to the user than a consideration of the analysis, although one with an analysis much lower than the ordinary should be looked upon with suspicion. In the case of feeds containing grit the purchaser buys rock at the price of grain.

The dry mashes vary greatly in their composition and analysis. The ingredients are stated on the labels (one or two lots were found misbranded in this respect, and the cases taken up), and the goods run, for the most part, pretty close to their guaranteed analyses, so that if the purchaser wishes, he can know what he is getting. Many of the higher grade mashes, price *not* taken into consideration, are excellent feeds; some of the lower grade ones are of little value unless reinforced by the feeder with meat scraps and other high protein feeds. In general, if one is going to purchase feeds of this class, he will get more for his money in buying the better quality and paying more, than he will in buying the "cheaper" sorts.

ALFALFA MEALS.

Alfalfa Meal is the entire alfalfa hay ground, and does not contain an admixture of ground alfalfa straw or other foreign materials.

Alfalfa hay is similar in composition to clover hay, but carries more protein. Where it can be grown, it is a very profitable crop and an excellent feed. Where, as in Maine, the feeder must pay freight on it practically across the continent, alfalfa meal is not ordinarily enough better, price considered, than good clover hay cut into short lengths to make its purchase profitable.

The few samples examined ran pretty well in accord with their guarantees.

DRIED MEAT AND FISH WASTES.

The feeds of this class, sold chiefly for poultry feeds, need little special discussion. Only a few of the brands registered are sold in any great quantity in Maine; several of the brands were not found by inspectors at all. The samples obtained were for the most part in accord with their guarantees. The few exceptions are noted in the detailed discussion.

TABULAR RESULTS OF ANALYSIS.

The details of registration and the results of the analyses are given in the pages which follow. For the description and explanation of the tables see page 106. The discussion of the results of the analyses begins on page 108.

Table showing registrations of feeding stuffs and results of examination of samples.

COTTON SEED MEALS.

Brand, Maker and Guaranties.	Results of Examination.
American Red Tag Cotton Seed Meal. American Cotton Oil Co., 27 Beaver St., New York, N. Y. A cotton seed product. Contains not more than 11.50 per cent. crude fiber, and not less than 7 per cent. fat and 38.55 per cent. protein. Registered in 1914 and 1915 by the Union Seed and Fertilizer Co., 27 Beaver St., New York, N. Y.	Three dealers' samples submitted in 1914 were up to guarantee in protein. No goods of this brand found by inspectors and no dealers' samples submitted since October, 1914.
Dove Brand Cotton Seed Meal. F. W. Brode & Co., Memphis, Tenn. Decorticated cotton seed. Contains not more than 10 per cent. crude fiber, and not less than 6 per cent. fat and 38.62 per cent. protein. Registered in 1914 and 1915.	Of 8 dealers' samples, 5 were up to guarantee in protein; 2 were slightly below; and one was over 1 per cent. below. 2 official samples were collected. One was up to guarantee in protein and the other slightly below. Both were high in fiber, one running over 3 per cent. above the claimed maximum. Both were up to guarantee in fat.
Owl Brand Cotton Seed Meal. F. W. Brode & Co., Memphis, Tenn. Decorticated cotton seed. Contains not more than 10 per cent. crude fiber, and not less than 6 per cent. fat and 41 per cent. protein. Registered in 1914 and 1915.	Of 74 dealers' samples, 48 were up to guarantee in protein; 6 were slightly below; 14 were from 1 to 2 per cent. below; and 6 were over 2 per cent. below. 27 official samples were collected. 14 were up to guarantee in protein; 4 were slightly below; 6 were from 1 to 2 per cent. below; and 3 were over 2 per cent. below. Complete examinations of 10 of the official samples were made, 3 of the samples that were up in protein, and 7 samples that were deficient in protein. Of the 3 that were up in protein, 2 carried no more fiber than claimed; the other was slightly high. Of the 7 that were low in protein, all were more than 1 per cent. too high in fiber, most of them considerably more; two carried over 14½ per cent. crude fiber. None of the samples examined were deficient in fat.
Buckeye Prime Cotton Seed Meal. (41% protein). Buckeye Cotton Oil Co., Cincinnati, O. Manufactured from cotton seed only. Contains not more than 10 per cent. crude fiber, and not less than 6.5 per cent. fat and 41 per cent. protein. Registered in 1914 and 1915.	Two dealers' samples were both up to guarantee in protein. 2 official samples were collected. One was up to guarantee in protein; the other was slightly below. A complete examination of the official sample which was up in protein was made; it was found up to guarantee in fat but slightly high in fiber.
Buckeye Prime Cotton Seed Meal. Buckeye Cotton Oil Co., Cincinnati, O. Manufactured from cotton seed only. Contains not more than 12 per cent. crude fiber, and not less than 6 per cent. fat and 38.62 per cent. protein. Registered in 1914 and 1915.	Of 32 dealers' samples, 18 were up to guarantee in protein; 12 were slightly below; and 2 were over 1 per cent. below. 10 official samples were collected. 7 were up to guarantee in protein; 2 were slightly below; and one was over 2 per cent. below. Complete examinations of 2 official samples were made; one of them a sample that was up in protein, the other the one that was deficient. The one that was up in protein carried a little more fiber than claimed; the one that was low in protein was very high in fiber, carrying over 15¼ per cent. Both samples were up to guarantee in fat.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
Cotton Seed Meal. Buckeye Cotton Oil Co. Cincinnati, O. Manufactured from cotton seed only. Contains not more than 12 per cent. crude fiber, and not less than 6 per cent. fat and 36 per cent. protein. Registered in 1914. Not registered in 1915.	Not sampled. So far as known to the Experiment Station no goods were shipped under this brand; it was registered to take care of certain lots of Buckeye Prime Cotton Seed Meal, guaranteed 38.62 per cent. protein, which on examination were found to fall short of that guarantee.
Acme Brand Pure Cottonseed Meal. T. H. Bunch Commission Co., Little Rock, Ark. Made from cotton seed. Contains not more than 12 per cent. crude fiber and not less than 7 per cent. fat and 38.60 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors and no samples were submitted by dealers.
Good Luck Cotton Seed Meal. S. P. Davis Little Rock, Ark. Cotton Seed meal, with as small amount of cotton seed hulls as possible in the manufacture. Contains not more than 9 per cent. crude fiber (On 1914 certificate: Contains not more than 10.5 per cent. crude fiber), and not less than 7 per cent. fat and 41 per cent. protein. Registered in 1914 and 1915.	Of 25 dealers' samples, 18 were up to guarantee in protein; 5 were slightly below; and 2 were over 1 per cent. below. 9 official samples were collected; 4 were up to guarantee in protein; 3 were from 1 to 2 per cent. below; and 2 were over 2 per cent. below. Complete examinations were made of 3 official samples that were low in protein. It will be noted that the company guaranteed less fiber in the 1915 goods than the 1914. Two of the 3 samples of which complete examinations were made carried the *lower* fiber guarantee of 9 per cent. Nevertheless, all 3 of them were over a per cent. in excess of the *higher* fiber guarantee of 10.50 per cent. All three were up to guarantee in fat.
Veribest Cotton Seed Meal. S. P. Davis, Little Rock, Ark. Cotton seed meal, with as small percentage of cotton seed hulls as possible to be used in the manufacture of this product. Contains not more than 12 per cent. crude fiber, and not less than 6 per cent. fat and 38.5 per cent. protein. Not registered in 1914. Registered in 1915.	Not sampled. So far as known to the Experiment Station no goods were shipped under this brand; it was registered to take care of certain lots of Good Luck Brand Cotton Seed Meal, guaranteed 41 per cent. protein, which on examination were found to fall short of that guarantee.
Cotton Seed Meal. (Illinois Brand). East St. Louis Cotton Oil Co., National Stock Yards, Ill. On 1914 certificate: Contains not more than 10 per cent. crude fiber, and not less than 6 per cent. fat and 41½ per cent. protein. On 1915 certificate: Contains not more than 10 per cent. crude fiber, and not less than 7 per cent. fat and 41 per cent. protein. Registered in 1914 and 1915.	Of 9 dealers' samples, 8 were up to guarantee in protein; one was slightly below. 4 official samples were collected. All were up to guarantee in protein. A complete examination of one official sample was made. It was up to guarantee in fat but was over a per cent. high in fiber.
Equity Brand Cotton Seed Meal and Cake. Feeders' Supply Co., Kansas City, Mo. Made from decorticated cotton seed. Contains not more than 10.5 per cent. crude fiber, and not less than 6 per cent. fat and 41 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors and no samples were submitted by dealers.
Colonial Brand Cotton Seed Meal. Humphreys-Godwin Co., Memphis, Tenn. Made from pressed cottonseed. Contains not more than 17 per cent. crude fiber, and not less than 6 per cent. fat and 34 per cent. protein. Not registered in 1914. Registered in 1915.	So far as known to the Experiment Station, no goods were shipped under this brand; it was registered to take care of certain lots of Dixie Brand Cotton Seed Meal, guaranteed 38.62 per cent., which on examination were found to fall short of that guarantee.

Feeding Stuffs—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Dixie Brand Cotton Seed Meal. Humphreys-Godwin Co., Memphis, Tenn. Made from pressed cottonseed. Contains not more than 12 per cent. crude fiber, and not less than 6 per cent. fat and 38.62 per cent. protein. Registered in 1914 and 1915.	Of 45 dealers' samples, 40 were up to guarantee in protein; 4 were slightly below; and one was over 1 per cent. below. 11 official samples were collected. 10 were up to guarantee in protein; one was over 3 per cent. deficient. Complete examinations of 2 of the official samples were made, one of them a sample that was up in protein, the other the one that was deficient. The former carried no more fiber than claimed; the latter was high in fibre. Both were up to guarantee in fat.
Forfat Brand Cotton Seed Meal. Humphreys-Godwin Co., Memphis, Tenn. Made from pressed cotton seed. Contains not more than 12 per cent. crude fiber, and not less than 6 per cent. fat and 38.63 per cent. protein. Registered in 1914 and 1915.	Of 4 dealers' samples, 2 were up to guarantee in protein; one was slightly below; and one was over 1 per cent. below. 4 official samples were collected. 3 were up to guarantee in protein; one was over 1 per cent. below. Complete examinations of 2 official samples were made, one of them a sample that was up in protein, the other the one that was deficient. The former carried no more fiber than claimed: the latter was a per cent. high in fiber. Both were up to guarantee in fat.
Anchor Brand Choice Cotton Seed Meal. Kemper Mill & Elevator Co., Kansas City, Mo. No certificate filed. Guaranteed on label to carry not more than 10 per cent. crude fiber, and not less than 7.5 per cent. fat and 41 per cent. protein. Unregistered.	One official sample was found to conform to its guarantees in protein, fat and fiber. No other goods of this brand were found by inspectors and no samples were submitted by dealers. The lot that was examined had been on hand since December, 1913.
Staff Brand Cotton Seed Meal. Larrowe Milling Co., Detroit, Mich. Made from decorticated cottonseed. Contains not more than 12 per cent. crude fibre and not less than 7 per cent. fat and 41 per cent. protein. Registered in 1914. Not registered in 1915.	One official sample was obtained. It was very slightly deficient in protein, a little high in fiber, and up to guarantee in fat. No other goods of this brand were found by inspectors and no samples were submitted by dealers.
Kineda Prime Cottonseed Meal. J. M. Macdonald, Cincinnati, O. Cottonseed product. Contains not more than 12 per cent. crude fiber, and not less than 6 per cent. fat and 38.6 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors and no samples were submitted by dealers.
Macado Cottonseed Meal, J. M. Macdonald, Cincinnati, O. Cottonseed product. Contains not more than 12 per cent. crude fiber, and not less than 6 per cent fat and 41 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors and no samples were submitted by dealers.
"Selden" Cotton Seed Meal. Memphis Cottonseed Products Co., Memphis, Tenn. Manufactured from pressed cottonseed. Contains not more than 10 per cent. crude fiber, and not less than 6 per cent. fat and 41 per cent. protein. Registered in 1914 and 1915.	One dealer's sample was up to guarantee in protein. 3 official samples were collected. They were all up to guarantee in protein. A complete examination of one of them was made; it carried no more fiber than claimed and was up to guarantee in fat.
Canary Extra Brand Cotton Seed Meal. C. L. Montgomery & Co., Memphis, Tenn. Fully decorticated cottonseed. Contains not more than 10 per cent. crude fiber, and not less than 6 per cent. fat and 41 per cent. protein. Not registered in 1914. Registered in 1915.	One dealer's sample was very slightly below guarantee in protein. One official sample was collected and a complete examination of it made. It conformed to its guarantees in protein, fiber and fat.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
Bee Brand Cotton Seed Meal. W. C. Nothern, Little Rock, Ark. Made from decorticated cotton seed. Contains not more than 10 per cent. crude fiber, and not less than 6 per cent. fat and 41 per cent. protein. Registered in 1914 and 1915.	Three dealers' samples were up to guarantee in protein. 4 official samples were collected. 3 were up to guarantee in protein; one was slightly below. Complete examinations of 2 samples were made. Both conformed to their guarantees in fat and fiber.
Butterfly Meal. W. C. Nothern, Little Rock, Ark. Made from pressed cotton seed. Contains not more than 12 per cent. crude fiber, and not less than 6 per cent. fat and 39 per cent. protein. Registered in 1914 and 1915.	One dealer's sample was slightly below guarantee in protein. 4 official samples were collected. One was up to guarantee in protein; 2 were slightly below; and one was over 2½ per cent. below. Complete examinations of 3 of the official samples were made, 2 of the samples that were slightly low in protein and one the sample that was lowest. The 2 former conformed to their fat and fiber guarantees; the latter was up to its guarantee in fat but quite high in fiber.
Dairy Brand Cotton Seed Meal. W. C. Nothern, Little Rock, Ark. Made from pressed cotton seed. Contains not more than 12 per cent. crude fiber, and not less than 6 per cent. fat and 35 per cent. protein. Not registered in 1914. Registered in 1915.	Not sampled. So far as known to the Experiment Station, no goods of this brand were shipped; it was registered to take care of Butterfly Meal, guaranteed 39 per cent. protein, which on examination was found to fall below that guarantee.
Baltimore Brand Cotton Seed Meal. W. Newton Smith, Baltimore, Md. Cotton Seed Meal. Contains not more than 10½ per cent. crude fiber, and not less than 7 per cent. fat and 38½ per cent. protein. Registered in 1914. Brand with same name but different guarantees registered in 1915; see below.	One dealer's sample was up to guarantee in protein. No goods of this brand were found by inspectors.
Baltimore Brand Cotton Seed Meal. W. Newton Smith, Baltimore, Md. Cotton Seed Meal. Contains not more than 10 per cent. crude fiber, and not less than 7 per cent. fat and 38.62 per cent. protein. Registered in 1915. Brand with same name but different guarantees registered in 1914; see above.	Not sampled. So far as known to the Experiment Station, no goods were shipped under this brand in 1915. It was registered to take care of certain lots of Dirigo Brand Cotton Seed Meal, guaranteed 41 per cent. protein, which on examination were found to fall short of that guarantee.
Dirigo Brand Cotton Seed Meal. W. Newton Smith, Baltimore, Md. Cotton Seed Meal. Contains not more than 10 per cent. crude fiber, and not less than 6 per cent. fat and 38½ per cent. protein. Registered in 1914. Brand with same name but different guarantees registered in 1915; see below.	Two dealers' samples and 1 official sample were up to guarantee in protein. No complete examinations were made.
Dirigo Brand Cotton Seed Meal. W. Newton Smith, Baltimore, Md. Cotton Seed Meal. Contains not more than 10½ per cent. crude fiber, and not less than 6 per cent. fat and 41 per cent. protein. Registered in 1915. Brand with same name but different guarantees registered in 1914; see above.	Of 3 dealers' samples, one was slightly below guarantee in protein; one was over 1 per cent. below; and one was over 2 per cent. below. Of 2 official samples, one was slightly below guarantee in protein and the other was over 1 per cent. below. No complete examinations were made.
"Pilgrim" Cotton Seed Meal. J. E. Soper Co., Boston, Mass. Pure cotton seed meal. Contains not more than 10 per cent. crude fiber, and not less than 5 per cent. fat and 38.5 per cent. protein. Registered in 1914 and 1915.	Of 6 dealers' samples, 5 were up to guarantee in protein and one was slightly below. 4 official samples were all up to guarantee in protein. A complete examination of one of them was made. It guarantee in fat but carried slightly more fiber than claimed.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
"Pioneer" Cotton Seed Meal. J. E. Soper Co., Boston, Mass. Pure Cotton Seed Meal. Contains not more than 10 per cent. crude fiber, and not less than 7 per cent. fat and 41 per cent. protein. Registered in 1914 and 1915.	Of 17 dealers' samples, 9 were up to guarantee in protein; 6 were slightly below; and 2 were over 1 per cent. below. Of 11 official samples, 7 were up to guarantee in protein and 4 were slightly below. A complete examination of one official sample was made; it conformed to its guarantees in both fat and fiber.
"Puritan" Cotton Seed Meal. J. E. Soper Co., Boston, Mass. Pure Cotton Seed Meal. Contains not more than 16 per cent. crude fiber, and not less than 5½ per cent. fat and 36 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors and no samples were submitted by dealers.
Cotton Seed Meal. Swift & Co., Atlanta, Ga. Made from cottonseed only. Contains not more than 10 per cent. crude fiber, and not less than 4 per cent. fat and 38.62 per cent. protein. Not registered in 1914. Registered in 1915.	One dealer's sample was up to guarantee in protein. 3 official samples were up to guarantee in protein. A complete examination of 2 of the official samples was made. Both were up to guarantee in fat but both were over a per cent. too high in fiber.
Texoma Brand High Grade Cotton Seed Meal. Texas Cake & Linter Co., Dallas, Texas. Made from decorticated cotton seed. Contains not more than 10 per cent. crude fiber, and not less than 6 per cent. fat and 41 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors and no samples were submitted by dealers.
"Durjan" Brand Cotton Seed Meal. Union Brokerage & Commission Co., Vicksburg, Miss. Made from decorticated cotton seed only. Contains not more than 10 per cent. crude fiber, and not less than 7.5 per cent. fat and 41 per cent. protein. Registered in 1914 and 1915.	Of 3 dealers' samples, one was up to guarantee in protein; one was slightly below; and one was over 1 per cent. below. No goods of this brand were found by inspectors.
"Magnolia" Brand Cotton Seed Meal. Union Brokerage & Commission Co., Vicksburg, Miss. Made from decorticated cotton seed only. Contains not more than 10 per cent. crude fiber, and not less than 7.5 per cent. fat and 38.62 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors and no samples were submitted by dealers.
Yellow Tag Choice Cotton Seed Meal. Union Seed & Fertilizer Co., New York. Cottonseed Meal. Contains not more than 10 per cent. crude fiber, and not less than 8 per cent. fat and 41.18 per cent. protein. Registered in 1914 and 1915.	Of 2 official samples, one was up to guarantee in protein and the other was slightly below. A complete examination of the latter was made. It was found to carry no more fiber than claimed, but was a little below guarantee in fat.

COTTON SEED FEEDS.

"Cyclone" Cotton Seed Feed. American Cotton Hull & Fiber Co., Memphis, Tenn. Composed of cottonseed meal and ground cottonseed hulls. Contains not more than 23 per cent. crude fiber, and not less than 3 per cent. fat and 20 per cent. protein. Registered in 1914. Not registered in 1915.	No samples obtained.
Creamo Brand Cottonseed Feed. Humphreys-Godwin Co., Memphis, Tenn. Composed of cottonseed meal and cottonseed hull bran. Contains not more than 22 per cent. crude fiber, and not less than 5 per cent. fat and 20 per cent. protein. Registered in 1914. Not registered in 1915.	No samples obtained.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
77 Cottonseed Feed. Humphreys-Godwin Co., Memphis, Tenn. Made from cottonseed meal and delinted cottonseed hulls. Contains not more than 28 per cent. crude fiber, and not less than 4 per cent. fat and 20 per cent. protein. Registered in 1914 and 1915.	No samples obtained.

FLAX SEED BY-PRODUCTS.

Cleveland Flax Meal. American Linseed Co., New York City. Made from flaxseed. Contains not more than 9 per cent. crude fiber, and not less than 2 per cent. fat and 36 per cent. protein. Registered in 1914 as Linseed Oil Meal. Registered in 1915.	No goods of this brand were found by inspectors.
"Hypro" Linseed Meal. American Linseed Co., New York City. Made from flaxseed. Contains not more than 9 per cent. crude fiber, and not less than 2 per cent. fat and 36 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat. It was found up to guarantee in fat but slightly high in fiber.
Old Process Linseed Meal. American Linseed Co., New York City. Made from flaxseed. Contains not more than 8 per cent. crude fiber, and not less than 5 per cent. fat and 34 per cent. protein. Registered in 1914 and 1915.	One dealer's sample and 2 official samples were up to guarantee in protein. One of the official samples was examined for fiber and fat. It was found in accord with its guarantees in both.
Amco Old Process Linseed Meal. American Milling Co., Peoria, Ill. Flaxseed product. Contains not more than 10 per cent. crude fiber, and not less than 5 per cent. fat and 30 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Pure Old Process Oil Meal made from Linseed Cake. Spencer Kellogg & Sons, Inc., Buffalo, N. Y., and Minneapolis, Minn. Ground Linseed Cake. Contains not more than 10 per cent. crude fiber, and not less than 5 per cent. fat and 33 per cent. protein. Not registered in 1914. Registered in 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat. It carried no more fiber than claimed, but was very slightly low in fat.
Old Process Linseed Oil Meal. Mann Bros Co., Buffalo, N. Y. Made from flaxseed. Contains not more than 10 per cent. crude fiber, and not less than 6 per cent. fat and 34 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Old Process Oil Meal. Metzger Seed & Oil Co., Toledo, O. Made from flaxseed. Contains not more than 10 per cent. crude fiber, and not less than 5 per cent. fat and 30 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Midland Brand Pure Old Process Ground Linseed Cake. Midland Linseed Products Co., Minneapolis, Minn. Made from flaxseed only. Contains not more than 9½ per cent. crude fiber, and not less than 5 per cent. fat and 32 per cent. protein. Registered in 1914 and 1915.	One dealer's sample and 2 official samples were up to guarantee in protein. One of the official samples was examined for fiber and fat. It conformed to its guarantees in both.
Major Brand Old Process Oil Meal. Toledo Seed & Oil Co., Toledo, O. Linseed. Contains not more than 10 per cent. crude fiber, and not less than 5 per cent. fat and 30 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found to conform to its guarantees in both.

Feeding Stuffs—Continued.

Brand, Maker and Guaranties.	Results of Examination.
STARCH FACTORY AND SIMILAR BY-PRODUCTS.	
Cream of Corn Gluten Feed. American Maize Products Co., N. Y. Corn starch by-product with corn bran. Contains not more than 8½ per cent. crude fiber, and not less than 2½ per cent. fat and 23 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat. It carried no more fiber than claimed, but was slightly deficient in fat.
Clinton Corn Gluten Feed. Clinton Sugar Refining Co., Clinton, Iowa. A corn gluten feed. Contains not more than 8 per cent. crude fiber, and not less than 3 per cent. fat and 23 per cent. protein. Registered in 1914 and 1915.	One official sample, the only one obtained, was in accord with guarantees in protein, fiber and fat.
Buffalo Corn Gluten Feed. Corn Products Refining Co., N. Y. Corn gluten feed. Contains not more than 8.5 per cent. crude fiber, and not less than 1 per cent. fat and 23 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat, and found in accord with guarantee in both.
Crescent Corn-Gluten Feed. Corn Products Refining Co., New York. A corn gluten feed. Contains not more than 8.5 per cent. crude fiber, and not less than 1 per cent fat and 23 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantees in both.
Diamond Corn Gluten Meal. Corn Products Refining Co., New York. A corn gluten meal. Contains not more than 4 per cent crude fiber, and not less than 1.5 per cent. fat and 40 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat. It carried no more fiber than claimed but was slightly low in fat.
Globe Corn Gluten Feed. Corn Products Refining Co., New York. A corn gluten feed. Contains not more than 8.5 per cent. crude fiber, and not less than 1 per cent. fat, and 23 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Douglas Corn Gluten Feed. Douglas Co., Cedar Rapids, Iowa. A corn gluten feed. Contains not more than 8 per cent. crude fiber and not less than 2 per cent. fat and 23 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both.
K K K Corn Gluten Feed. J. C. Hubinger Bros. Co., Keokuk, Iowa. Corn starch by-product with corn solubles. Contains not more than 7.5 per cent. crude fiber, and not less than 2.4 per cent. fat and 23 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat.
Jenks Gluten Feed. Huron Milling Co., Harbor Beach, Mich. Corn starch by-product with corn bran. Contains not more than 8 per cent. crude fiber, and not less than 3 per cent. fat and 22 per cent. protein. Registered in 1914 and 1915.	One dealer's sample and 2 official samples were up to guarantee in protein. One official sample was examined for fiber and fat and found in accord with guarantee in both.
Staley's Gluten Feed. A. E. Staley Mfg. Co., Decatur, Ill. Composed of gluten meal, corn bran and the residue resulting from the evaporation of sheep water. Contains not more than 12 per cent. crude fiber, and not less than 2½ per cent. fat and 23 per cent. protein. Registered in 1914. Not registered in 1915.	The only sample obtained was from a lot of goods shipped in 1913. It was in accord with its guarantee in protein, fiber and fat.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
BREWERY AND DISTILLERY BY-PRODUCTS.	
Ajax Flakes. Chapin & Co., Hammond, Ind. Corn distillers' grains. Contains not more than 14 per cent. crude fiber, and not less than 11 per cent. fat and 30 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. Both samples were examined for weed seeds; none were found.
Continental Gluten Feed. Continental Cereal Co., Peoria, Ill. A distillery by-product manufactured from corn, oats, rye and barley. Contains not more than 10½ per cent. crude fiber, and not less than 10 per cent. fat and 29 per cent. protein. Registered in 1914 and 1915.	Only one lot of goods of this brand was found by inspectors. This lot was shipped in bulk and the goods were in a bin in the warehouse of the dealer. A sample was taken and examined, but because it is very doubtful whether the sample was representative of the goods the results are not published.
Corn 3 D Grains. Dewey Bros. Co., Blanchester, Ohio. Composed of distillers' dried grains. Contains not more than 13 per cent. crude fiber and not less than 9 per cent. fat and 26 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
"Bull Brand" Dried Brewers Grains. Farmers' Feed Co., New York City. Wet brewers' grains (dried). Contains not more than 17.20 per cent. crude fiber, and not less than 6.30 per cent. fat and 27.20 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. Both were examined for weed seeds and were found to contain a few seeds of wild buckwheat, yellow foxtail, penny cress, and pigweed.
Hector Distillers Dried Grains. Hottelet Co., Milwaukee, Wis. Offal of distilleries properly dried. Contains not more than 14 per cent. crude fiber, and not less than 10 per cent. fat and 30 per cent. protein. Not registered in 1914. Registered in 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat; it was up to guarantee in fat but was over 1 per cent. too high in fiber. One sample was examined for weed seeds; none were found.
National Distillers Dried Grains. Hottelet & Co., Milwaukee, Wis. No certificate filed. Claims on package: Crude fiber not over 14 per cent; fat not less than 8 per cent.; protein not less than 26 per cent. Unregistered.	Only one lot of this feed, consisting of 2 tons received in a mixed car with other feeds, was found by inspectors. Shippers subsequently claimed that this lot was shipped by mistake. Sample drawn from these goods was found in accord with guarantee in protein and fat but high in fiber. No weed seeds were found.
Brownie Grains. Larrowe Milling Co., Detroit, Mich. Composed of steam dried distillers' grains made principally from corn. Contains not more than 9 per cent. crude fiber, and not less than 7 per cent. fat and 26 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. One sample was examined for weed seeds; none were found.
Columbia Corn Distillers Grains. New York & Kentucky Co., Rochester, N. Y. No certificate filed. Claims on package: Crude fiber not over 14 per cent; fat not less than 10 per cent.; protein not less than 30 per cent. Unregistered; case pending.	One official sample was over 1 per cent. low in protein but in accord with its fat and fiber guarantees. It was examined for weed seeds; none were found.
Fourex Distillers Dried Grains. Ubiko Milling Co., Cincinnati, O. Distillers' dried corn grains. Contains not more than 13 per cent. crude fiber, and not less than 12 per cent. fat and 31 per cent. protein. Registered in 1914 and 1915.	One official sample was found very slightly below guarantee in protein, up to guarantee in fat, and slightly high in fiber. It was examined for weed seeds; none were found.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
SUGAR BEET BY-PRODUCTS.	
Dried Beet Pulp. Larrowe Milling Co., Detroit, Mich. Residue of sugar beets dried after extraction of sugar. Contains not more than 20 per cent. crude fiber, and not less than one-half of 1 per cent. fat and 8 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both.
Dried Beet Pulp. Chas. Pope, Riverdale, Ill. Composed only of residue of sugar beets dried after extraction of sugar. Contains not more than 20 per cent. crude fiber, and not less than one-half of 1 per cent. fat and 8 per cent. protein. Not registered in 1914. Registered in 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both.
WHEAT BY-PRODUCTS.	
Acme Feed. Acme-Evans Co., Indianapolis, Ind. Wheat bran, wheat middlings and not exceeding mill's run of ground cleaned screenings. Contains not more than 9 per cent. crude fiber and not less than 4 per cent. fat and 16.50 per cent. protein. Registered in 1914 and 1915.	Of 2 official samples, one was up to guarantee in protein and one was slightly below. One was examined for fiber and fat and found in accord with guarantee in both. One sample was examined for weed seeds; a few hulls of corn cockle and wild buckwheat were found.
Trojan Bran. The Allen & Wheeler Co., Troy, O. Pure offal from wheat. Contains not more than 9.50 per cent. crude fiber and not less than 4 per cent. fat and 14.50 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. Both samples were examined for weed seeds; a few hulls of corn cockle were found.
Trojan Middlings. The Allen & Wheeler Co., Troy, O. Offal from wheat including screenings not exceeding mill run. Contains not more than 6 per cent. crude fiber, and not less than 4 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. One sample was examined for weed seeds; none were found.
Trojan Mixed Feed. The Allen & Wheeler Co., Troy, O. Offal from wheat, including screenings not exceeding mill run. Contains not more than 8 per cent. crude fiber, and not less than 4 per cent. fat and 14.50 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. One sample was examined for weed seeds; some hulls of corn cockle were found.
Bran & Middlings. Alma Roller Mills, operated by Alma Grain & Fiber Co., Alma, Mich. Remainder of wheat which has gone through the roller process of making flour. Contains not more than 9.25 per cent. crude fiber, and not less than 4.1 per cent. fat and 15.05 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Amico Bran. Amendt Milling Co., Monroe, Mich. Wheat Bran. Contains not more than 9.51 per cent. crude fiber, and not less than 3 per cent. fat and 14 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Amico Middlings. Amendt Milling Co., Monroe, Mich. Wheat Middlings. Contains not more than 4.30 per cent. crude fiber and not less than 5 per cent. fat and 15 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.

Feeding Stuffs—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Amico Mixed Feed. Amendt Milling Co., Monroe, Mich. Wheat Mixed Feed. Contains not more than 8 per cent. crude fiber and not less than 4 per cent. fat and 15 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Bran with ground screenings not exceeding mill run. Ansted & Burk Co., Springfield, O. Composed of wheat bran with ground screenings not exceeding mill run. Contains not more than 11½ per cent. fiber and not less than 3 per cent. fat and 14 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. Both samples were examined for weed seeds; a few seeds and hulls of corn cockle were found.
Middlings with ground screenings not exceeding mill run. Ansted & Burk Co., Springfield, O. Wheat middlings with ground screenings not exceeding mill run. Contains not more than 7½ per cent. crude fiber, and not less than 4 per cent. fat, and 14½ per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. Both samples were examined for weed seeds; none were found.
Mixed Feed with ground screenings not exceeding mill run. Ansted & Burk Co., Springfield, O. Wheat mixed feed with groung screenings not exceeding mill run. Contains not more than 11½ per cent. crude fiber, and not less than 3½ per cent. fat and 14½ per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. Both samples were examined for weed seeds; a few hulls of corn cockle were found.
Atlas Wheat Bran, with ground screenings not exceeding mill run. Bernhard Stern & Sons, Inc. (Atlas Flour Mills) Milwaukee, Wisconsin. Wheat bran with ground screenings not exceeding mill run. Contains not more than 11 per cent. crude. fiber, and not less than 3 per cent. fat and 13 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat. It was examined for weed seeds and found to contain a few seeds of green foxtail and pale persicaria and a few hulls of corn cockle and wild buckwheat.
Atlas Wheat Flour Middlings with ground screenings not exceeding mill run. Bernhard Stern & Sons, Inc., (Atlas Flour Mills)-Milwaukee, Wis. Wheat flour middlings with ground screenings not exceeding mill run. Contains not more than 7 per cent. crude fiber, and not less than 3 per cent. fat and 14 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was found in accord with guarantee in protein and fat but a little high in fiber.
Standard Wheat Middlings with ground screenings, not exceeding mill run. Bernhard Stern & Sons, Inc. (Atlas Flour Mills) Milwaukee, Wis. Wheat middlings with ground screenings not exceeding mill run. Contains not more than 10.5 per cent crude fiber, and not less than 3.5 per cent fat and 13.5 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Wheat Bran and Wheat Screenings. Aunt Jemima Mills Co., St. Joseph, Mo. Wheat bran, wheat screenings (not exceeding mill run). Contains not more than 10 per cent. crude fiber, and not less than 3.5 per cent fat and 14.5 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat. It was examined for weed seeds; a few seeds of wild rose were found.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
Banner Flour Middlings. Banner Milling Co., Buffalo, N. Y. Wheat middlings with ground screenings not exceeding mill run. Contains not more than 9.75 per cent. crude fiber, and not less than 4.25 per cent. fat and 15 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat.
Fancy Low Grade. Barber Milling Co., Minneapolis, Minn. Feed Flour. Contains not more than 4 per cent. crude fiber and not less than 5 per cent. fat and 18 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was three-quarters of a per cent. below guarantee in protein and over 1½ per cent. below in fat. It carried no more fiber than claimed.
"Winona" Coarse Wheat Bran. Bay State Milling Co., Winona, Minn. A pure wheat product. Contains not more than 11 per cent. crude fiber, and not less than 5 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
"Winona" Fancy White Flour Middlings. Bay State Milling Co., Winona, Minn. A pure wheat product. Contains not more than 3 per cent. crude fiber, and not less than 4.5 per cent. fat and 18 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
"Winona" Wheat Middlings. Bay State Milling Co., Winona, Minn. Pure wheat product with less than 8 per cent. of ground and cleaned screenings from wheat. Contains not more than 8 per cent. crude fiber, and not less than 5 per cent. fat and 17 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
"Winona" Fancy Mixed Wheat Feed. Bay State Milling Company, Winona, Minn. Composed of wheat bran, middlings and red dog flour, with less than 5 per cent. ground and cleaned screenings from wheat. Contains not more than 10 per cent. crude fiber and not less than 5 per cent. fat and 17 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat.
Reddog Flour. Bay State Milling Co., Winona, Minn. A pure wheat product. Contains not less than 2.5 per cent. crude fiber, and not less than 4.05 per cent. fat and 18 per cent. protein. Registered in 1914 and 1915.	The only lot of goods of this brand found by inspectors consisted of only 2 sacks. A sample was taken but as it is doubtful whether it fairly represents the goods, the results are not published.
Big Diamond Bran. Big Diamond Mills Co., Minneapolis, Minn. Wheat bran with ground screenings not exceeding mill run. Contains not more than 11.07 per cent. crude fiber and not less than 4 per cent. fat and 14 per cent.protein. Registered in 1914 and 1915.	The only official sample obtained was up to guarantee in protein and fat but a little high in fiber.
Big Diamond Wheat Mixed Feed. Big Diamond Mills Co., Minneapolis, Minn. Composed of wheat bran, flour middlings, and ground screenings not exceeding mill run. Contains not more than 8 per cent. crude fiber, and not less than 4.5 per cent. fat and 19 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.

Feeding Stuffs—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Blanton Mixed Feed. Blanton Milling Co., Indianapolis, Ind. Composed of wheat bran, middlings and whole wheat screenings. Contains not more than 10 per cent. crude fiber, and not less than 3.7 per cent. fat and 15.7 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. Both samples were examined for weed seeds; a few seeds and hulls of corn cockle were found.
Bull's Eye Mixed Feed. Blish Milling Co., Seymour, Ind. Pure wheat bran and middlings. Contains not less than 9.10 per cent. crude fiber and not less than 4.4 per cent. fat and 16 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat. It carried no more fiber than claimed but was slightly low in fat. Both samples were examined for weed seeds; one contained few and the other many seeds and hulls of corn cockle.
Wheat Bran. Buffalo Cereal Co., Buffalo, N. Y. Wheat bran with screenings not exceeding mill run. Contains not more than 11 per cent. crude fiber, and not less than 3 per cent. fat and 14 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Flour Middlings. Buffalo Cereal Co., Buffalo, N. Y. Flour middlings with not to exceed mill run of ground screenings. Contains not more than 8 per cent. crude fiber, and not less than 4.5 per cent. fat and 16 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Middlings. W. A. Burling, Muir, Mich. Contains not more than 7.2 per cent. crude fiber and not less than 3.7 per cent. fat and 14.6 per cent. protein. Not registered in 1914. Registered in 1915 by Chas. M. Cox Co., Boston, Mass.	The only official sample obtained was below guarantee in protein, but in accord with guarantee in fiber and fat.
Choice Bran. L. G. Campbell Mfg. Co., Owatonna, Minn. Contains not more than 12.2 per cent. crude fiber, and not less than 4.5 per cent. fat and 13.4 per cent. protein. Registered in 1914 and 1915.	Two official samples were both in accord with guarantee in protein, fiber and fat Both were examined for weed seeds and found to contain some hulls of corn cockle and wild buckwheat; one contained a few seeds of yellow foxtail.
C. V. Wheat Bran with ground screenings not exceeding mill run. Cannon Valley Milling Co., Minneapolis, Minn. No certificate filed. Claims on package: Crude fiber not over 13 per cent; fat not less than 4 per cent.; protein not less than 13 per cent. Unregistered; case pending.	The only official sample obtained was in accord with guarantee in protein, fiber and fat.
Unadulterated Wheat Mixed Feed. Cavalier Milling Co., Cavalier, N. D. Registered by Chas. M. Cox Co., Boston, Mass. Composed of wheat bran and wheat middlings. Contains not more than 10 per cent. crude fiber, and not less than 4.5 per cent. fat and 14 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat. It contained a few hulls of wild buckwheat and corn cockle.
Coarse Bran. C. S. Christensen Co., Lake Crystal & Madelia, Minn. A wheat product. Contains not more than 12.1 per cent. crude fiber, and not less than 4.4 per cent. fat and 14.6 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Choice Middlings. C. S. Christensen Co., Lake Crystal & Madelia, Minn. Wheat product. Contains not more than 8.25 per cent. crude fiber, and not less than 4.15 per cent. fat and 14.75 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
Wheat flour middlings with ground screenings not exceeding mill run. C. S. Christensen Co., (Madelia Roller Mills) Madelia, Minn. Contains not more than 5.35 per cent. crude fiber, and not less than 3 per cent. fat and 14.25 per cent. protein. Registered in 1914. Registered in 1915 by Chas. M. Cox Co., Boston, Mass.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat.
Jersey Wheat Bran with ground screenings not exceeding mill run. Geo. C. Christian & Co., Minneapolis, Minn. No certificate filed. Claims on package: Crude fiber not over 12 per cent.; fat not less than 4 per cent.; protein not less than 13 per cent. Not registered; case pending.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat.
Poland Wheat Standard Middlings with ground screenings not exceeding mill run. Geo. C. Christian & Co., Minneapolis, Minn. Contains not more than 9.5 per cent. crude fiber, and not less than 4 per cent. fat and 14 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Middlings. Christian Breisch & Co., N. Lansing, Mich. Contains not more than 4.13 per cent. crude fiber, and not less than 5.25 per cent. fat and 14.96 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Mixed Feed. Christian Breisch & Co., N. Lansing, Mich. Contains not more than 8.47 per cent. crude fiber, and not less than 2.58 per cent fat and 13.56 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat. It contained some hulls of corn cockle.
Claro Standard Middlings. Claro Milling Co., Waseca, Minn. Pure wheat by-product with ground screenings not exceeding mill run. Contains not more than 12 per cent. crude fiber, and not less than 3 per cent. fat and 14 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. One sample was examined for weed seeds; a few hulls of wild buckwheat and corn cockle were found.
Claro Mixed Feed. Claro Milling Co., Waseca, Minn. Composed of bran, standard and flour middlings, red dog and ground screenings not exceeding mill run. Contains not more than 12 per cent. crude fiber, and not less than 3 per cent. fat and 15 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat.
Commander Bran. Commander Mill Co., Minneapolis, Minn. Wheat bran with ground screenings not exceeding mill run. Contains not more than 11 per cent. crude fiber, and not less than 4 per cent. fat and 14 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. One sample was examined for weed seeds; a few seeds of wild buckwheat and many hulls of wild buckwheat and corn cockle were found.
Wheat Bran with ground screenings not exceeding mill run. Commercial Milling Co., Detroit, Mich. Contains not more than 12 per cent. crude fiber, and not less than 3.5 per cent. fat and 14.5 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat. It contained a few hulls of corn cockle and ragweed.
Wheat Fine Middlings with ground screenings not exceeding mill run. Commercial Milling Co., Detroit, Mich. Contains not more than 6 per cent. crude fiber, and not less than 7 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was up to guarantee in protein.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Wheat Mill Feed Middlings. Commercial Milling Co., Detroit, Mich. Wheat middlings, with ground screenings not exceeding mill run. Contains not more than 11 per cent. crude fiber, and not less than 4 per cent. fat and 13.5 per cent. protein. Not registered in 1914. Registered in 1915.	So far as known to the Experiment Station, no goods were shipped under this brand. It was registered to take care of certain lots of Standard Wheat Middlings shipped by the Commercial Milling Company and guaranteed to carry 16 per cent. protein, which on examination were found to fall short of that guarantee.
Wheat Standard Middlings with ground screenings not exceeding mill run. Commercial Milling Co., Detroit, Mich. On 1914 certificate: Contains not more than 9.9 per cent. crude fiber, and not less than 5.5 per cent. fat and 16 per cent. protein. On 1915 certificate: Contains not more than 9 per cent. crude fiber, and not less than 5 per cent. fat and 16 per cent. protein. Registered in 1914 and 1915.	Of 3 official samples, one was up to guarantee in protein; one was nearly 2 per cent. and the third slightly over 2 per cent. below. The sample that was up in protein was examined for fiber and fat and found in accord with guarantee in both. 2 samples were examined for weed seeds; none were found.
Wheat Mixed Feed with ground screenings not exceeding mill run. Commercial Milling Co., Detroit, Mich. Contains not more than 11 per cent. crude fiber, and not less than 4.5 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat. It contained a few hulls of corn cockle and wild buckwheat.
Wheat Bran with ground screenings not exceeding mill run. Wm. A. Coombs Milling Co., Coldwater, Mich. Contains not more than 8 per cent. crude fiber and not less than 3 per cent. fat and 14 per cent. protein. (1915 certificate gives 10 per cent. as maximum fiber guarantee). Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein and fat. Both carried the 1914 fiber guarantee of 8 per cent. They ran considerably in excess of that figure in fiber. One of them was in accord with the 1915 guarantee of 10 per cent.; the other slightly over ran it.
Middlings with ground screenings not exceeding mill run. Wm. A. Coombs Milling Co., Coldwater, Mich. Contains not more than 8 per cent. crude fiber, and not less than 3 per cent. fat and 15 per cent. protein. (1915 certificate gives 9 per cent. as maximum fiber guarantee). Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat. It carried the 1914 fiber guarantee of 8 per cent.
Mixed Feed with ground screenings not exceeding mill run. Wm. A. Coombs Milling Co., Coldwater, Mich. Contains not more than 8 per cent. crude fiber, and not less than 3 per cent. fat and 15 per cent. protein. (1915 certificate gives 10 per cent. as maximum fiber guarantee). Registered in 1914 and 1915.	The only official sample obtained was up to guarantee in protein and fat. It carried the 1914 fiber guarantee of 8 per cent. It considerably exceeded that figure but was in accord with the 1915 guarantee of 10 per cent.
Wirthmore Middlings. Chas. M. Cox Co., Boston, Mass. Composed of pure wheat middlings and red dog flour. Contains not more than 7 per cent. crude fiber, and not less than 4 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat.
Wirthmore Wheat Feed with less than mill run of screenings. Chas. M. Cox Co., Boston, Mass. Composed of wheat bran and red dog flour. Contains not more than 7 per cent. crude fiber, and not less than 4 per cent. fat and 16 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was up to guarantee in protein and fat but was over 1 per cent. high in fiber. It contained a few hulls of corn cockle and wild buckwheat.
Dudley Wheat Bran with ground screenings not exceeding mill run. Composed of wheat bran and ground screenings not exceeding mill run. Contains not more than 9 per cent. crude fiber, and not less than 4 per cent. fat and 15.5 per cent. protein. Registered in 1914 and 1915 by Chas. M. Cox Co., Boston, Mass.	No goods of this brand were found by inspectors.

Feeding Stuffs—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Monogram Fancy Bran with ground screenings not exceeding mill run. Composed of wheat bran and ground screenings not exceeding mill run. Contains not more than 10 per cent. crude fiber, and not less than 4 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915 by Chas. M. Cox Co., Boston, Mass.	A sample of bran from a lot invoiced as "Monogram Bran" was obtained by an inspector. The label did not agree with the filed certificate and the goods were further misbranded in that they did not carry the name of the manufacturer. The protein, fat and fiber guarantees were the same as those on the certificate. The sample was found in accord with guarantee in protein and fat but slightly high in fiber. It contained a few hulls of corn cockle.
Newport Winter Bran with ground screenings not to exceed mill run. Composed of wheat bran with mill run of screenings. Contains not more than 11 per cent. crude fiber, and not less than 3.5 per cent. fat and 14.5 per cent. protein. Registered in 1914 and 1915 by Chas. M. Cox Co., Boston, Mass.	No goods of this brand were found by inspectors.
Columbia Wheat Mixed Feed with ground screenings not exceeding mill run. Chas. M. Cox Co., Boston, Mass. Composed of wheat middlings and wheat bran. Contains not more than 9 per cent. crude fiber, and not less than 4 per cent. fat and 16 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Wheat Bran with ground screenings not exceeding mill run. Crystal Milling Co.- Composed of wheat bran and mill run of screenings. Contains not more than 11.8 per cent. crude fiber, and not less than 3.65 per cent. fat and 13.25 per cent. protein. Not registered in 1914. Registered in 1915 by Chas. M. Cox Co., Boston, Mass.	No goods of this brand were found by inspectors.
Pure Winter Wheat Bran. Delphos Milling Co., Delphos, Kansas. No certificate filed. Claims on package: Crude fiber not over 11 per cent.; fat not less than 4 per cent.; protein not less than 14.5 per cent. Unregistered.	Only one lot of this bran, consisting of 2 tons received in a mixed car with other feeds, was found by inspectors. Shippers subsequently claimed that this lot was shipped by mistake. Sample drawn from these goods was found in accord with guarantee in protein fiber and fat; no weed seeds were found.
Wheat Middlings. Donahue-Stratton Co., Milwaukee, Wis. Offal from the manufacture of wheat flour. Contains not more than 8 per cent. crude fiber, and not less than 5 per cent. fat and 16½ per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were tound by inspectors.
Duluth Imperial Bran. Duluth Superior Milling Co., Duluth, Minn. Composed of wheat bran and not to exceed mill run of ground screenings. Contains not more than 12.25 per cent. crude fiber, and not less than 3.75 per cent. fat and 14.5 per cent. protein. Registered in 1914 and 1915.	Two official samples were both ,p to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. Both samples were found to contain some hulls of corn cockle.
Flour Middlings. Duluth-Superior Milling Co., Duluth, Minn. On 1914 certificate: Contains not more than 7 per cent. crude fiber, and not less than 5 per cent. fat and 16.5 per cent. protein. On 1915 certificate: Contains not more than 7.5 per cent. crude fiber, and not less than 5 per cent. fat and 16.25 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were sound by inspector

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
Middlings. Duluth-Superior Milling Co., Duluth, Minn. Composed of middlings and not to exceed mill run of ground screenings. On 1914 certificate: Contains not more than 8 per cent. crude fiber, and not less than 5.5 per cent. fat and 17.5 per cent. protein. On 1915 certificate: Contains not more than 7.75 per cent. crude fiber, and not less than 4.75 per cent. fat and 16.5 per cent. protein. Registered in 1914 and 1915.	One official sample was obtained. The goods were misbranded in that the guaranteed analysis stated on the package agreed neither with the 1914 nor the 1915 certificate. The claims on the package were: Fiber 8 per cent., fat 5.50 per cent., and protein 16.50 per cent. On this basis goods were in accord with guarantee in fiber and fat but were slightly low in protein. On the basis of the 1915 certificate (these goods were sampled in 1915) they were up to guarantee in fat but slightly low in protein, and slightly high in fiber.
Boston Mixed Feed. Duluth-Superior Milling Co., Duluth, Minn. Composed of wheat bran, middlings, red dog flour, and not to exceed mill run of ground screenings. On 1914 certificate: Contains not more than 9.5 per cent. crude fiber, and not less than 4.5 per cent. fat and 16 per cent. protein. On 1915 certificate: Contains not more than 9.75 per cent. crude fiber, and not less than 4.25 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	Four official samples were obtained, all 1914 shipments. The goods were misbranded in that the protein guarantee stated on the package did not agree with that on the filed certificate. The package label claimed 16.50 per cent. protein. The 4 samples all fell short of this guarantee; all but one fell short of the guarantee of 16 per cent. on the 1914 certificate. All were up to the guarantee of 15 per cent. on the 1915 certificate. Goods of this brand shipped since January, 1915, found by inspectors, were labeled in accord with the 1915 certificate. The fiber and fat claims on the package were in accord with the 1914 certificate. One sample was examined for fiber and fat and found in accord with guarantee in both. 3 samples were examined for weed seeds; all contained some hulls of corn cockle and wild buckwheat; 2 contained a few seeds of green foxtail, yellow foxtail, mustard and penny cress.
Red Dog Flour. Duluth-Superior Milling Co., Duluth, Minn. On 1914 certificate. Contains not more than 3.5 per cent. crude fiber, and not less than 4.5 per cent. fat and 17.5 per cent. protein. On 1915 certificate: Contains not more than 3 per cent. crude fiber, and not less than 4.25 per cent. fat and 16.75 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Superb Red Dog. Eagle Roller Mill Co., New Ulm, Minn. No certificate filed. Claims on package: Crude fiber not over 4.73 per cent.; fat not less than 5.43 per cent.; protein not less than 19.48 per cent. Unregistered.	Only one lot of this feed was found by inspectors. It consisted of one carload. 2 samples were both decidedly below guarantee in protein and slightly below in fat. They carried no more fiber than claimed.
Elmore Flour Middlings. Elmore Milling Co., Oneonta, N. Y. Low grade wheat flour—wheat middlings. Contains not more than 5 per cent. crude fiber, and not less than 4.25 per cent. fat and 16.5 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Elmore Snow Middlings. Elmore Milling Co., Oneonta, N. Y. Made of low grade wheat flour—wheat middlings. Contains not more than 4.5 per cent. crude fiber, and not less than 4.25 per cent. fat and 17 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
E-A-Co. Wheat Bran with ground screenings. Everett, Aughenbaugh & Co., Waseca, Minn. Composed of wheat bran with ground screenings not exceeding mill run. Contains not more than 12 per cent. crude fiber, and not less than 3 per cent. fat and 14 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. Both contained some hulls of wild buckwheat and corn cockle; one contained a few seeds of green foxtail and mustard.
E-A-Co. Wheat Middlings with ground screenings. Everett, Aughenbaugh & Co., Waseca, Minn. Composed of standard and flour middlings and ground screenings not exceeding mill run. Contains not more than 10 per cent. crude fiber, and not less than 3 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat.
E-A-Co. Mixed Feed with ground screenings. Everett, Aughenbaugh & Co., Waseca, Minn. Composed of wheat bran, middlings and ground screenings not to exceed mill run. On 1914 certificate: Contains not more than 12 per cent. crude fiber and not less than 3 per cent. fat and 15 per cent. protein. On 1915 certificate: Contains not more than 12 per cent. crude fiber, and not less than 5 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. Both samples contained some hulls of wild buckwheat and corn cockle.
Dairy Maid Winter Wheat Bran with ground screenings not exceeding mill run. Federal Milling Co., Lockport, N. Y. Winter wheat offal with ground screenings not exceeding mill run. Contains not more than 10 per cent. crude fiber, and not less than 4 per cent. fat and 14.5 per cent. protein. Not registered in 1914. Registered in 1915.	Of 3 official samples, one was up to guarantee in protein and 2 were over one-half per cent. below. One was examined for fiber and fat; it was up to guarantee in fat but slightly high in fiber. All contained some hulls of corn cockle and wild buckwheat and a few seeds of various sorts common in wheat screenings.
Dairy Maid Winter Wheat Flour Middlings with ground screenings not exceeding mill run. Federal Milling Co., Lockport, N. Y. Winter wheat offal with ground screenings not exceeding mill run. Contains not more than 7 per cent. crude fiber, and not less than 5 per cent. fat and 16 per cent. protein. Not registered in 1914. Registered in 1915.	Of 3 official samples, one was up to guarantee in protein; one was nearly one per cent. below; and one was over 1½ per cent. below. The 2 low samples were examined for fiber and fat and found in accord with guarantee in both. 2 samples were examined for weed seeds; none were found.
"Dairy" Winter Wheat Middlings with ground screenings not exceeding mill run. Federal Milling Co., Lockport, N. Y. Winter wheat offal with ground screenings not exceeding mill run. Contains not more than 8 per cent. crude fiber, and not less than 4.5 per cent. fat and 14 per cent. protein. Not registered in 1914. Registered in 1915.	So far as known to the Experiment Station, no goods were shipped under this brand. It was registered to take care of certain lots of Dairy Maid Middlings guaranteed 16 per cent. protein, which on examination were found to fall short of that guarantee.
Dairy Maid Winter Wheat Mixed Feed with ground screenings not exceeding mill run. Federal Milling Co., Lockport, N. Y. Winter wheat offal with ground screenings not exceeding mill run. Contains not more than 10 per cent. crude fiber, and not less than 4 per cent. fat and 15 per cent. protein. Not registered in 1914. Registered in 1915.	Of 2 official samples, one was up to guarantee in protein and one was slightly below. One was examined for fiber and fat and found in accord with guarantee in both.
Lucky Spring Wheat Bran with ground screenings not exceeding mill run. Federal Milling Co., Lockport, N. Y. Spring wheat offal with ground screenings not exceeding mill run. Contains not more than 11 per cent. crude fiber, and not less than 4.5 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	Of 4 official samples, 3 were up to guarantee in protein and one was nearly 1 per cent. below. One was examined for fiber and fat and found in accord with guarantee in both. 2 samples were examined for weed seeds; one contained some hulls of wild buckwheat and corn cockle, the other a few hulls of corn cockle.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Lucky Winter Bran. Federal Milling Co., Lockport, N. Y. Wheat offal. Contains not more than 10 per cent. crude fiber, and not less than 4 per cent. fat and 14.5 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Lucky Spring Wheat Flour Middlings with ground screenings not exceeding mill run. Federal Milling Co., Lockport, N. Y. Spring wheat offal with ground screenings not exceeding mill run. Contains not more than 9 per cent. crude fiber, and not less than 5 per cent. fat and 17 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both.
Lucky Winter Flour Middlings. Federal Milling Co., Lockport, N. Y. Flour offal. Contains not more than 7 per cent. crude fiber, and not less than 5 per cent. fat and 16 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Lucky Spring Wheat Mixed Feed with ground screenings not exceeding mill run. Federal Milling Co., Lockport, N. Y. Spring wheat offal with ground screenings not exceeding mill run. Contains not more than 10 per cent. crude fiber, and not less than 4 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. Both samples were examined for weed seeds; some hulls of corn cockle and wild buckwheat and a few seeds of various sorts common in wheat screenings were found.
Lucky Winter Mixed Feed. Federal Milling Co., Lockport, N. Y. Wheat offal. Contains not more than 10 per cent. crude fiber, and not less than 4 per cent. fat and 15 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Sphinx Fancy Spring Wheat Flour Middlings with ground screenings not exceeding mill run. Federal Milling Co., Lockport, N. Y. Spring wheat offal with ground screenings not exceeding mill run. Contains not more than 9 per cent. crude fiber and not less than 4.5 per cent fat and 17 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat.
Sphinx Fancy Spring Wheat Mixed Feed with ground screenings not exceeding mill run. Federal Milling Co., Lockport, N. Y. Spring wheat offal with ground screenings not exceeding mill run. Contains not more than 9 per cent. crude fiber, and not less than 4 per cent. fat and 15.5 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Kennel Club Flour. Federal Milling Co., Lockport, N. Y. Second clear wheat flour. Contains not more than 1 per cent. crude fiber, and not less than 2 per cent. fat and 14 per cent. protein. Not registered in 1914. Registered in 1915.	The only lot of goods of this brand found by inspectors was so small that no sample was taken.
Ideal Mixed Feed. Fergus Flour Mill Co., Fergus Falls, Minn. No certificate filed. Claims on package: Crude fiber not stated; fat not less than 4.60 per cent. (or 4.80; figures on sacks were not distinct); protein not less than 17 per cent. Unregistered; case pending.	The only official sample obtained was below guarantee in protein but up in fat. It carried 8.87 per cent. fiber.

FEEDING STUFFS—Concluded.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
Peerless Mixed Feed. Fuller-Holway Co., Augusta, Me. Composed of wheat, bran, middlings, low grade flour, with ground screenings not to exceed mill run. Contains not more than 7.9 per cent. crude fiber, and not less than 4.15 per cent. fat and and 16.5 per cent. protein. Registered in 1914 and 1915.	One sample submitted by the manufacturer was up to guarantee in protein. The only official sample obtained carried no more fiber than claimed but was over 1 per cent. below guarantee in fat and over 2 per cent. below in protein. It contained a few hulls of corn cockle.
Garland Mixed Feed. Garland Milling Co., Greensburg, Ind. A winter wheat product; bran, middlings, screenings and wheat cleanings not exceeding mill run. Contains not more than 9 per cent. crude fiber, and not less than 4 per cent. fat and 16 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat. It contained some hulls of corn cockle. The goods were misbranded in that the protein and fat guarantees stated on the package did not agree with those on the filed certificate.
Globe Dairy Feed. Globe Elevator Co., Buffalo, N. Y. Composed of wheat bran, wheat middlings, ground wheat screenings, low grade flour. Contains not more than 10 per cent. crude fiber, and not less than 4 per cent. fat and 14 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Grafton Wheat Feed. Grafton Roller Mill Co., Grafton, N. D. Products of wheat. Contains not more than 9.3 per cent. crude fiber, and not less than 4.5 per cent. fat and 15.4 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat. It contained a few hulls of corn cockle and wild buckwheat.
Red Flag Mixed Feed. D. H. Grandin Milling Co., Jamestown, N. Y. Composed of red dog, low grade flour, wheat bran which may contain mill run screenings, ½ of 1 per cent. salt. Contains not more than 7 per cent. crude fiber, and not less than 4.3 per cent. fat and 13.73 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
C. D. M. White Middlings with ground screenings not exceeding mill run. Griswold & Mackinnon, St. Johnsbury, Vt. Contains not more than 6.25 per cent. crude fiber, and not less than 4.5 per cent. fat and 16 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Xtragood Mixed Feed. Griswold & Mackinnon, St. Johnsbury, Vt. Composed of wheat bran, wheat middlings, wheat red dog, wheat low grade flour. Contains not more than 7.5 per cent. crude fiber, and not less than 4 per cent. fat and 16 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in the latter, but slightly high in fiber. One contained a few, the other some, hulls of corn cockle.
Gwinn's Wheat Bran. Gwinn Milling Co., Columbus, O. Wheat bran. Contains not more than 8 per cent. crude fiber, and not less than 4 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat. It was up to guarantee in fat but over 2 per cent. high in fiber. Both contained a few hulls of corn cockle and wild buckwheat.
Gwinn's Wheat Middlings with screenings not exceeding mill run. Gwinn Milling Co., Columbus, O. Wheat middlings with ground screenings not exceeding mill run. Contains not more than 6 per cent. crude fiber, and not less than 4 per cent. fat and 16 per cent. protein. Registered in 1914 and 1915.	Two offiical samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. One sample was examined for weed seeds; none were found.

Feeding Stuffs—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Gwinn's Dairy Feed with screenings not exceeding mill run. Gwinn Milling Co., Columbus, Ohio. Composed of bran and middlings with screenings not exceeding mill run. Contains not more than 7 per cent. crude fiber, and not less than 4 per cent. fat and 16 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat. It was up to guarantee in fat but slightly high in fiber. Both contained a few hulls of corn cockle.
Gwinn's Red Dog. Gwinn Milling Co., Columbus, O. Wheat product. Contains not more than 5 per cent. crude fiber, and not less than 4 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Flake Bran. Jonathan Hale & Sons, Lyons, Mich. Wheat bran. Contains not more than 7.5 per cent. of crude fiber, and not less than 3.5 per cent. fat and 14 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Acme Middlings. Jonathan Hale & Sons, Lyons, Mich. Natural product produced during the process of flour manufacture. Contains not more than 7.2 per cent. crude fiber, and not less than 3.7 per cent. fat and 14.6 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat.
Acme Mixed Feed. Jonathan Hale & Sons, Lyons, Mich. Bran and middlings mixed. Contains not more than 7.4 per cent. crude fiber, and not less than 3.6 per cent. fat and 14.53 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Diamond (H) Mixed Feed. H. L. Halliday Milling Co., Cairo, Ill. Wheat bran, wheat shorts, wheat middlings. Contains not more than 8 per cent. crude fiber, and not less than 4 per cent. fat and 14,5 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Semolino Wheat Bran and screenings not to exceed mill run. Hays City Milling & Elevator Co., Hays City, Kansas. No certificate filed. Claims on package: Crude fiber not over 8.14 per cent.; fat not less than 3.50 per cent.; protein not less than 15 per cent. Unregistered; case pending.	The only official sample obtained was up to guarantee in protein and fat, but over 1 per cent. high in fiber. It contained a few seeds of pigweed.
Choice Wheat Bran with trace of screenings. Hecker-Jones-Jewell Milling Co., Buffalo, N. Y. Contains not more than 10.36 per cent. crude fiber and not less than 3.95 per cent. fat and 15.75 per cent. protein. Registered in 1914.	Of 2 official samples, one was up to guarantee in protein; the other was slightlyi below. One was examined for fiber and fat. It was up to guarantee in fat but slightly high in fiber. Both contained some hulls of corn cockle, and wild buckwheat; one contained a few seeds of lady's thumb.
Choice Wheat Bran with trace of screenings. Hecker-Jones-Jewell Milling Co., Buffalo, N. Y. Contains not more than 11.75 per cent. crude fiber and not less than 3.5 per cent. fat and 15 per cent. protein. Registered in 1915.	The only official sample obtained was up to guarantee in protein. It contained some hulls of corn cockle and wild buckwheat.

Feeding Stuffs—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Winter Wheat Bran with trace of screenings. Hecker-Jones-Jewell Milling Co., Buffalo, N. Y. Made from wheat. Contains not more than 9.9 per cent. crude fiber, and not less than 3.17 per cent. fat and 14.5 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Fancy White Middlings. Hecker-Jones-Jewell Milling Co., Buffalo, N. Y. Made from wheat. Contains not more than 5.5 per cent. crude fiber, and not less than 5 per cent. fat and 16.5 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Flour Middlings with mill run screenings. Hecker-Jones-Jewell Mfg. Co., Buffalo, N. Y. Made from wheat. On 1914 certificate: Contains not more than 7.27 per cent. crude fiber, and not less than 5.78 per cent. fat and 16.65 per cent. protein. On 1915 certificate: Contains not more than 8 per cent. crude fiber, and not less than 5.5 per cent. fat and 16 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained carried the guarantees of the 1914 certificate. It was up to its guarantee in protein but slightly below in fat and high in fiber. With the 1915 guarantees, it would have been up in fat and practically in accord with guarantee in fiber.
Standard Middlings with mill run screenings. Hecker-Jones-Jewell Mfg. Co., Buffalo, N. Y. Made from wheat. On 1914 certificate: Contains not more than 7.62 per cent. crude fiber, and not less than 6.08 per cent. fat and 17.4 per cent. protein. On 1915 certificate: Contains not more than 8.5 per cent. crude fiber, and not less tha 6 per cent. fat and 16.5 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat. It was below guarantee in fat and high in fiber. The goods sampled carried the 1914 guarantees, but the above statements hold in regard to the 1915 figures as well. No weed seeds were found in either sample.
Winter Wheat Middlings with mill run screenings. Hecker-Jones-Jewell Milling Co., Buffalo, N. Y. Made from wheat. Contains not more than 7.13 per cent. crude fiber, and not less than 4.67 per cent. fat and 15.59 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Mixed Feed with mill run screenings. Hecker-Jones-Jewell Mlg. Co., Buffalo, N. Y. Made from wheat. On 1914 certificate: Contains not more than 8.83 per cent. crude fiber, and not less than 5.36 per cent. fat and 14.64 per cent. protein. On 1915 certificate: Contains not more than 9 per cent. crude fiber, and not less than 5 per cent. fat and 15.75 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat. It carried the 1914 guarantees, but is also in accord with the 1915 figures. It contained a few seeds and some hulls common in wheat screenings.
Red Dog. Hecker-Jones-Jewell Mlg. Co., Buffalo, N. Y. Made from wheat. On 1914 certificate: Contains not more than 3.83 per cent. crude fiber, and not less than 3.2 per cent. fat and 16.41 per cent. protein. On 1915 certificate: Contains not more than 5.25 per cent. crude fiber, and not less than 5 per cent. fat and 16.75 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat. It was in accord with guarantee in both. The goods sampled both carried the 1914 guarantees but were also in accord with the 1915 figures.
Wheat Bran with ground screenings. Hunter-Robinson-Wenz Milling Co. No certificate filed. Claims on package: Crude fiber not over 11 per cent.; fat not less than 4 per cent.; protein not less than 15.5 per cent. Unregistered. Case pending.	Two official samples were both in accord with guarantee in protein and fiber. One was up to guarantee in fat and the other slightly below.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
"Montana" Brand Wheat Mixed Feed with ground screenings not exceeding mill run. Composed of wheat mixed feed with ground screenings not exceeding mill run. Contains not more than 11 per cent. crude fiber, and not less than 4 per cent. fat and 14.5 per cent. protein. Registered in 1914 by the Oscar Holway Co., Auburn, Me. Not registered in 1915.	No goods of this brand were found by inspectors.
Jenks White Middlings. Huron Milling Co., Harbor Beach, Mich. Flour middlings. Contains not more than 2½ per cent. crude fiber, and not less than 3½ per cent. fat and 13 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both.
Jenks Mixed Feed. Huron Milling Co., Harbor Beach, Mich. Composed of wheat bran and flour. Contains not more than 5.85 per cent. crude fiber, and not less than 4.6 per cent. fat and 12 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat. It was up to guarantee in fat but nearly 3 per cent. high in fiber. Both contained a few hulls of corn cockle.
Wheat Bran. Indiana Milling Co., Terre Haute, Ind. Wheat bran, with ground screenings not exceeding mill run. Contains not more than 10 per cent. crude fiber, and not less than 4 per cent. fat and 14 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was in accord with guarantee in protein and fat and practically so in fiber. It contained a few seeds of corn cockle and some hulls of corn cockle and wild buckwheat.
Dairy Winter Mixed Feed. Henry Jennings, Boston, Mass. Winter wheat bran, winter middlings and corn cob meal. On 1914 certificate: Contains not more than 17 per cent. crude fiber, and not less than 2 per cent. fat and 9 per cent. protein. On 1915 certificate: Contains not more than 25 per cent. crude fiber, and not less than 2 per cent. fat and 9 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Wheat Flour Middlings with ground screenings not exceeding mill run. W. J. Jennison Co., Minneapolis, Minn. Wheat flour middlings with ground screenings not exceeding mill run. Contains not more than 5½ per cent. crude fiber, and not less than 4½ per cent. fat and 17 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Palace Bran. Kehlor Flour Mills Co., East St. Louis, Mo. Made from pure hard winter wheat. Contains not more than 10 per cent. crude fiber, and not less than 4 per cent. fat and 14½ per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. One sample was examined for weed seeds; a few hulls of corn cockle and wild buckwheat were found.
Kehlor's Mill Feed. Kehlor Flour Mills Co., East St. Louis, Mo. Composed of pure wheat bran and brown middlings run together. Contains not more than 8 per cent. crude fiber and not less than 4 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. Both samples contained a few hulls of corn cockle.
Anchor Bran with ground wheat screenings not exceeding mill run. Kemper Mill & Elevator Co., Kansas City, Mo. Bran and ground wheat screenings. Contains not more than 10 per cent. crude fiber, and not less than 4 per cent. fat and 14.5 per cent. protein. Not registered in 1914. Registered in 1915.	Two official samples were both in accord with guarantee in protein, fiber and fat. One contained no weed seeds; the other a few seeds of pigweed, corn cockle, sedge and wild rose.

Feeding Stuffs—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Diamond K Bran with ground wheat screenings not exceeding mill run. Kemper Mill & Elevator Co., Kansas City, Mo. Bran with ground wheat screenings not exceeding mill run. Contains not more than 10 per cent. crude fiber, and not less than 4 per cent. fat and 14.5 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was in accord with guarantee in protein and fiber but slightly low in fat.
Carnation Gray Middlings with screenings not exceeding mill run. Kemper Mill & Elevator Co., Kansas City, Mo. Wheat shorts and ground screenings. Contains not more than 8 per cent. crude fiber, and not less than 4.3 per cent. fat and 16 per cent. protein. Not registered in 1914. Registered in 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. One sample was examined for weed seeds; none were found.
Crescent Mixed Feed with ground screenings not exceeding mill run. Kemper Mill & Elevator Co., Kansas City, Mo. Pure wheat bran and middlings with ground screenings. Contains not more than 5 per cent. crude fiber, and not less than 4 per cent. fat and 16 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was up to guarantee in protein and fat but over 3 per cent. above the fiber guarantee on the filed certificate. The goods were misbranded in that the maximum fiber guarantee was given as 10 per cent. on the package. The fiber was within that maximum figure.
Pyramid Mixed Feed. Kimball Bros. Co., Bath, Me. Bran and middlings. On 1914 certificate: Contains not more than 8.47 per cent. crude fiber, and not less than 13.56 per cent. protein. Fat not given. On 1915 certificate: Contains not more than 8.47 per cent. crude fiber, and not less than 3.25 per cent. fat and 14 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained carried the 1914 guarantees. It was found in accord with them as well as the 1915 figures.
Badger Fancy Middlings. Chas. A. Krause Milling Co., Milwaukee, Wis. Composed of Maizo red dog flour, wheat middlings with ground screenings not exceeding mill run. Contains not more than 7 per cent. crude fiber, and not less than 4½ per cent. fat and 12 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Badger Fancy Mixed Feed. Chas. A. Krause Milling Co., Milwaukee, Wis. Composed of Maizo red dog flour, wheat bran with ground screenings not to exceed mill run. Contains not more than 9 per cent. crude fiber, and not less than 4 per cent. fat and 12½ per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Wheat Bran with ground screenings not exceeding mill run. Lake of the Woods Mlg. Co., Ltd., Montreal, P. Q. Composed of wheat bran and ground screenings not exceeding mill run. Contains not more than 9 per cent. crude fiber, and not less than 4 per cent. fat and 15.5 per cent. protein. Registered in 1914 by Chas. M. Cox Co., Boston, Mass. Not registered in 1915.	No goods of this brand were found by inspectors.
Wheat Bran with mill run screenings not to exceed 8 per cent. Larrabee Flour Mills Co., Hutchinson and Safford, Kans., and Clinton, Mo. Composed of wheat bran with mill run of screenings not to exceed 8 per cent. Contains not more than 10 per cent. crude fiber, and not less than 3.5 per cent. fat and 14.5 per cent. protein. Not registered in 1914. Registered in 1915 by Chas. M. Cox Co., Boston, Mass.	The only official sample obtained was in accord with guarantee in protein and fat and practically so in fiber. No weed seeds were found.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
Golden Bull Bran. Lawrenceburg Roller Mills Co., Lawrenceburg, Ind. Pure wheat product. Contains not more than 11.5 per cent. crude fiber, and not less than 2 per cent. fat and 15.5 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Golden Bull Middlings. Lawrenceburg Roller Mills Co., Lawrenceburg, Ind. Pure wheat product. Contains not more than 8 per cent. crude fiber, and not less than 3 per cent. fat and 17.5 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Golden Bull Mixed Feed. Lawrenceburg Roller Mills Co., Lawrenceburg, Ind. Wheat product with ground screenings not exceeding mill run. Contains not more than 10.2 per cent. crude fiber, and not less than 2.5 per cent. fat and 16 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Snowflake Bran. Lawrenceburg Roller Mills Co., Lawrenceburg, Ind. Pure wheat product. Contains not more than 9.5 per cent. crude fiber, and not less than 3.8 per cent. fat and 14.2 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Snowflake Middlings. Lawrenceburg Roller Mills Co., Lawrenceburg, Ind. Wheat product. Contains not more than 6 per cent. crude fiber, and not less than 5.1 per cent. fat and 16 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein and fat, but slightly high in fiber. No weed seeds were found.
Snowflake Mixed Feed with ground screenings not exceeding mill run. Lawrenceburg Roller Mills Co., Lawrenceburg, Ind. Wheat product with ground screenings not exceeding mill run. Contains not more than 8 per cent. crude fiber, and not less than 4.3 per cent. fat and 15.2 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. Both samples contained a few hulls of corn cockle; one contained some seeds of corn cockle and a few of dock.
Perfection Roller Mills Michigan Winter Wheat Bran. John C. Liken & Co., Sebewaing, Mich. Contains not more than 12 per cent. crude fiber, and not less than 3.5 per cent. fat and 14 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Perfection Roller Mills Michigan Winter Wheat Middlings. John C. Liken & Co., Sebewaing, Mich. Contains not more than 8 per cent. crude fiber, and not less than 4.5 per cent. fat and 16 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Elmco Wheat Fancy Bran. Listman Mill Co., LaCrosse, Wis. Pure wheat. Contains not more than 12.16 per cent. crude fiber, and not less than 3.86 per cent. fat and 15.69 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was guaranteed to carry not over 10.18 per cent. crude fiber, and not less than 5.12 per cent. fat and 16.5 per cent. protein. It was over one-half per cent. below guarantee in protein and 1 per cent. below in fat; it was over 1 per cent. high in fiber.
Elmco Wheat Fancy Mixed Feed and screenings. Listman Mill Co., LaCrosse, Wis. Pure wheat. Contains not more than 9.15 per cent crude fiber, and not less than 4.09 per cent. fat and 15.55 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was in accord with guarantee in protein and fat, but slightly high in fiber.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
Elmco Wheat Red Dog Flour. Listman Mill Co., LaCrosse, Wis. Pure wheat. Contains not more than 5 per cent. crude fiber, and not less than 3 per cent. fat and 15.5 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was guaranteed to carry not more than 9.09 per cent. crude fibre, and not less than 4.77 per cent. fat and 17.07 per cent. protein. It was found to be over 1 per cent. below guaranty in protein and over 1½ per cent below in fat; it carried no more fibre than claimed.
Waseo Bran. Lyon & Greenleaf, Wauseon, O. Wheat bran. Contains not more than 9.5 per cent. crude fiber, and not less than 4 per cent. fat and 14.5 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was up to guarantee in fat, slightly low in protein, and over 2 per cent. high in fiber.
Waseo Middlings with ground screenings not exceeding mill run. Lyon & Greenleaf, Wauseon, Ohio. Wheat middlings or shorts with ground screenings not exceeding mill run. Contains not more than 6 per cent. crude fiber, and not less than 4 per cent. fat and 17 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Waseo Mixed Feed with ground screenings not exceeding mill run. Lyon & Greenleaf, Wauseon, O. Wheat middlings and bran with ground screenings not exceeding mill run. Contains not more than 8 per cent. crude fiber, and not less than 4 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein and fat, but slightly high in fiber. It contained a few seeds of dock.
Bran. Maple Leaf Milling Co., Ltd., Toronto, Ont., Can. Wheat bran. Contains not more than 12 per cent. crude fiber, and not less than 4.5 per cent. fat and 15.5 per cent. protein. Registered in 1914 and 1915 by Chas. M. Cox Co., Boston, Mass.	No goods of this brand were found by inspectors.
Rex Middlings. Maple Leaf Milling Co., Ltd., Toronto, Ont., Can. Wheat Middlings. Contains not more than 10 per cent. crude fiber, and not less than 5.5 per cent. fat and 16 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Red Dog. Marshall Milling Co. Contains not more than 3.74 per cent. crude fiber and not less than 4 per cent. fat and 15.05 per cent. protein. Not registered in 1914. Registered in 1915 by Griswold & McKinnon, St. Johnsbury, Vt.	The only official sample obtained was found in accord with guarantee in protein and fat but over one-half per cent. high in fiber.
Brooks' Fancy Mixed Feed. A. H. McLeod Milling Co., St. Johnsbury, Vt. Bran and red dog flour. Contains not more than 9 per cent. crude fiber, and not less than 4.5 per cent. fat and 16 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Fancy Bran. Melrose Milling Co., Melrose, Minn. Contains not more than 11 per cent. crude fiber, and not less than 3 per cent. fat and 14 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was found in accord with guarantee in protein and fat. It was slightly high in fiber.
Middlings. Melrose Milling Co., Melrose, Minn. Contains not more than 14 per cent. crude fiber, and not less than 3 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
"Monteo" Montana Flour Mills Co., Lewistown, Mont. Mixture of by-products from milling of the wheat berry. Contains not more than 9.1 per cent. crude fiber, and not less than 3.8 per cent. fat and 15.8 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Big B Choice Wheat Bran. Moseley & Motley Milling Co., Rochester, N. Y. Contains not more than 12 per cent. crude fiber, and not less than 3 per cent. fat and 14 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Big B Mixed Feed, with ground screenings not exceeding mill run. Moseley & Motley Milling Co., Rochester, N. Y. Composed of wheat bran, flour middlings, ground screenings not exceeding mill run. Contains not more than 9.5 per cent. crude fiber, and not less than 4.5 per cent. fat and 16 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Wheat Middlings with ground screenings not exceeding mill run. Moseley & Motley Milling Co., Rochester, N. Y. Wheat with ground screenings not exceeding mill run. Contains not more than 10 per cent. crude fiber, and not less than 4.5 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Wheat Bran with screenings not exceeding mill run. National Feed Co., St. Louis, Mo. Wheat bran and wheat screenings. Contains not more than 10 per cent. crude fiber, and not less than 4 per cent. fat and 14.5 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Wheat Mixed Feed with screenings not exceeding mill run. National Feed Co., St. Louis, Mo. Composed of wheat bran, wheat middlings, and wheat screenings not exceeding mill run. Contains not more than 10 per cent. crude fiber, and not less than 4 per cent. fat and 14.5 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
"Seal of Minnesota" Bran with ground screenings not exceeding mill run. New Prague Flouring Mill Co., New Prague, Minn. Wheat bran with screenings (ground) not exceeding mill run. Contains not more than 11 per cent. crude fiber, and not less than 4.75 per cent. fat and 14.6 per cent. protein. Not registered in 1914. Registered in 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat; it was in accord with guarantee in fiber, but one-half per cent. low in fat. Both samples contained some hulls of wild buckwheat; one contained a few seeds of yellow foxtail.
"Seal of Minnesota" Standard Middlings. New Prague Flouring Mill Co., New Prague, Minn. Middlings from wheat. Contains not more than 6.75 per cent. crude fiber, and not less than 5.8 per cent. fat and 17.75 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
"Niagara Falls Milling Company's Choice Wheat Bran" Niagara Falls Milling Co., Niagara Falls, N. Y. Wheat. Contains not more than 13 per cent. crude fiber and not less than 3 per cent. fat and 14 per cent. protein. Registered in 1914 and 1915.	Two official samples were both in accord with guarantee in protein, fiber and fat. Both contained a few hulls of corn cockle; one contained a few of wild buckwheat.
Niagara Falls Milling Company's Choice Wheat Middlings. Niagara Falls Milling Co., Niagara Falls, N. Y. Wheat. Contains not more than 11 per cent. crude fiber and not less than 4 per cent. fat and 16 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat. It contained some hulls of wild buckwheat.
Niagara Falls Milling Company's Perfect Mixed Feed. Niagara Falls Milling Co., Niagara Falls, N. Y. Wheat. Contains not more than 10½ per cent. crude fiber and not less than 3 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
N. M. Co.'s Wheat Bran with ground screenings not exceeding mill run. Noblesville Milling Co., Noblesville, Ind. Wheat bran and ground wheat screenings. Contains not more than 8 per cent. crude fiber, and not less than 3.7 per cent. fat and 14.5 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was up to guarantee in protein but slightly below in fat and over 1½ per cent. high in fiber.
N. M. Co.'s Middlings. Noblesville Milling Co., Noblesville, Ind. Wheat Middlings. Contains not more than 7 per cent. crude fiber, and not less than 4 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
N. M. Co.'s Mixed Feed. Noblesville Milling Co., Noblesville, Ind. Wheat bran, middlings and ground wheat screenings. Contains not more than 8 per cent. crude fiber, and not less than 4 per cent. fat and 16 per cent. protein. Registered in 1914 and 1915.	One dealer's sample and 3 official samples were all up to guarantee in protein. Two official samples were examined for fiber and fat. Both were in accord with guarantee in fat and one was in fiber; the other was over 1 per cent. high in fiber. Two samples were examined for weed seeds; some hulls of corn cockle were found in both; in one some hulls of wild buckwheat and a few seeds of yellow foxtail and green foxtail were also found.
N. M. Co.'s Goodcatch Feed. Noblesville Milling Co., Noblesville, Ind. Composed of wheat bran, middlings and ground wheat screenings not exceeding mill run. Contains not more than 11 per cent. crude fiber, and not less than 4 per cent. fat and 15 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Pure Wheat Bran. Northwestern Consolidated Milling Co., Minneapolis, Minn. Wheat bran. Contains not more than 11 per cent. crude fiber, and not less than 4 per cent. fat and 14.5 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. Both samples contained some hulls of corn cockle.
Wheat Flour Middlings with ground screenings not exceeding mill run. Northwestern Consolidated Milling Co., Minneapolis, Minn. Wheat flour middlings with ground screenings not exceeding mill run. Contains not more than 6 per cent. crude fiber, and not less than 4.5 per cent. fat and 15.5 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both.

Feeding Stuffs—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Wheat Standard Middlings with ground screenings not exceeding mill run. Northwestern Consolidated Milling Co., Minneapolis, Minn. Wheat standard middlings with ground screenings not exceeding mill run. Contains not more than 11 per cent. crude fiber, and not less than 4.5 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. In one sample no weed seeds were found; the other contained a few weed seeds of pigweed and a few hulls of wild buckwheat.
Wheat Mixed Feed Composed of Wheat Bran, Flour Middlings and ground screenings not exceeding mill run. Northwestern Consolidated Milling Co., Minneapolis, Minn. Wheat mixed feed composed of bran, flour middlings and ground screenings not exceeding mill run. Contains not more than 10 per cent. crude fiber, and not less than 4.5 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat. It contained some hulls of corn-cockle.
Planet Feed. Northwestern Consolidated Milling Co., Minneapolis, Minn. Wheat bran and red dog flour. Contains not more than 8 per cent. crude fiber, and not less than 4 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat.
XXX Comet. Northwestern Consolidated Milling Co., Minneapolis, Minn. Red Dog Flour. Contains not more than 3 per cent. crude fiber, and not less than 4 per cent. fat and 16.5 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Wheat Bran with ground screenings not exceeding mill run. Northwestern Elevator & Mill Co., Toledo, O. Wheat product. Contains not more than 6 per cent. crude fiber, and not less than 4 per cent. fat and 13 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Sunshine Winter Mixed Feed. Paris Flouring Co., Portland, Me. Pure wheat products only. Contains not more than 8 per cent. crude fiber, and not less than 4 per cent. fat and 14.5 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Wheat Middlings with ground screenings. Peninsular Milling Co., Flint, Mich. Wheat middlings with ground screenings not exceeding mill run. Contains not more than 7 per cent. crude fiber, and not less than 4 per cent. fat and 15 per cent. protein. Not registered in 1914. Registered in 1915.	Two official samples were both misbranded in that the packages carried a guarantee of 16 per cent. protein, not agreeing with the filed certificate. Both were slightly below that figure but were up to the certificate guarantee of 15 per cent. One sample was examined for fiber and fat and found in accord with guarantee in both. It contained a few hulls of corn cockle.
Pilco Fancy Winter Bran with not exceeding mill run screenings. Pilliod Milling Co., Swanton, O. Contains not more than 11 per cent. crude fiber, and not less than 4 per cent. fat and 14 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was in accord with the certificate guarantees in protein, fiber and fat. The goods were misbranded in that they did not carry a statement of the guarantees on the label.
Mixed Feed. Pilliod Milling Co., Swanton, Ohio. No certificate filed. No statement of guarantees on package. Unregistered. Case pending.	The only official sample obtained carried 15.13 per cent. protein, 3.42 per cent. fat, and 7.64 per cent. fiber.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
Pillsbury's Wheat Bran with ground screenings not exceeding mill run. Pillsbury Flour Mills Co., Minneapolis, Minn. Wheat bran with ground screenings. Contains not more than 12 per cent. crude fiber, and not less than 4 per cent. fat and 14.5 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. One sample contained a few hulls of corn cockle and the other a few seeds and a few hulls of weeds of various sorts common in wheat screenings.
Pillsbury's Wheat "A" Middlings with ground screenings not exceeding mill run. Pillsbury Flour Mills Co., Minneapolis, Minn. Shorts, ground screenings and red dog. Contains not more than 7 per cent. crude fiber, and not less than 4½ per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both.
Pillsbury's Wheat Standard "B" Middlings with ground screenings not exceeding mill run. Pillsbury Flour Mills Co., Minneapolis, Minn. Standard middlings and ground screenings. Contains not more than 10 per cent. crude fiber, and not less than 4½ per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. One sample was examined for weed seeds; none were found.
Pillsbury's Fancy Wheat Mixed Feed with ground screenings not exceeding mill run. Pillsbury Flour Mills Co., Minneapolis, Minn. Wheat bran, ground screenings and red dog. Contains not more than 9 per cent. crude fiber, and not less than 4½ per cent. fat and 16 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. Both samples contained some hulls of corn cockle and wild buckwheat; one also contained a few seeds of green foxtail.
Pillsbury's XX Daisy. Pillsbury Flour Mills Co., Minneapolis, Minn. Red dog or low grade wheat flour. Contains not more than 4 per cent. crude fiber and not less than 4½ per cent. fat and 17 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in the latter, but slightly high in fiber.
Wheat Bran with ground screenings not exceeding mill run. Geo. P. Plant Milling Co., St. Louis, Mo. No certificate filed. Claims on package: Crude fiber not over 11 per cent.; fat not less than 3 per cent.; protein not less than 15 per cent. Unregistered.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat. It contained a few seeds of pigweed and green foxtail.
Champion Mixed Feed with ground screenings not exceeding mill run. Portland Milling Co., Portland, Mich. Winter wheat offal. Contains not more than 8.47 per cent. crude fiber, and not less than 3.58 per cent. fat and 13.56 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. Both samples contained a few hulls of corn cockle.
Bran. Quaker City Flour Mills Co., Philadelphia, Pa. Wheat bran and ground screenings not to exceed mill run. Contains not more than 10½ per cent. crude fiber, and not less than 3 per cent. fat and 13 per cent. protein. Not registered in 1914. Registered in 1915 by Chas. M. Cox Co., Boston, Mass.	The only official sample obtained was in accord with guarantee in protein, fiber and fat. It contained some hulls of corn cockle.
Winter Wheat Middlings. Quaker City Flour Mills Co., Philadelphia, Pa. Made from pure wheat with ground screenings not to exceed the mill-run. Contains not more than 5½ per cent. crude fiber, and not less than 4 per cent. fat and 14 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. One sample was examined for weed seeds; none were found.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
Bell Cow Bran. Quaker Oats Co., Chicago, Ill. Wheat bran with ground screenings not exceeding mill run. Contains not more than 7.6 per cent. crude fiber, and not less than 5.5 per cent. fat and 15.3 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was up to guarantee in protein and fat, but over 2 per cent. high in fiber.
Bell Cow Middlings. Quaker Oats Co., Chicago, Ill. Wheat middlings with ground screenings not exceeding mill run. Contains not more than 7.6 per cent. crude fiber, and not less than 5.5 per cent. fat and 15.5 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Queen Bee Bran. Queen Bee Flour Mills Co., Minneapolis, Minn. Wheat bran only. Contains not more than 10.5 per cent. crude fiber, and not less than 4.3 per cent. fat and 14.5 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Queen Bee Standard Middlings with not to exceed mill run of ground screenings. Queen Bee Flour Mills Co., Minneapolis, Minn. Wheat middlings and ground wheat screenings. Contains not more than 9.5 per cent. crude fiber, and not less than 4.5 per cent. fat and 16.5 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Queen Bee Red Dog or Low Grade. Queen Bee Flour Mills Co., Minneapolis, Minn. Low grade flour or red dog milled from wheat only. Contains not more than 5.2 per cent. crude fiber, and not less than 3.2 per cent. fat and 17.2 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat.
Pure Wheat Shorts. Redfield Flouring Mills, Geo. C. Christian, Redfield, S. Dakota. No certificate filed. Claims on package: Crude fiber not over 8 per cent.; fat not less than 4 per cent.; protein not less than 18 per cent. (or possibly 16 per cent.; figures were indistinct on sacks). Unregistered; case pending.	The only official sample obtained was in accord with guarantee in fiber and fat. It carried 16 per cent. protein. It contained a few hulls of wild buckwheat.
Mixed Feed. Richardton Roller Mills, Richardton, N. Dak. Made from pure hard spring wheat, contains no wheat screenings, contains stream scourings from one scourer of mill run. Contains not more than 6.7 per cent. crude fiber, and not less than 4.9 per cent. fat and 16.88 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein and fat, but over 2 per cent. high in fiber. It contained a few hulls of corn cockle and wild buckwheat.
Robin Hood Bran. Robin Hood Mills, Ltd., Moose Jaw, Sask. Wheat Bran. Contains not more than 9.8 per cent. crude fiber, and not less than 5.2 per cent. fat and 16.25 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Royal Bran. Royal Milling Co., Great Falls, Mont. Bran from wheat with ground screenings not exceeding mill run. Contains not more than 9 per cent. crude fiber, and not less than 3 per cent. fat and 15.5 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
Royal Standard Middlings. Royal Milling Co., Great Falls, Mont. Wheat standard middlings or shorts with ground screenings not exceeding mill run. Contains not more than 7.5 per cent. crude fiber, and not less than 4 per cent. fat and 16.5 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Royal Mixed Feed. Royal Milling Co., Great Falls, Mont. Wheat bran and flour middlings, with ground screenings not exceeding mill run. Contains not more than 8 per cent. crude fiber, and not less than 3.5 per cent. fat and 16 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Choice Wheat Standard Middlings with ground screenings not exceeding mill run. Rush City Milling Co., Rush City, Minn. No certificate filed. Claims on package: Crude fiber not over 8.20 (or 9.20) per cent; fat not less than 4.20 per cent.; protein not less than 13.50 per cent. Unregistered.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both.
Bran. Russell-Miller Milling Co., Minneapolis, Minn. Wheat only. Contains not more than 11 per cent. crude fiber, and not less than 4 per cent. fat and 13 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat. It contained some hulls of corn cockle.
Flour Middlings. Russell-Miller Milling Co., Minneapolis, Minn. Wheat only. Contains not more than 6 per cent. crude fiber, and not less than 5 per cent. fat and 16 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Standard Middlings. Russell-Miller Milling Co., Minneapolis, Minn. Wheat only. Contains not more than 9 per cent. crude fiber, and not less than 4 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both.
Occident Wheat Feed. Russell-Miller Milling Co., Minneapolis, Minn. Wheat only. Contains not more than 10 per cent. crude fiber, and not less than 4.5 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in the latter and practically so in fiber. Both samples contained a few hulls of corn cockle and wild buckwheat.
Red Dog Flour. Russell-Miller Milling Co., Minneapolis, Minn. Wheat only. Contains not more than 6 per cent. crude fiber, and not less than 4.5 per cent. fat and 16 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Wheat Bran with screenings not exceeding mill run. Saginaw Milling Co., Saginaw, Mich. Bran with screenings not exceeding mill run. Contains not more than 11 per cent. crude fiber, and not less than 4 per cent. fat and 15 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Gold Mine Feed. Sheffield-King Milling Co., Minneapolis, Minn. Composed of bran, shorts, low grade flour, wheat product and pulverized screenings. Contains not more than 8.98 per cent. crude fiber, and not less than 4.9 per cent. fat and 15.9 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in the former and practically so in fat. One sample was examined for weed seeds; few hulls of corn cockle were found.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
Sleepy Eye Bran. Sleepy Eye Flour Mills Co., Minneapolis, Minn. Pure wheat bran only. On 1914 certificate: Contains not more than 13.3 per cent. crude fiber, and not less than 4.4 per cent. fat and 15.3 per cent. protein. On 1915 certificate: Contains not more than 10.5 per cent. crude fiber, and not less than 4.3 per cent. fat and 14.5 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Sleepy Eye Standard Middlings. Sleepy Eye Flour Mills Co., Minneapolis, Minn. On 1914 certificate: Pure wheat middlings only. Contains not more than 9.4 per cent. crude fiber, and not less than 4.3 per cent. fat and 17.2 per cent. protein. On 1915 certificate: Pure wheat middlings with not to exceed mill run of ground screenings. Contains not more than 9.5 per cent. crude fiber, and not less than 4.5 per cent. fat and 16.5 per cent. protein. Registered in 1914 and 1915.	Two official samples both carried the 1914 guarantees. They both fell short of that guarantee in protein and slightly below the 1915 protein guarantee. One was examined for fiber and fat and found in accord with guarantee in both. One sample was examined for weed seeds; a few seeds each of yellow foxtail and wild buckwheat and many hulls of wild buckwheat were found.
Sleepy Eye Red Dog or Low Grade. Sleepy Eye Flour Mills Co., Minneapolis, Minn. Manufactured from wheat only. On 1914 certificate: Contains not more than 5 per cent. crude fiber, and not less than 3 per cent. fat and 17.3 per cent. protein. On 1915 certificate: Contains not more than 5.2 per cent. crude fiber, and not less than 3.2 per cent. fat and 17.2 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Wheat Bran. Southwestern Milling Co., Kansas City, Mo. No certificate filed. Claims on package: crude fiber not over 10.22 per cent.; fat not less than 3.58 per cent.; protein not less than 16.16 per cent. Unregistered.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. No weed seeds were found in either sample.
Try Me Winter Mixed Feed. Sparks Milling Co., Alton, Ill. Pure wheat bran and middlings with ground screenings not exceeding mill run. Contains not more than 8 per cent. crude fiber, and not less than 3.5 per cent. fat and 16 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. Both samples contained a few hulls of corn cockle.
Star & Crescent Bran with ground screenings not exceeding mill run. Star & Crescent Milling Co., Chicago, Ill. Wheat with ground screenings not exceeding mill run. Contains not more than 10 per cent. crude fiber, and not less than 4 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Stock's Bran. F. W. Stock & Sons, Hillsdale, Mich. Wheat bran. Contains not more than 10 per cent. crude fiber, and not less than 3 per cent. fat and 14 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. A few hulls of corn cockle were found in both samples.
Stock's Middlings. F. W. Stock & Sons, Hillsdale, Mich. Wheat middlings. Contains not more than 6 per cent. crude fiber, and not less than 4 per cent. fat and 16½ per cent. protein. Registered in 1914 and 1915.	Two official samples were both slightly below guarantee in protein. One sample was examined for weed seeds; many seeds and hulls of various sorts common in wheat screenings were found.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Flour Middlings. F. W. Stock & Sons, Hillsdale, Mich. No certificate filed; Claims on package: Crude fiber not over 6 per cent.; fat not less than 5 per cent.; protein not less than 16 per cent. Unregistered.	The only official sample obtained was one-half per cent. below guarantee in protein and over 1½ per cent. below in fat. It was in accord with guarantee in fiber. A few hulls of corn cockle and wild buckwheat were found.
Stock's Monarch Wheat Feed. F. W. Stock & Sons, Hillsdale, Mich. Bran and middlings. Contains not more than 10 per cent. crude fiber, and not less than 4 per cent. fat and 16 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. One sample was examined for weed seeds; a few seeds of yellow foxtail and some hulls of corn cockle were found.
Stock's Superior Wheat Feed. F. W. Stock & Sons, Hillsdale, Mich. Bran, middlings and low grade flour. Contains not more than 7 per cent. crude fiber, and not less than 4½ per cent. fat and 16 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in the latter and practically so in fiber. In one sample a few hulls of wild buckwheat and corn cockle were found; in the other a few seeds and some hulls of various sorts common in wheat screenings.
Stott's Spring Bran with ground screenings. David Stott Flour Mills, Inc., Detroit, Mich. Spring wheat bran and ground screenings. Contains not more than 10 per cent. crude fiber, and not less than 4½ per cent. fat and 16 per cent. protein. Registered in 1914 and 1915.	Of 3 official samples, 2 were up to guarantee in protein and one was slightly below. 2 were examined for fiber and fat and found in accord with guarantee in both. All 3 samples contained some weed seeds and some hulls of various sorts common in wheat screenings.
Stott's Pure Winter Wheat Bran with ground screenings not exceeding mill run. David Stott Flour Mills,Inc.,Detroit,Mich. Contains not more than 10 per cent. crude fiber, and not less than 4½ per cent. fat and 16 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. Both samples contained a few hulls of wild buckwheat and one contained a few seeds of green foxtail and mustard.
Stott's Climax Middlings. David Stott Flour Mills, Inc., Detroit, Mich. White and brown wheat middlings. Contains not more than 8 per cent. crude fiber, and not less than 5 per cent. fat and 17 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in the former and practically so in fat. One sample was examined for weed seeds; a few seeds of green foxtail were found.
Stott's Fine White Middlings. David Stott Flour Mills, Inc., Detroit, Mich. Fine wheat middlings. Contains not more than 6 per cent. crude fiber, and not less than 5 per cent. fat and 16 per cent. protein. Registered in 1914 and 1915.	Of 2 official samples, one was up to guarantee in protein and one was one-half per cent. below. One sample was examined for fiber and fat and found in accord with guarantee in the former but over ¾ per cent. low in fat.
Stott's Pennant Middlings. David Stott Flour Mills, Inc., Detroit, Mich. Brown wheat middlings. Contains not more than 7 per cent. crude fiber, and not less than 5 per cent. fat and 17 per cent. protein. Registered in 1914 and 1915.	Of 3 official samples, one was up to guarantee in protein, one was nearly 1 per cent. below and one was over 1 per cent. below. The 2 low samples were examined for fiber and fat. Both were ¾ per cent. below guarantee in fat. One was in accord with guarantee in fiber, the other slightly high. Several varieties of whole and crushed weed seeds and hulls werr found in the only sample examined foe weed seeds.
Stott's Heavy Mixed Pure Wheat Feed. David Stott Flour Mills, Inc., Detroit, Mich. Wheat flour, wheat bran and wheat middlings. Contains not more than 7 per cent. crude fiber, and not less than 4½ per cent. fat and 16 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat. It contained a few seeds of field pepper-grass, mustard, and yellow foxtail and a few hulls of corn cockle and wild buckwheat.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Stott's Honest Mixed Feed. David Stott Flour Mills, Inc., Detroit, Mich. Winter wheat bran and middlings. Contains not more than 8 per cent. crude fiber, and not less than 5 per cent. fat and 16½ per cent. protein. Registered in 1914 and 1915.	Five official samples were obtained. One was up to guarantee in protein; 2 were slightly below; and 2 were over ½ per cent. below. The sample that was up in protein was examined for fiber and fat. It was in accord with guarantee in fat and practically so in fiber. 2 samples were examined for weed seeds. In one a few, in the other many seeds and hulls of various sorts common in wheat screenings were found.
Stag Flour. David Stott Flour Mills, Inc., Detroit, Mich. Low grade fine wheat wheat flour. Contains not more than 3 per cent. crude fiber, and not less than 1½ per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both.
Bran. Tennant & Hoyt Co., Lake City, Minn. Contains ground screenings not exceeding mill run. Moisture 12.50 per cent. Contains not more than 11 per cent. crude fiber, and not less than 4 per cent. fat and 14 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat. It contained a few seeds of wild buckwheat and mustard and many hulls of wild buckwheat and corn cockle.
Wheat Middlings with ground screenings not exceeding mill run. Tennant & Hoyt Co., Lake City, Minn. Composed of wheat middlings and mill run of screenings. Contains not more than 8 per cent. crude fiber, and not less than 5 per cent. fat and 15 per cent. protein. Not registered in 1914. Registered in 1915 by Chas. M. Cox Co., Boston, Mass.	The only official sample obtained was in accord with guarantee in protein, fiber and fat. It contained some hulls of corn cockle, wild buckwheat and mustard.
Wheat Bran with ground screenings not exceeding mill run. George Urban Milling Co., Buffalo, N. Y. Contains not more than 12.5 per cent. crude fiber, and not less than 3.5 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	Two official samples were both in accord with guarantee in protein, fiber and fat. Both contained many weed seeds and hulls of various sorts common in wheat screenings.
Wheat Middlings with ground screenings not exceeding mill run. George Urban Milling Co., Buffalo, N. Y. Contains not more than 9.5 per cent. crude fiber, and not less than 4.5 per cent. fat and 16 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Wheat Mixed Feed with ground screenings not exceeding mill run. George Urban Milling Co., Buffalo, N. Y. Contains not more than 10.5 per cent. crude fiber, and not less than 4 per cent. fat and 16 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Farmers' Favorite Bran. Valley City Milling Co., Grand Rapids, Mich. Wheat bran and mill run of screenings. On 1914 certificate: Contains not more than 10.42 per cent. crude fiber, and not less than 2.8 per cent. fat and 14.65 per cent. fat and 14.65 per cent. protein. On 1915 certificate: Contains not more than 10 per cent. crude fiber, and not less than 3.7 per cent. fat and 15.25 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.

Feeding Stuffs—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Farmers' Favorite Middlings with reduced screenings. Valley City Milling Co., Grand Rapids, Mich. Wheat middlings and mill run of screenings. On 1914 certificate: Contains not more than 7 per cent. crude fiber, and not less than 4.25 per cent. fat and 15.5 per cent. protein. On 1915 certificate: Contains not more than 5.8 per cent. crude fiber, and not less than 4.2 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	Two official samples were both misbranded in that they carried guarantees agreeing with neither the 1914 nor the 1915 certificates. Both were up to both the package and the certificate guarantees in protein. One was examined for fiber and fat. It was in accord with both fiber guarantees but fell slightly below both guarantees in fat. No weed seeds were found in the one sample examined.
Farmers' Favorite Cow Feed with reduced screenings. Valley City Milling Co., Grand Rapids, Mich. Composed of wheat bran, wheat middlings and mill run of screenings. On 1914 certificate: Contains not more than 7.5 per cent. crude fiber, and not less than 4.25 per cent. fat and 14.18 per cent. protein. On 1915 certificate: Contains not more than 8.1 per cent. crude fiber, and not less than 4.2 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	Two official samples were both misbranded in that they carried guarantees not agreeing with the filed certificates. Both samples were in accord with the certificate guarantee in protein, but one was over 1 per cent. below the protein guarantee on its label; one sample was examined for fiber and fat and found in accord with the certificate guarantee in both but above its label guarantee in fiber.
Victor Spring Wheat Bran with screenings not exceeding mill run. Victor Milling Co., Victor, N. Y. Contains not more than 15 per cent. crude fiber, and not less than 4 per cent. fat and 14.6 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Victor Spring Wheat Middlings with screenings not exceeding mill run. Victor Milling Co., Victor, N. Y. Contains not more than 10 per cent. crude fiber, and not less than 5 per cent. fat and 17.5 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Victor Spring Mixed Feed. Victor Milling Co., Victor, N. Y. Composed of spring wheat bran, spring wheat middlings and low grade flour. Contains not more than 10 per cent. crude fiber, and not less than 4.5 per cent. fat and 15 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Voigt's Pure Bran with ground screenings not exceeding mill run. Voigt Milling Co., Grand Rapids, Mich. On 1914 certificate: Contains not more than 7.5 per cent. crude fiber, and not less than 6.5 per cent. fat and 17 per cent. protein. On 1915 certificate: Contains not more than 11 per cent. crude fiber, and not less than 3½ per cent. fat and 14 per cent. protein. Registered in 1914 and 1915.	The 2 official samples obtained both carried the 1914 guarantees. They were both nearly 2 per cent. below that guarantee in protein, over 2 per cent. below in fat, and nearly 1 per cent. high in fiber. Both contained some hulls of corn cockle. Both samples would have been in accord with the 1915 guarantees which all goods of this brand shipped into Maine are now carrying.
Voigt's Middlings. Voigt Milling Co., Grand Rapids, Mich. No screenings in middlings. On 1914 certificate: Contains not more than 5 per cent. crude fiber, and not less than 5.5 per cent. fat and 14.5 per cent. protein. On 1915 certificate: Contains not more than 8 per cent. crude fiber, and not less than 4 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained carried the 1914 guarantees. It was in accord with that guarantee in fiber but over 1 per cent. below in protein and over 1½ per cent. below in fat. On the basis of the 1915 figures, it was in accord with guarantee in fiber, slightly low in fat, and, of course, more deficient in protein than on the 1914 basis.
Voigt's Mixed Feed containing screenings not exceeding mill run. Voigt Milling Co., Grand Rapids, Mich. Contains not more than 9 per cent. crude fiber, and not less than 4 per cent. fat and 14.25 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was taken before these goods were registered. Its guarantees were much in excess of those filed in the certificate. On the basis of the claims on the package the goods were very deficient in protein and fat and high in fiber. On the basis of the certificate guarantees, the goods were in accord in protein and fiber, but slightly low in fat.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
Big Jo Bran. Wabasha Roller Mill Co., Wabasha, Minn. On 1914 certificate: Contains not more than 9.62 per cent. crude fiber, and not less than 5.15 per cent. fat and 16.39 per cent. protein. On 1915 certificate: Contains not more than 11.6 per cent. crude fiber, and not less than 3.2 per cent. fat and 15.3 per cent. protein. Registered in 1914 and 1915.	The 2 official samples obtained both carried the 1914 guarantees. On that basis, they were both in accord with guarantee in protein and one was in accord with guarantee in fat. The other was slightly low in fat and both were high in fiber. On the basis of the 1915 guarantees, both would have been in accord with guarantee in all respects. Both samples contained a few hulls of corn cockle.
Big Jo Flour Middlings. Wabasha Roller Mill Co., Wabasha, Minn. Contains not more than 3.5 per cent. crude fiber, and not less than 4.3 per cent. fat and 16.5 per cent. protein. Not registered in 1914. Registered in 1915.	Two official samples were both misbranded in that the guarantees on the package did not agree with the filed certificate. On either basis, both were up to guarantee in protein. One was examined for fiber and fat and found in accord with the certificate guarantee in both. On the basis of the label guarantee, it was slightly low in fat and slightly high in fiber.
Big Jo Middlings. Wabasha Roller Mill Co., Wabasha, Minn. On 1914 certificate: Contains not more than 7.16 per cent. crude fiber, and not less than 6.54 per cent. fat and 17.73 per cent. protein. On 1915 certificate: Contains not more than 10.85 per cent. crude fiber, and not less than 4.65 per cent. fat and 15.4 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Big Jo Mixed Feed. Wabasha Roller Mill Co., Wabasha, Minn. Composed of 50 per cent. Big Jo Bran, 25 per cent. Big Jo Middlings and 25 per cent. Big Jo Flour Middlings. Contains not more than 9.35 per cent. crude fiber, and not less than 3.75 per cent. fat and 15.8 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat.
Mixed Feed. Waggoner-Gates Milling Co., Independence, Mo. Composed of pure wheat bran and middlings. Contains not more than 9 per cent. crude fiber, and not less than 3 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915 by Chas. M. Cox Co., Boston, Mass.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. In one sample no weed seeds were found; in the other, a few hulls of corn cockle.
Wheat Bran with ground screenings not exceeding mill run. Washburn-Crosby Co., Minneapolis, Minn. Wheat bran and ground screenings not exceeding mill run. Contains not more than 12 per cent. crude fiber, and not less than 4 per cent. fat and 14.5 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. Both samples contained a few hulls of wild buckwheat and corn cockle and one contained a few seeds of wild buckwheat.
Wheat Flour Middlings with ground screenings not exceeding mill run. Washburn-Crosby Co., Minneapolis, Minn. Wheat standard middlings, red dog flour and ground screenings not exceeding mill run. Contains not more than 6.5 per cent. crude fiber, and not less than 5 per cent. fat and 17 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.

Feeding Stuffs—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Wheat Standard Middlings with ground screenings not exceeding mill run. Washburn-Crosby Co., Minneapolis, Minn. Composed of wheat standard middlings and ground screenings not exceeding mill run. Contains not more than 9.5 per cent. crude fiber, and not less than 5 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in fiber, but slightly low in fat
Wheat Mixed Feed with ground screenings not exceeding mill run. Washburn-Crosby Co., Minneapolis, Minn. Composed of wheat bran, wheat flour middlings and ground screenings not exceeding mill run. Contains not more than 9 per cent. crude fiber, and not less than 4.5 per cent. fat and 16 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat.
Red Dog Flour (Adrian). Washburn-Crosby Co., Minneapolis, Minn. Wheat. Contains not more than 4 per cent. crude fiber, and not less than 5 per cent. fat and 17 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both.
WebsterMixed Feed Webster Mill Co., Webster, S. Dak. Composed of bran, middlings and low grade and ground screenings not exceeding mill run. Contains not more than 10 per cent. crude fiber, and not less than 4.8 per cent. fat and 15.3 per cent. protein. Registered in 1914 and 1915 by E. S. Woodworth Co., Minneapolis, Minn.	Two official samples were both in accord with guarantee in protein and fiber. One was up to guarantee in fat; the other was slightly below. Both contained a few seeds and some hulls of various sorts common in wheat screenings.
Weltin's Choice Winter Wheat Bran. No certificate filed. Claims on package: Crude fiber not stated; fat not less than 3.55 per cent.; protein not less than 14.30 per cent. Unregistered.	The only official sample obtained was in accord with guarantee in protein and fat and contained 9 per cent. fiber. No weed seeds were found.
Wheat Bran. Western Canada Flour Mills Co., Ltd., Toronto, Ont., Can. Composed of wheat bran with ground screenings not exceeding mill run. Contains not more than 10.86 per cent. crude fiber, and not less than 5.5 per cent. fat and 16.82 per cent. protein. Registered in 1914 by Chas. M. Cox Co., Boston, Mass. Not registered in 1915.	The only official sample obtained was in accord with guarantee in protein and fiber, but slightly low in fat.
Middlings. Western Canada Flour Mills Co., Ltd., Toronto, Ont., Canada. Contains not more than 9 per cent. crude fiber and not less than 4.5 per cent. fat and 15.5 per cent. protein. Not registered in 1914. Registered in 1915 by Chas. M. Cox Co., Boston, Mass.	The only official sample obtained was in accord with guarantee in protein, fiber and fat.
"Black Hawk Bran" with ground screenings not exceeding mill run. New Prague Flouring Mill Co., New Prague, Minn. Wheat bran with ground screenings not exceeding mill run. (Manufactured by Western Flour Mills Co., Davenport, Iowa). Contains not more than 11 per cent. crude fiber, and not less than 4.75 per cent. fat and 14.6 per cent. protein. Registered in 1914 and 1915.	Two official samples were both in accord with guarantee in protein. Both were over one-half per cent. below in fat. One was in accord with guarantee in fiber; the other slightly high. One sample was examined for weed seeds; none were found.

Feeding Stuffs—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Pure Winter Wheat Bran. Williams Bros. Co., Kent, O. Pure winter wheat. Contains not more than 12 per cent. crude fiber, and not less than 4 per cent. fat and 9 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors. The protein guarantee in the opposite column is meaningless and is apparently an attempted evasion of the analysis feature of the feeding stuffs law. Compare the guarantee of any of the reliable brands of bran.
Pure Winter Wheat Middlings. Williams Bros. Co., Kent, O. Pure winter wheat. Contains not more than 15 per cent. crude fiber, and not less than 2 per cent. fat and 10 per cent. protein. Registered in 1914. Not registered in 1915.	The only official sample obtained was in accord with the guarantees as stated in the opposite column. These guarantees are meaningless, as no wheat middlings could have anything remotely resembling this composition, and are apparently an attempted evasion of the analysis feature of the feeding stuffs law. Compare the guarantees of any of the reliable brands of middlings.
Kent Mixed Feed. Williams Bros. Co., Kent, O. Pure Ohio wheat bran and pure winter wheat middlings mixed. Contains not more than 15 per cent. crude fiber, and not less than 2 per cent. fat and 12 per cent. protein. Registered in 1914 and 1915.	Two official samples were both in accord with the guarantees as stated in the opposite column. These guarantees are meaningless as no wheat mixed feed could have anything like this composition, and are apparently an attempted evasion of the analysis feature of the feeding stuffs law. Compare the guarantees of any of the reliable brands of mixed feed. Both samples contained a few hulls of corn cockle.
Wheat bran. Williamson Milling Co., Clay Center, Kans. Contains not more than 12 per cent. crude fiber, and not less than 3.5 per cent. fat and 15.5 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Bran. Yerxa, Andrews & Thurston, Inc., Minneapolis, Minn. Contains not more than 13 per cent. crude fiber, and not less than 5.5 per cent. fat and 12 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Flour Middlings. Yerxa, Andrews & Thurston, Inc., Minneapolis, Minn. Contains not more than 6.5 per cent. crude fiber, and not less than 5.5 per cent. fat and 15.5 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.

ADULTERATED WHEAT BY-PRODUCTS.

Holstein Feed. Indiana Milling Co., Terre Haute, Ind. Composed of wheat bran with ground screenings not exceeding mill run. Cob meal. Contains not more than 16 per cent. crude fiber, and not less than 3 per cent. fat and 12 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Sterling Feed. Indiana Milling Co., Terre Haute, Ind. Wheat bran, with ground screenings not exceeding mill run. Ground corn and cob. Contains not more than 16 per cent. crude fiber, and not less than 3 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	Of 3 official samples, 2 were up to guarantee in protein and one was over one-half per cent. below. The low sample was examined for fiber and fat and found up to guarantee in the latter, but slightly high in fiber. In one sample many, in one a few, in one no weed seeds were found. All contained a few hulls of corn cockle and wild buckwheat.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
Bluegrass Feed (Registered in 1915 as Blue Grass Valley Feed). A. Waller & Co., Inc., Henderson, Ky. Composed of winter wheat bran, winter wheat middlings, ground corn and cob. Contains not more than 17 per cent. crude fiber, and not less than 2 per cent. fat and 9 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat. It was in accord with guarantee in fat but exceeded even its very high fiber guarantee by over 2 per cent. Both contained a few hulls and one a few seeds of corn cockle.

CORN AND OATS GROUND TOGETHER.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
Corn & Oats ½ & ½. Buffalo Cereal Co. Buffalo, N. Y. Guaranteed pure. Contains not more than 4 per cent. crude fiber, and not less than 4 per cent. fat and 9 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was found in accord with guarantee in protein and fat, but nearly 3 per cent. high in fiber. The fiber guarantee on these goods is too low; only 2 of all samples of corn-and-oat feeds examined at this experiment station in the past 3 years have had as little as 4 per cent. fiber.
Corn and Oat Chop (Registered in 1915 as Chop Feed). Carll Bros., Waterboro, Me. Composed of corn and oats. Contains not more than 5 per cent. crude fiber, and not less than 4 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein and fiber but slightly low in fat. No weed seeds were found. The sample was taken from the spout leading from the bin where the goods were in bulk, and may, therefore, not be exactly representative.
Corn & Oat Chop. Dinsmore Grain Co., Wiscasset, Me. Composed of corn, corn feed meal and oats. Contains not more than 4.8 per cent. crude fiber, and not less than 3.5 per cent. fat and 10 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Corn and Oat Feed. Eastern Grain Co., Bangor, Me. 50 lbs. corn and 32 lbs. oats ground together. Contains not more than 6 per cent. crude fiber, and not less than 5 per cent. fat and 10 per cent. protein. (On 1914 certificate: Contains not less than 11 per cent. protein). Registered in 1914 and 1915.	The only official sample obtained carried the 1914 protein guarantee of 11 per cent. It fell short of that but was in accord with the 1915 guarantee of 10 per cent. It was in accord with guarantee in fiber but over one-half per cent. below in fat. No weed seeds were found.
Pure Corn & Oats. Elmore Milling Co., Oneonta, N. Y. Composed of ground oats and corn meal. Contains not more than 6 per cent. crude fiber, and not less than 5 per cent. fat and 10 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
G. M. Co. Oatfeed. Gray Milling Co., East Gray, Me. Corn meal and oats. Contains not more than 7 per cent. crude fiber, and not less than 4 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein and fiber, but over 1 per cent. below in fat. It contained a few hulls of wild buckwheat and green foxtail. The sample was taken from the spout leading from the bin where the goods were in bulk, and therefore may not be exactly representative.
Gwinn's Horse & Mule Feed. Gwinn Milling Co., Columbus, O. Corn and oats. Contains not more than 9 per cent. crude fiber, and not less than 4 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.

Feeding Stuffs—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Corn and Oat Chop. J. B. Ham Co., Lewiston, Me. Corn and oats. Contains not more than 5 per cent. crude fiber, and not less than 4 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was up to guarantee in protein but over one-half per cent. below in fat and nearly 2 per cent. high in fiber. It contained a few hulls of wild buckwheat and corn cockle. The sample was taken from the bin where the goods were in bulk and therefore may not be exactly representative.
H-H Ground Feed. E. P. Ham, Lewiston, Me. Composed of ground oats and corn meal. Contains not more than 5.5 per cent. crude fiber, and not less than 4.5 per cent. fat and 10.5 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Corn and Oat Feed. Houlton Mills & Light Co., Houlton, Me. Composed of corn and oats. Contains not more than 8 per cent. crude fiber, and not less than 4 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Corn & Oat Chop. Kimball Bros. Co., Bath, Me. Corn and oats. Contains not more than 5.82 per cent. crude fiber, and not less than 4 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein and fiber but slightly low in fat. The sample was taken from one sack only and therefore may not be exactly representative.
Monmouth Pure Corn & Oats Feed. E. M. Marks, Monmouth, Me. Corn and oats ground together. Contains not less than 9 per cent. crude fiber, and not less than 5 per cent. fat and 9 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein and fiber, but was 1 per cent. low in fat. It contained a few seeds of pigweed.
Corn and Oat Chop. Merrill & Mayo Co., Waterville, Me. Corn and oats. Contains not more than 6 per cent. crude fiber, and not less than 5 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein and fiber, but over ¾ per cent. low in fat.
Corn and Oats, Half and Half. A. Nowak & Son, Buffalo, N. Y. Ground corn, crushed oats. Contains not more than 7 per cent. crude fiber, and not less than 4 per cent. fat and 9 per cent. protein. Registered in 1914 by Consolidated Milling Corporation, Buffalo, N. Y. Registered in 1915.	No goods of this brand were found by inspectors.
Corn and Oat Chop. Park & Pollard Co., Boston, Mass. Composed of ground corn and oats. Contains not more than 8 per cent. crude fiber and not less than 3.5 per cent. fat and 10 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat.
Puritas Corn & Oat Feed. Portland Milling Co., Portland, Mich. Ground corn and oats. Contains not more than 6.38 per cent. crude fiber, and not less than 4.23 per cent. fat and 10.41 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Chop Feed. A. A. Wilson, Springvale, Me. Corn and oats. Contains not more than 6 per cent. crude fiber, and not less than 4 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein and fiber but slightly low in fat. It contained a few seeds of Pennsylvania persicaria, lady's thumb and yellow foxtail and a few hulls of wild buckwheat.

Feeding Stuffs—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Corn and Oats. Yeaton's Mills, South Berwick, Me. Composed of 50 lbs. corn and 32 lbs. oats ground together. Contains not more than 5.5 per cent. crude fiber, and not less than 5 per cent. fat and 10.5 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat. No weed seeds were found.
HOMINY FEEDS.	
Homco Feed. American Hominy Co., Indianapolis, Ind. Composed of white corn only. Contains not more than 7 per cent. crude fiber, and not less than 7 per cent. fat and 9.5 per cent. protein. (On 1915 certificate: Not less than 10 per cent. protein). Registered in 1914 and 1915.	The 2 official samples obtained carried the protein guarantee registered in 1914 of 9.5 per cent. Both were up to that guarantee; one was up to the 10 per cent. guarantee. One sample was examined for fiber and fat. It carried no more fiber than claimed but was three-quarters of a per cent. low in fat.
Homcoline Feed. American Hominy Co., Indianapolis, Ind. Consists of white corn only. Contains not more than 7 per cent. crude fiber, and not less than 5 per cent. fat and 17 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Keystone Hominy Feed. M. F. Baringer, Philadelphia, Pa. Pure feed made from corn. Contains not more than 10 per cent. crude fiber, and not less than 6 per cent. fat and 9 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Bufceco Hominy Feed. Buffalo Cereal Co., Buffalo, N. Y. Guaranteed pure. Contains not more than 5 per cent. crude fiber and not less than 6 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Wirthmore Hominy Meal. Chas. M. Cox Co., Boston, Mass. Made from white corn. Contains not more than 5 per cent. crude fiber, and not less than 7½ per cent. fat and 9½ per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat. It was up to its guarantee in fat but slightly high in fiber.
Hiquality Hominy Feed. Donahue-Stratton Co., Milwaukee, Wis. Composed of white corn hominy. Contains not more than 7 per cent. crude fiber and not less than 7 per cent. fat and 10 per cent. protein. Registered in 1914 by the Oscar Holway Co., Auburn, Me. Not registered in 1915.	No goods of this brand found by inspectors.
Snowflake Brand Hominy. Oscar Holway Co., Auburn, Me. Corn hominy. Contains not more than 7 per cent. crude fiber, and not less than 7 per cent. fat and 9.75 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Badger Hominy Feed. Chas. A. Krause Milling Co., Milwaukee, Wis. Made from white corn. Contains not more than 5 per cent. crude fiber, and not less than 6 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Frumentum Hominy Feed. United States Frumentum Co., Detroit, Mich. Hull, germ and starchy ingredients of white corn. Contains not more than 7 per cent. crude fiber, and not less than 7.3 per cent. fat and 9.5 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with its guarantee in protein, fiber and fat.

Feeding Stuffs—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Choice Steam Cooked Hominy Feed. Miner-Hillard Milling Co., Wilkes-Barre, Pa. Contains not more than 5 per cent. crude fiber, and not less than 5 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	One dealer's sample was up to guarantee in protein. No goods of this brand were found by inspectors.
Hominy Feed. Mystic Milling Co., Sioux City, Iowa. No certificate filed. Claims on package: Crude fiber not over 5 per cent.; fat not less than 6.5 per cent.; protein not less than 11 per cent. Unregistered; case pending.	The only official sample obtained was slightly low in both protein and fat and slightly high in fiber.
Yellow Hominy Feed. Quaker Oats Co., Chicago, Ill. Contains not more than 4 per cent. crude fiber, and not less than 4 per cent. fat and 9 per cent. protein. Registered in 1914 and 1915.	Two official samples both up to guarantee in protein. One was examined for fiber and fat and found in accord with its guarantees in both.
Blue Ribbon Hominy Chop or Meal. J. E. Soper Co., Boston, Mass. By-product pure white corn. Contains not more than 5 per cent. crude fiber, and not less than 7 per cent. fat (On 1915 certificate: not less than 6 per cent. fat) and 10 per cent. protein. Registered in 19 4 and 1915.	The only official sample obtained was found in accord with its guarantees in protein and fat, but was slightly high in fiber. (The fat guarantee on the package was 7 per cent. as on the 1914 certificate).
"Logan" Hominy Feed. Standard Cereal Co., Chillicothe, O. Portions of the grain of corn. Contains not more than 6 per cent. crude fiber, and not less than 7 per cent. fat and 9 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
"Standco" Hominy Feed. Standard Cereal Co., Chillicothe, O. Portions of the grain of corn. Contains not more than 4 per cent. crude fiber, and not less than 7 per cent. fat and 10 per cent. protein. Registered in 1914. Not registered in 1915.	The only official sample obtained was found in accord with its guarantees in all respects.

FEEDS UTILIZING CORN AND OAT BY-PRODUCTS.

Protein Under 15 Per Cent.

Bufceco Chop Feed. Buffalo Cereal Co., Buffalo, N. Y. Composed of ground corn, hominy feed, oat shorts and oat hulls. Contains not more than 9 per cent. crude fiber, and not less than 3 per cent. fat and 7 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Bufceco Dairy Feed. Buffalo Cereal Co., Buffalo, N. Y. Composed of ground corn, wheat bran and middlings, hominy feed, corn gluten feed, oat shorts, oat middlings and oat hulls. Contains not more than 9 per cent. crude fiber, and not less than 3 per cent. fat and 12 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Bufceco Horse Feed. Buffalo Cereal Co., Buffalo, N. Y. Composed of ground oats, corn and barley, wheat middlings, hominy feed, oat shorts, oat middlings, oat hulls, corn gluten feed, linseed meal. Contains not more than 9 per cent. crude fiber, and not less than 4 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was slightly low in protein, over 1 per cent. low in fat, and nearly 1 per cent. high ini fiber. It contained a few seeds each of wild buckwheat, field peppergrass, dock and Pennsylvania persicaria.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
Bufceco Steam Cooked Feed. Buffalo Cereal Co., Buffalo, N. Y. Composed of ground corn and oats, hominy feed, oat shorts, oat hulls and oat middlings. Contains not more than 9 per cent. crude fiber, and not less than 4 per cent. fat and 8 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both.
Bufceco Stock Feed. Buffalo Cereal Co., Buffalo, N. Y. Composed of ground corn and oats, wheat middlings, hominy feed, oat shorts, oat hulls and oat middlings. Contains not more than 9 per cent. crude fiber, and not less than 4 per cent. fat and 8 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Iroquois Chop Feed. Buffalo Cereal Co., Buffalo, N. Y. Composed of ground corn, hominy feed, oat shorts and oat hulls. Contains not more than 9 per cent. crude fiber, and not less than 3 per cent. fat and 7 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Chesbro Stock Feed. Chesbro Milling Co., Salamanca, N. Y. Contains not more than 9 per cent. crude fiber, and not less than 3.25 per cent. fat and 8 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Trojan Feed. Chesbro Milling Co., Salamanca, N. Y. Contains not more than 19 per cent. crude fiber, and not less than 4 per cent. fat and 7 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Coarse Feed Corn Meal. Commercial Milling Co., Detroit, Mich. Contains not more than 2 per cent. crude fiber and not less than 3 per cent. fat and 8.50 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Henkel's Chop Feed. Commercial Milling Co., Detroit, Mich. Composed of corn meal, rye and oat middlings, oats and oat hulls. On 1914 certificate: Contains not more than 8 per cent. crude fiber and not less than 5 per cent. fat and 8 per cent. protein. On 1915 certificate: Contains not more than 9 per cent. crude fiber, and not less than 4.5 per cent. fat and 9 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Husted Justice Brand Horse Scientific Feed Consolidated Milling Corp., Buffalo, N. Y. Composed of crushed oats, corn feed meal, whole oats, corn, gluten feed linseed oil meal, oat middlings, oat hulls, clipped oat by-products, wheat middlings, salt ¾ of 1 per cent. Contains not more than 9 per cent. crude fiber, and not less than 4 per cent. fat and 12 per cent. protein. Registered in 1914. Not registered in 1915.	.No goods of this brand were found by inspectors.

Feeding Stuffs—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Mayflower Stock Feed. Consolidated Milling Corp., Buffalo, N. Y. Composed of corn feed meal, whole oats, wheat middlings, crushed oats, oat middlings, oat hulls, clipped oat by-products, salt ¾ of 1 per cent. Contains not more than 9 per cent. crude fiber, and not less than 3 per cent. fat and 7 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Wirthmore Stock Feed. Chas. M. Cox Co., Boston, Mass. A compound of ground barley, ground oats, ground hominy meal, ground corn and oat meal mill by-products, oat middlings, oat shorts and oat hulls. Contains not more than 9½ per cent. crude fiber, and not less than 4 per cent. fat and 9 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. In one sample no weed seeds were found; in the other a few seeds of pigweed and mustard.
Sterlingworth Stock Feed. Eastern Grain Co., Portland, Me. Composed of corn meal, hominy, dried brewers' grains, wheat bran, oat meal, and oat middlings, salt. Contains not more than 15 per cent. crude fiber, and not less than 5 per cent. fat and 10 per cent. protein. Not registered in 1914. Registered in 1915.	Of 2 official samples, one was up to guarantee in protein, the other slightly below. Both samples were misbranded in that the fiber guarantee on the labels did not agree with that on the filed certificate. One sample was examined for fiber and fat and found in accord with the certificate guarantee in both, but above the fiber guarantee of 12 per cent. which the label carried. One sample was examined for weed seeds; a few hulls of wild buckwheat were found.
Elmore Stock Feed. Elmore Milling Co., Oneonta, N. Y. Composed of corn meal, hominy, dried brewers' grains, wheat bran, oat meal mill by-product (oat hulls, oat middlings, oat shorts), salt. On 1914 certificate: Contains not more than 16 per cent. crude fiber, and not less than 5 per cent. fat and 10 per cent. protein. On 1915 certificate: Contains not more than 12 per cent. crude fiber, and not less than 4 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	Two official samples both carried the 1914 certificate guarantees. Both were up to guarantee in protein. One was examined for fiber and fat and was found in accord with guarantee in fiber but 1 per cent. low in fat. On the basis of the 1915 guarantees it would have been up in fat but over 1½ per cent. high in fiber. One sample was examined for weed seeds; a few seeds each of wild buckwheat, mustard and giant ragweed were found.
Farmers' Union Stock Feed. Farmers' Union Grain & Supply Co., Waterville, Me. Composed of corn meal, hominy, dried brewers' grains, wheat bran, oat meal mill by-products (oat hulls, oat middlings, oat shorts), salt. Contains not more than 12 per cent. crude fiber, and not less than 4 per cent. fat and 10 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was found in accord with guarantee in protein and fat and practically so in fiber.
Lucky Oat-Corn Feed. Federal Milling Co., Lockport, N. Y. Crushed oats, cracked corn, corn feed meal and hominy feed. Contains not more than 8 per cent. crude fiber, and not less than 3 per cent. fat and 9 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Empire Feed. Felt Bros. & Gage Co. (Empire Mills), Olean, N. Y. Composed of corn, hominy and oat hulls. Contains not more than 9 per cent. crude fiber, and not less than 3 per cent. fat and 7.5 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
Buffalo Stock Feed. Globe Elevator Co., Buffalo, N. Y. Composed of corn, barley, oats, red dog flour, oat hulls, oat middlings, hominy feed, cottonseed meal, salt. Contains not more than 9 per cent. crude fiber, and not less than 4 per cent. fat and 9 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
No. 1 Chop Feed. Globe Elevator Co., Buffalo, N. Y. Composed of ground corn and oats and oat hulls, flour middlings, salt ½ of 1 per cent. Contains not more than 9 per cent. crude fiber, and not less than 3 per cent. fat, and 9 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Grandin's Stock Food. D. H. Grandin Milling Co., Jamestown, N. Y. Composed of pure oats, corn, barley, barley middlings, hominy, oat hulls, salt. Contains not more than 10 per cent. crude fiber, and not less than 3.5 per cent. fat and 8.5 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. No weed seeds were found in either sample.
Xtragood Stock Feed. Griswold & Mackinnon, St. Johnsbury, Vt. Composed of corn, hominy, oat hull. On 1914 certificate: Contains not more than 10 per cent. crude fiber, and not less than 3½ per cent. fat and 10 per cent. protein. On 1915 certificate. Contains not more than 9 per cent. crude fiber, and not less than 2.97 per cent. fat and 7.5 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Haskell's Stock Feed. W. H. Haskell & Co., Toledo, O. Composed of ground corn, ground oats, hominy feed, oat hulls, oat shorts and salt. Contains not more than 8 per cent. crude fiber, and not less than 4 per cent. fat and 8 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. No weed seeds were found in either sample.
Hecker's Manhattan Feed. Hecker Cereal Co., New York City. Composed of ground corn, oat hulls, oat middlings, oat shorts, hominy feed, salt one-half of one per cent. Contains not more than 12 per cent. crude fiber, and not less than 3 per cent. fat and 7 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Hecker's Stock Feed. Hecker Cereal Co., New York, N. Y. Composed of ground corn, ground barley, red dog, oat middlings, oat shorts, oat hulls, hominy feed, cottonseed meal, salt one-half of one per cent. Contains not more than 10 per cent. crude fiber, and not less than 4 per cent. fat and 10 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
"Trojan" Stock Feed. Wm. S. Hills Co., Boston, Mass. Composed of corn, barley, oat-feed and salt. Contains not more than 12 per cent. crude fiber, and not less than 3 per cent. fat and 7 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
Purity Stock Feed. Wm. S. Hills Co., Boston, Mass. Composed of corn, barley, middlings, hominy, oat feed and salt. Contains not more than 9 per cent. crude fiber, and not less than 3¼ per cent. fat and 10 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was misbranded in that none of the guarantees on the label agreed with the filed certificate. On the basis of the certificate guarantees, it was up in protein and fat but nearly 2 per cent. high in fiber. The protein and fat guarantees on the package were lower than those filed, so it was of course in accord with them. Its package guarantee of fiber was 7 per cent., and on that basis it was nearly 4 per cent. high in fiber.
The H-O Co.'s Algrane Milk Feed. The H-O Co., Buffalo, N. Y. Composed of oat hulls, wheat middlings, cottonseed meal, oat shorts, corn gluten feed, ground corn, ground oats, ground grain screenings, molasses, salt one-half of one per cent. Contains not more than 10 per cent. crude fiber, and not less than 4 per cent. fat and 14 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
The H-O Co.'s Algrane Horse Feed. The H-O Co., Buffalo, N. Y. Composed of oats, oat shorts, ground corn, oat hulls, wheat middlings, hominy feed, corn gluten feed, ground grain screenings, molasses, salt one-half of one per cent. Contains not more than 10 per cent. crude fiber, and not less than 4 per cent. fat and 11 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Park City Stock Feed. Lake Erie Milling Co., Toledo, O. Composed of corn, oats, oat groats, oat middlings, oat hulls, corn meal offal, one-half of one per cent. salt. Contains not more than 9 per cent. crude fiber, and not less than 3½ per cent. fat and 9 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Brooks' Fancy Corn & Oats Stock Feed. A. H. McLeod Milling Co., St. Johnsbury, Vt. Composed of corn, oats and gluten. Contains not more than 8.5 per cent. crude fiber, and not less than 3 per cent. fat and 9 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Park City Stock Feed. Mollett Grain & Milling Co., Toledo, O. Composed of corn, oats, oat groats, oat middlings and oat hulls, ¾ of 1 per cent. salt. Contains not more than 10 per cent. crude fiber, and not less than 3½ per cent. fat and 8½ per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Famous Feed. Northern Illinois Cereal Co., Lockport, Ill. Composed of corn, oat hulls, oat shorts and oat middlings. Contains not more than 12 per cent. crude fiber, and not less than 3 per cent. fat and 9 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
Buffalo Horse Feed (formerly Monarch Chop Feed). A. Nowak & Son, Buffalo, N. Y. Composed of ground oats, corn feed meal, hominy feed, oat hulls, clipped oat by-product containing some seeds, wheat middlings, ¾ of 1 per cent. salt. Contains not more than 12 per cent. crude fiber, and not less than 3 per cent. fat and 7 per cent. protein. Registered in 1914 as Monarch Chop by Consolidated Milling Corp., Buffalo, N. Y. Registered in 1915.	No goods of this brand were found by inspectors.
Justice Stock Feed (formerly Husted Justice Brand Stock Scientific Feed). A. Nowak & Son, Buflalo, N. Y. Composed of ground oats, corn feed meal, linseed oil meal, wheat middlings, oat middlings, oat hulls, clipped oat by-product containing some seeds, salt ¾ of 1 per cent. Contains not more than 9 per cent. crude fiber, and not less than 3 per cent. fat and 10 per cent. protein. Registered in 1914 as Husted Justice Brand Stock Scientific Feed by The Consolidated Milling Corporation, Buffalo, N. Y. Registered in 1915.	No goods of this brand were found by inspectors.
Stock Feed. Park & Pollard Co., Boston, Mass. Composed of corn meal, hominy feed and oat feed. Contains not more than 12 per cent. crude fiber, and not less than 3 per cent. fat and 9 per cent. protein. Registered in 1914 and 1915. (Under this registration the Park & Pollard Company shipped 2 distinct feeds. One was invoiced by them as "Stock Feed, White," and carried a label with the statements above; the other was invoiced as "Stock Feed, Dark," and carried the same label except that the ingredients were stated as "Ground: Wheat bran, Wheat middlings, Corn, Barley, Oats, Corn gluten, Cottonseed Meal, Beet pulp, Oat hulls, Hominy, Linseed oil meal and salt. The matter of the registration of a second brand is pending).	One dealer's sample was up to guarantee in protein. 7 official samples were examined. 2 were up to guarantee in protein. 2 were over ½ per cent. below; 2 were over one per cent. below and one was nearly 2 per cent. below. The 2 that were up in protein carried the "dark" label. Of the 5 that were below, 3 carried the "light" label, one the dark, and in the case of the fifth the inspector did not note the list of ingredients. Both the sample on which the list of ingredients was not noted *and the low sample that was* LABELED *like the "dark" stock feed*, apparently consist only of the "light" ingredients. The 5 low samples were examined for fat and fiber. All were in accord with guarantee in fat; 3 were in fiber. One of the others was slightly high in fiber and the other carried over 18 per cent. of fiber.
Pilco Chop or Stock Feed. Pilliod Milling Co., Swanton, O. Contains not more than 9 per cent. crude fiber, and not less than 4 per cent. fat and 10 per cent. protein. Not registered in 1914. Registered in 1915.	Four official samples were examined. All were misbranded in that the package guarantees differed from those in the filed certificate. 2 of the labels carried a guarantee of only 7 per cent. protein. On that basis they were up to guarantee, but on the basis of the certificate guarantee were 1½ per cent. below. The other 2 labels carried a guarantee of 9 per cent. protein. On that basis they were one-half per cent. below, and on the basis of the certificate guarantee they were 1½ per cent. below. All carried the certificate guarantee of 4 per cent. fat. Of 3 samples examined for fat, 2 were up to guarantee, the other was slightly below. On the basis of the certificate fiber guarantee one sample was in accord, one was slightly high, and one was over 2 per cent. high. One of the samples carried over 2 per cent. of salt.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
Pilco Yellow Feed Meal. Pilliod Milling Co., Swanton, O. No certificate filed. No guarantees on package.	The only official sample obtained carried 9 per cent. protein. It was purchased for a first class corn meal, but was a very poor appearing product and it is to be assumed from the label that it was not a straight corn meal, for "feed meal" is commonly accepted as meaning the siftings obtained in the manufacture of cracked corn and table meal. The sale of such a product is unlawful without registration. The case is now the subject of correspondence.
Iowa Stock Feed. Purity Oats Co., Davenport, Iowa. Composed of corn meal, wheat middlings, hominy feed, brewers' dried grains, oat meal mill by-product (oat hulls, oat shorts, oat middlings), 1 per cent. of table salt. Contains not more than 12.75 per cent. crude fiber and not less than 4 per cent. fat and 10 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Boss Feed. Quaker Oats Co., Chicago, Ill. Composed of ground corn, hominy feed, oatmeal mill by-product, oat middlings, oat hulls, oat shorts, one-half of one per cent. salt. Contains not more than 12 per cent. crude fiber, and not less than 3 per cent. fat and 8 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Maz-All Corn Feed. Quaker Oats Co., Chicago, Ill. Corn by-products. Contains not more than 2 per cent. crude fiber, and not less than 1.4 per cent. fat and 8 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat.
Schumacher Stock Feed. Quaker Oats Co., Chicago, Ill. Conposed of ground corn, hominy feed, ground barley, wheat flour, cottonseed meal, wheat middlings, with ground screenings not exceeding mill run, ground puffed rice, oatmeal mill by-product, oat middlings, oat hulls, oat shorts, one-half of one per cent. salt. Contains not more than 10 per cent. crude fiber, and not less than 3.25 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. In one sample no weed seeds were found, in the other a few seeds of pigweed, green foxtail, mustard, and wild rose.
Sterling Stock Feed. Quaker Oats Co., Chicago, Ill. Composed of ground corn, hominy feed, ground barley, wheat flour, wheat middlings with ground screenings not exceeding mill run, ground puffed wheat, ground puffed rice, oatmeal mill by-product, oat middlings, oat hulls, oat shorts, one-half of one per cent. salt. Contains not more than 10 per cent. crude fiber, and not less than 3.25 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Victor Feed. Quaker Oats Co., Chicago, Ill. Composed of ground corn, hominy feed, oatmeal mill by-product, oat middlings, oat hulls, oat shorts, one-half of one per cent. salt. Contains not more than 12 per cent. crude fiber, and not less than 3 per cent. fat and 8 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat.

Feeding Stuffs—Continued.

Brand, Maker and Guaranties.	Results of Examination.
White Diamond Feed. Quaker Oats Co., Chicago, Ill. Composed of ground corn, hominy feed, oatmeal mill by-product, oat middlings, oat hulls, oat shorts, one-half of one per cent. salt. Contains not more than 9 per cent. crude fiber, and not less than 3.25 per cent. fat and 8 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein and fat but was slightly high in fiber.
Oat Feed. Robin Hood Mills, Ltd., Moose Jaw, Sask. Oat hulls and oat shorts. Contains not more than 28 per cent. crude fiber, and not less than 2.5 per cent. fat and 5.25 per cent. protein. Not registered in 1914. Registered in 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat, and was found in accord with guarantee in both.
Robin Hood Reground Oat Feed. Robin Hood Mills, Ltd., Moose Jaw, Sask., Can. Composed of mill run oat hulls reground, mill run oat middlings, mill run oat flour. Contains not more than 30 per cent. crude fiber, and not less than 3 per cent. fat and 6 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Stott's Winner Feed. David Stott Flour Mills, Inc., Detroit, Mich. Composed of corn meal, oats, ground wheat screenings, oat hulls and salt. Contains not more than 10 per cent. crude fiber, and not less than 5 per cent. fat and 9 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat. It contained a few seeds of dock, yellow foxtail, pigweed and mustard.

MOLASSES FEEDS.

Protein Under 15 Per Cent.

Anchor Brand Horse Feed (Molasses Feed). Globe Elevator Co., Buffalo, N. Y. Composed of crushed and ground oats, ground and cracked corn, corn bran, wheat bran, crushed barley, molasses. Contains not more than 9 per cent. crude fiber, and not less than 3 per cent. fat and 9 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Anchor Brand Stock Feed (Molasses Feed). Globe Elevator Co., Buffalo, N. Y. Composed of ground oats, ground corn and corn bran, ground wheat and barley screenings, clipped oat by-products, molasses, salt ¾ of 1 per cent. Contains not more than 14 per cent. crude fiber, and not less than 3 per cent. fat and 8 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat.
H. & S. Horse, Mule & Dairy Feed. Dwight E. Hamlin, Pittsburg, Pa. Composed of alfalfa, pure cane molasses, oil meal, brewers' and distillers' grains, and one-half of one per cent. salt. Contains not more than 16 per cent. crude fiber, and not less than 3½ per cent. fat and 14 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
H. & S. Alfalfa Feed. Dwight E. Hamlin, Pittsburg, Pa. Composed of alfalfa, cane syrup and dried grains. Contains not more than 16 per cent. crude fiber, and not less than 3½ per cent. fat and 14 per cent. protein. Registered in 1914 and 1915.	Two official samples were obtained. One was in accord with guarantee in protein, fiber and fat. The other was in accord with guarantee in fiber, but 1½ per cent. below in protein and ½ per cent. below in fat.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
The H-O Co.'s DE-FI Feed. The H-O Co., Buffalo, N. Y. Composed of oat hulls, oat shorts, ground corn, hominy feed, wheat middlings, oat middlings, molasses, salt one-half of one per cent., ground grain screenings. Contains not more than 21 per cent. crude fiber, and not less than 3 per cent. fat and 8 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
The H-O Co.'s Horse Feed with Molasses. The H-O Co., Buffalo, N. Y. Composed of oats, oat shorts, ground corn, oat hulls, wheat middlings, hominy feed, corn gluten feed, ground grain screenings, molasses, salt one-half of one per cent. Contains not more than 10 per cent. crude fiber, and not less than 4 per cent. fat and 11 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
The H-O Co.'s Milk Feed with Molasses. The H-O Co., Buffalo, N. Y. Composed of oat hulls, wheat middlings, cottonseed meal, oat shorts, corn gluten feed, ground grain screenings, ground corn, ground oats, molasses, salt one-half of one per cent. Contains not more than 10 per cent. crude fiber, and not less than 4 per cent. fat and 14 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
The H-O Co.'s New England Stock Feed. The H-O Co., Buffalo, N. Y. Composed of ground corn, wheat middlings, hominy feed, oat hulls, oat shorts, ground oats, ground grain screenings, molasses, salt one-half of 1 per cent. Contains not more than 10 per cent. crude fiber, and not less than 4 per cent. fat and 9 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat.
Molassine Meal. Molassine Co. of America, Boston, Mass. Composed of molasses and cooked sphagnum moss. Contains not more than 7 per cent. crude fiber, and not less than one-half of one per cent. fat and 7 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat. See discussion on page —.
Vim-O-Lene Horse Feed. A. Nowak & Son, Buffalo, N. Y. Composed of crushed oats, wheat bran, cracked corn, corn feed meal, molasses, salt ¾ of 1 per cent. Contains not more than 9 per cent. crude fiber, and not less than 2 per cent. fat and 8 per cent. protein. Registered in 1914 by The Consolidated Milling Corporation, Buffalo, N. Y., as Husted O-Mo-Lene Horse Feed. Registered in 1915.	No goods of this brand were found by inspectors.
Peters' Arab Horse Feed. M. C. Peters Mill Co., Omaha, Neb. Composed of corn, oats, alfalfa and molasses. Contains not more than 15 per cent. crude fiber, and not less than 2 per cent. fat and 9 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Peters' King Corn. M. C. Peters Mill Co., Omaha, Neb. Composed of corn, oats, alfalfa, molasses. Contains not more than 18 per cent. crude fiber, and not less than 1.5 per cent. fat and 9 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.

Feeding Stuffs—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Purina Feed with Molasses. Purina Mills (Ralston-Purina Co.), St. Louis, Mo. Composed of cracked corn, crushed oats, ground alfalfa, molasses, and one per cent. salt. Contains not more than 11.7 per cent. crude fiber and not less than 1.7 per cent. fat and 9.3 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat.
Green Cross Horse Molasses Mixed Feed. Quaker Oats Co., Chicago, Ill. Composed of alfalfa meal, ground corn, crushed oats, cottonseed meal, molasses, oatmeal mill by-product, oat middlings, oat hulls, oat shorts. Contains not more than 12 per cent. crude fiber, and not less than 2.5 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Xtra-vim Feed. Xtra-vim Molasses Feed Co., Boston, Mass. Composed of cane sugar molasses and sphagnum moss. Contains not more than 4.5 per cent. of crude fiber, and not less than .81 per cent. fat and 4.61 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was slightly low in both protein and fat, and slightly high in fiber, but the nature of these goods makes it almost impossible to get a fair sample of them and the results should therefore, not be depended upon. See discussion on page —.

MOLASSES FEEDS.

With Over 15 Per Cent. Protein.

Sucrene Dairy Feed. American Milling Co., Peoria, Ill. Composed of molasses, cottonseed meal, corn gluten feed, ground and bolted grain screenings, clipped oat by-product, linseed meal and salt. Contains not more than 12 per cent. crude fiber, and not less than 3.5 per cent. fat and 16.5 per cent. protein. Registered in 1914 and 1915.	Of 3 official samples, 2 were up to guarantee in protein and one was slightly below. 2 samples were examined for fiber and fat and found in accord with guarantee in both. One sample was examined for weed seeds; many seeds of green foxtail were found.
Arcady Dairy Feed. Arcady Farms Milling Co., Rondout, Ill. Composed of malt sprouts, dried brewers' grains, cottonseed meal, cleaned, ground and bolted grain screenings, ground and bolted clipped oat by-product, molasses, one-half of one per cent. salt. Contains not more than 15 per cent. crude fiber, and not less than 3½ per cent. fat and 16 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Clover Leaf Dairy Feed. Clover Leaf Milling Co., Buffalo, N. Y. Composed of cottonseed meal, corn gluten feed, mixed broken grains consisting of wheat, corn, barley, flax, speltz, ground grain screenings, clipped oat by-product, molasses and a small percentage of salt. Contains not more than 12 per cent. crude fiber, and not less than 3.5 per cent. fat and 16.5 per cent. protein. Registered in 1914 and 1915.	Of 2 official samples, one was up to guarantee in protein and the other slightly below. Both were in accord with guarantee in fat. The sample that was slightly low in protein was slightly high in fiber; the other was in accord with guarantee. One sample was examined for weed seeds; a few seeds of lady's thumb and mustard, and a few hulls of wild buckwheat were found.
Husted Justice Brand Dairy Scientific Ration. Consolidated Milling Corp., Buffalo, N. Y. Composed of cottonseed meal, corn gluten feed, linseed oil meal, wheat middlings, corn distillers' dried grains, corn feed meal, clipped oat by-products, malt sprouts or brewers' dried grains, molasses, salt ¾ of 1 per cent. Contains not more than 9 per cent. crude fiber, and not less than 4 per cent. fat and 20 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
Molassified Bran. Consolidated Milling Corp., Buffalo, N. Y. Composed of wheat, bran and molasses. Contains not more than 24 per cent. crude fiber, and not less than 2 per cent. fat and 15 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Anchor Brand Dairy Feed (Molasses Feed). Globe Elevator Co., Buffalo, N. Y. Composed of cottonseed meal, corn gluten feed, linseed oil meal, malt sprouts, dried brewers' grains, ground grain screenings, clipped oat by-products, wheat middlings, molasses, salt ¾ of 1 per cent. Contains not more than 12 per cent. crude fiber, and not less than 4 per cent. fat and 18 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
H. & S. Alfalfa Feed (For Milch Cows). Dwight E. Hamlin, Pittsburg, Pa. Composed of alfalfa, cottonseed meal, pure cane molasses, brewers' and distillers' dried grains, and one-half of one per cent. salt. Contains not more than 16 per cent. crude fiber, and not less than 3½ per cent. fat and 20 per cent. protein. (On 1915 certificate not less than 3.5 per cent. fat and 16 per cent. protein.) Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
International Special Dairy Feed. International Sugar Feed Co., Minneapolis, Minn. Composed of cottonseed meal, molasses, ground cleaned grain screenings, ground clipped oat by-product, salt. Contains not more than 12 per cent. crude fiber, and not less than 4½ per cent. fat and 15 per cent. protein. Registered in 1914 Not registered in 1915.	No goods of this brand were found by inspectors.
Cream-O-Lene Dairy Ration. A. Nowak & Son, Buffalo, N. Y. Composed of cottonseed meal, corn gluten feed, linseed oil meal, wheat middlings, corn distillers' dried grains, corn feed meal, clipped oat by-product, malt sprouts, brewers' dried grains, ground and bolted wheat screenings, molasses, salt ¾ of 1 per cent. Contains not more than 9 per cent. crude fiber, and not less than 4 per cent. fat and 20 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein and fat but slightly high in fiber. It contained some seeds of yellow foxtail and green foxtail.
Purina Cow Chow Feed. Purina Mills (Ralston Purina Co.), St. Louis, Mo. Composed of cottonseed meal, gluten feed, brewers' dried grains, molasses, alfalfa and one per cent. salt. Contains not more than 12 per cent. crude fiber and not less than 5 per cent. fat and 24 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was in accord with guarantee in protein and fat, but was over 2 per cent. high in fiber.
Blue Ribbon Dairy Feed. Quaker Oats Co., Chicago, Ill. Composed of hominy feed, malt sprouts, wheat, bran, with ground screenings not exceeding mill run, cottonseed meal, oatmeal mill by-product, oat middlings, oat hulls, oat shorts, molasses, new process linseed oil meal. Contains not more than 12 per cent. crude fiber, and not less than 3.5 per cent. fat and 25 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. One sample was examined for weed seeds; a few seeds of wild buckwheat, green foxtail and pigweed were found.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
Daisy Dairy Feed. Quaker Oats Co., Chicago, Ill. Composed of molasses, malt sprouts, cottonseed meal, ground grain screenings, clipped oat by-product, linseed meal. Contains not more than 14.5 per cent. crude fiber, and not less than 4 per cent. fat and 16 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Quaker Dairy Feed with Molasses. Quaker Oats Co., Chicago, Ill. Composed of molasses, malt sprouts, cottonseed meal, ground grain screenings, clipped oat by-product, new process linseed oil meal. Contains not more than 14.5 per cent. cude fiber, and not less than 4 per cent. fat and 16 per cent. protein. Registered in 1914 and 1915.	Of 2 official samples, one was up to guarantee in protein, the other over one-half per cent. below. One was examined for fiber and fat and found in accord with guarantee in both. One sample was examined for weed seeds; very many seeds of pigweed were found and some of green foxtail and wild buckwheat.
Hammond Dairy Feed. Western Grain Products Co., Hammond, Ind. Composed of cottonseed meal, corn distillers' grains, malt sprouts, ground clipped oat by-product, ground grain screenings, molasses and salt. Contains not more than 11 per cent. crude fiber, and not less than 3.5 per cent. fat and 16.5 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in the latter but over 2 per cent. high in fiber. Both samples contained very many seeds and hulls of several kinds, including pigweed, wild buckwheat, foxtail, etc.

MISCELLANEOUS COMPOUNDED FEEDS.

PROTEIN OVER 15 PER CENT.

"B-G" Cow Feed. Bath Grain Co., Bath, Maine. Composed of beet pulp, cottonseed meal, gluten, bran, middlings, hominy and salt. Contains not more than 14 per cent. crude fiber, and not less than 4 per cent. fat and 20 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat. No weed seeds were found.
Blatchford's Calf Meal. Blatchford Calf Meal Factory, Waukegan, Ill. Composed of locust bean meal, unpressed flaxseed, wheat flour, barley meal, ground beans and peas, old process oil meal, cocoa shell meal, cocoanut meal, recleaned cottonseed meal, foenugreek, dried milk, anise, salt, rice polish. Contains not more than 6.75 per cent. crude fiber, and not less than 5 per cent. fat and 24 per cent. protein. Registered in 1914 and 1915.	Of 3 official samples, 2 were up to guarantee in protein, the other slightly below. One was examined for fiber and fat. It was in accord with guarantee in the latter but nearly 1 per cent. high in fiber.
Blatchford's Pig Meal. Blatchford Calf Meal Factory, Waukegan, Ill. Composed of linseed oil meal, oat meal, wheat flour, corn meal, barley meal, recleaned cottonseed meal, cocoa shell meal, bean meal, rice polish, crushed flaxseed, foenugreek, salt. Contains not more than 7 per cent. crude fiber, and not less than 5 per cent. fat and 18 per cent. protein. Not registered in 1914. Registered in 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in the latter, but slightly high in fiber.
Bufceco Creamery Feed. Buffalo Cereal Co., Buffalo, N. Y. Composed of ground corn, wheat bran and middlings, hominy feed, corn gluten feed, cottonseed meal, oat shorts, oat middlings and oat hulls. Contains not more than 9 per cent. crude fiber and not less than 4 per cent. fat and 18 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
Unicorn Dairy Ration. Chapin & Co., Hammond, Ind. Composed of corn distillers' grains, cottonseed meal, linseed meal, hominy meal, gluten feed, corn starch by-products with corn bran, barley feed, malt sprouts, brewers' grains and pure wheat bran. Contains not more than 10 per cent. crude fiber, and not less than 5.5 per cent. fat and 26 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein and fat but over 1½ per cent. high in fiber. It contained a few seeds of charlock, wild buckwheat, yellow foxtail, lady's thumb and knot grass.
Peerless Dairy Feed. Chesbro Milling Co., Salamanca, N. Y. Composed of brewers' grains, cottonseed meal, oil meal, bran, middlings, malt sprouts, hominy. Contains not more than 9 per cent. crude fiber, and not less than 7 per cent. fat and 23 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Henkel's Fine White Feed. Commercial Milling Co., Detroit, Mich. Composed of wheat and rye middlings with ground screenings not exceeding mill run and corn products. Contains not more than 6 per cent. crude fiber, and not less than 4 per cent. fat and 16 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Wirthmore Balanced Ration Feed. Chas. M. Cox Co., Boston, Mass. Composed of cottonseed meal, Buffalo gluten, linseed meal, malt sprouts, distillers' grains, bran and hominy, or corn meal. Contains not more than 8.75 per cent. crude fiber, and not less than 5 per cent. fat and 26 per cent protein. Registered in 1914 and 1915.	Two official samples were both misbranded in that the guarantees on the labels did not agree with the filed certificate. On the basis of either the certificate or the label guarantees, both were up to guarantee in protein and the only one examined for fat was also up to guarantee in that. The fiber guarantee on the label was 9.50 per cent. On that basis, the only sample examined for fiber was in accord, but on the basis of the certificate guarantee it was slightly high. One sample was examined for weed seeds; a few seeds of wild buckwheat and mustard were found.
Dewey's Ready Ration. Dewey Bros. Co., Blanchester, Ohio. Composed of Eagle distillers' dried grains, linseed oil meal, cottonseed meal, malt sprouts, wheat bran, wheat middlings, hominy feed, one-half per cent. salt. Contains not more than 10 per cent. crude fiber and not less than 6 per cent. fat and 25 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Elmore Milk Grains. Elmore Milling Co., Oneonta, N. Y. Composed of corn distillers' dried grains, 41 per cent. cottonseed meal, old process linseed meal, corn gluten feed, hominy meal, choice wheat bran, barley malt sprouts, dried brewers' grains, salt. Contains not more than 10 per cent. crude fiber, and not less than 6 per cent. fat and 25 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein and fat, but slightly high in fiber. It contained a few seeds of wild buckwheat, corn cockle, yellow foxtail and mustard.
Farmers' Union Ready Ration. Farmers' Union Grain & Supply Co. Waterville, Me. Composed of corn distillers' dried grain, 41 per cent. cottonseed meal, old process linseed meal, corn gluten feed, hominy meal, choice wheat bran, barley, malt sprouts, dried brewers' grains, salt. Contains not more than 10 per cent. crude fiber, and not less than 6 per cent. fat and 25 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was in accord with guarantee in protein and fiber but slightly below in fat.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
C. O. P. E. Cow Feed. B. W. Gibbs, Bridgton, Maine. Composed of cottonseed meal, oil meal, gluten, hominy, corn and oats, ground corn bran, wheat bran. Contains not more than 8 per cent. crude fiber, and not less than 4 per cent. fat and 20 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Purity Milk Maker. Wm. S. Hills Co., Boston, Mass. Composed of distilled grains, wheat middlings, salt, cottonseed meal, malt sprouts, oil meal, gluten feed, hominy. Contains not more than 9 per cent. crude fiber, and not less than 7 per cent. fat and 24 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was in accord with guarantee in protein and fat, and practically so in fiber. It contained a few seeds each of wild buckwheat and charlock.
Jersey Cow Feed. Houlton Mill & Light Co., Houlton, Me. Composed of wheat, corn, buckwheat, cottonseed meal. Contains not more than 16 per cent. crude fiber, and not less than 5 per cent. fat and 17 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Larro-Feed. Larrowe Milling Co., Detroit, Mich. Composed of cottonseed meal, corn gluten feed, dried distillers' grains, (mainly from corn) dried beet pulp, standard wheat bran, standard wheat middlings, and ¾ of 1 per cent. of salt. Wheat bran and wheat middlings may contain ground screenings not exceeding mill run. Contains not more than 14 per cent. crude fiber, and not less than 3 per cent. fat and 19 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. No weed seeds were found in either sample.
MINGO. Larrowe Milling Co., Detroit, Mich. Composed of dried beet pulp, cottonseed meal, malt sprouts, corn gluten feed, linseed oil meal, wheat bran, which may contain ground screenings not exceeding mill run, dried distillers' grains (mainly from corn) and ¾ of 1 per cent. of salt. Contains not more than 12 per cent. crude fiber, and not less than 4 per cent. fat and 25 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat. It contained some hulls of corn cockle and wild buckwheat.
Buckeye Feed. Quaker Oats Co., Chicago, Ill. Mixed wheat feed with ground screenings not exceeding mill run and rye shorts. Contains not more than 8.5 per cent. crude fiber, and not less than 4.5 per cent. fat and 15.5 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in fat and practically so in fiber. One contained a few, the other some, seeds and hulls of various weeds common in wheat screenings.
Schumacher Calf Meal. Quaker Oats Co., Chicago, Ill. Composed of oatmeal, wheat meal, ground flaxseed, cottonseed meal, dried casein, one-half of one per cent. bicarbonate of soda. Contains not more than 3 per cent. crude fiber, and not less than 8 per cent. fat and 19 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein. fiber and fat.
Ryde's Cream Calf Meal. Ryde & Co., Chicago, Ill. Composed of Carob beans, flaxseed, wheat flour, cottonseed, beans, lentils, Fenugreek, anise, cocoa meal, salt. Contains not more than 6 per cent. crude fiber, and not less than 5 per cent. fat and 25 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat.

Feeding Stuffs—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Towle's Balanced Ration. J. N. Towle & Co., Bangor, Me. Composed of wheat bran, choice cottonseed meal, old process linseed meal, hominy meal, corn meal, gluten feed and one per cent. salt. Contains not more than 9.13 per cent. crude fiber, and not less than 5.72 per cent. fat and 22.13 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein and fat, but slightly high in fiber.
Towle's Pig Feed. J. N. Towle & Co., Bangor, Me. Composed of wheat bran, wheat middlings, old process linseed meal, corn meal and meat meal. Contains not more than 7.22 per cent. crude fiber, and not less than 6.72 per cent. fat and 20.63 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in fiber and fat, but 2 per cent. below in protein. It contained some hulls of wild buckwheat.
Ubiko Horse and Stock Feed. Ubiko Milling Co., Cincinnati, Ohio. Composed of wheat middlings, hominy meal, wheat bran, brewers' dried grains, old process linseed meal. Contains not more than 9 per cent. crude fiber, and not less than 6 per cent. fat and 16 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was in accord with guarantee in protein and fat, but nearly one per cent. high in fiber.
Union Grains, Ubiko, Biles Ready Dairy Ration. Ubiko Milling Co., Cincinnati, O. Composed of Fourex distillers' dried grains, choice cottonseed meal, old process linseed meal, white wheat middlings, winter wheat bran, hominy meal, barley malt sprouts, one-half per cent. of fine table salt. Contains not more than 9 per cent. crude fiber, and not less than 7 per cent. fat and 24 per cent. protein. Registered in 1914 and 1915.	Three official samples were all up to guarantee in protein. One dealer's sample was one per cent. below. 2 samples were examined for fiber and fat and were both found in accord with guarantee in the latter, but both about 1 per cent. high in fiber. Two samples were examined for weed seeds; in one a few, in the other some, seeds of mustard and wild buckwheat were found.
Crescent Dairy Feed. Wentworth Bros., Cornish, Me. Composed of cornmeal, wheat bran, cottonseed meal, distillers' grains, oil meal and salt. Contains not more than 9 per cent. crude fiber, and not less than 7 per cent. fat and 24 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was in accord with guarantee in protein and fiber, but nearly 1 per cent. below in fat.

COMPOUNDED POULTRY FEEDS.

Amico Scratch Grain. Amendt Milling Co., Monroe, Mich. Wheat, wheat screenings, cracked corn, Kaffir corn, or milo maize, barley, rye, buckwheat, clipped oats, corn germ, linseed oil cake, sunflower seeds, charcoal, shell, grit. Contains not more than 5 per cent. crude fiber, and not less than 2.5 per cent. fat and 10 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Homco Chick Feed. American Hominy Co., Indianapolis, Ind. Composed of cracked corn, cracked wheat, cracked Kaffir corn, Hen-e-ta No. 2 (sodium, lime, silica and phosphorus compound), millet. Contains not more than 5 per cent. crude fiber, and not less than 2.5 per cent. fat and 9 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.

Feeding Stuffs—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Homco Dry Mash. American Hominy Co., Indianapolis, Ind. Composed of Homcoline (corn germ meal), Homco (hominy feed), wheat middlings, bran, Hen-e-ta (sodium, lime, silica and phosphorus compound), linseed oil meal. Contains not more than 7 per cent. crude fiber, and not less than 4 per cent. fat and 14 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Homco Scratch Feed. American Hominy Co., Indianapolis, Ind. Composed of cracked corn, wheat, barley, Homcoline (corn germ meal), Kaffir corn. Contains not more than 6 per cent. crude fiber, and not less than 2.5 per cent. fat and 10 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Homco Superior Scratch Feed. American Hominy Co., Indianapolis, Ind. Composed of cracked corn, whole wheat, barley, Kaffir corn, sunflower seed, Homcoline (corn germ meal). Contains not more than 5 per cent. crude fiber, and not less than 2.5 per cent. fat and 10.5 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Cluck Cluck Scratch Feed. American Milling Co., Peoria, Ill. Composed of corn, wheat, barley, Kaffir corn, sunflower seed and buckwheat. Contains not more than 5 per cent. crude fiber, and not less than 2.5 per cent. fat and 10 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
"B-G" Dry Mash. Bath Grain Co., Bath, Maine. Composed of corn meal, meat scraps, bran, linseed oil meal, gluten, bone and meat meal, cottonseed meal, hominy, alfalfa, granulated charcoal. Contains not more than 12 per cent. crude fiber and not less than 4 per cent. fat and 18 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat.
"B-G" Scratch Feed. Bath Grain Co., Bath, Maine. Composed of cracked corn, Kaffir corn, wheat, buckwheat, barley, oats, sunflower seed, charcoal. Contains not more than 5 per cent. crude fiber, and not less than 2.5 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat.
Blatchford's "Fill the Basket" Egg Mash. Blatchford Calf Meal Factory, Waukegan, Ill. Composed of Blatchford's Calf Meal (locust bean meal, unpressed flaxseed, rice polish, wheat flour, barley meal, ground beans, peas, old process oil meal, cocoa shell meal, cocoanut meal, recleaned cottonseed meal, foenugreek, dried milk, anise and salt) also alfalfa, barley, bone, corn and oatmeals, wheat bran, wheat middlings, beef scraps, fish, capsicum, powdered limestone. Contains not more than 10 per cent. crude fiber, and not less than 4 per cent. fat and 19 per cent. protein. Registered in 1914 and 1915.	Two official samples were both practically in accord with guarantee in protein, fiber, and fat. One was very slightly off in fat, and the other equally slightly in fiber. No weed seeds were found in either sample.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Blatchford's Milk Mash. Blatchford Calf Meal Factory, Waukegan, Ill. Composed of Blatchford's calf meal (locust bean meal, unpressed flaxseed, rice polish, wheat flour, barley meal, ground beans and peas, old process oil meal, cocoa shell meal, cocoanut meal, recleaned cottonseed meal, foenugreek, dried milk, anise and salt); also barley, bone, corn and oatmeals, wheat middlings, beef scraps, fish and powdered limestone. Contains not more than 7.5 per cent. crude fiber, and not less than 4 per cent. fat and 20 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat.
Monarch Poultry Mash. F. H. Brastow & Son, So. Brewer, Maine. Composed of wheat bran, wheat middlings, gluten feed, beef scraps, alfalfa meal and corn meal. Contains not more than 7 per cent. crude fiber, and not less than 5.5 per cent. fat and 20 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was up to guarantee in protein, but over one-half per cent. below in fat and over one per cent. high in fiber.
Bufceco Chick Feed. Buffalo Cereal Co., Buffalo, N. Y. Composed of corn, wheat, Kaffir corn, peas, millet, oat groats. Contains not more than 2 per cent. crude fiber, and not less than 2 per cent. fat and 12 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was found in accord with guarantee in fiber and fat and practically so in protein. It contained many weed seeds of several varieties.
Bufceco Poultry Mash. Buffalo Cereal Co., Buffalo, N. Y. Composed of ground corn, wheat bran and middlings, hominy feed, corn gluten feed, oat middlings and rolled oats. Contains not more than 6 per cent. crude fiber, and not less than 4 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Bufceco Scratching Grains. Buffalo Cereal Co., Buffalo, N. Y. Composed of corn, oats, barley, buckwheat, Kaffir corn, peas, sunflower seed and wheat. Contains not more than 5 per cent. crude fiber, and not less than 3 per cent. fat and 10 per cent. protein. Not registered in 1914. Registered in 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in the former but slightly low in fat. One sample was examined for weed seeds; many were found of several varieties.
Iroquois Chick Feed. Buffalo Cereal Co., Buffalo, N. Y. Composed of corn, wheat, Kaffir corn, peas and millet. Contains not more than 3 per cent. crude fiber, and not less than 2 per cent. fat and 10 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat.
Iroquois Poultry Mash. Buffalo Cereal Co., Buffalo, N. Y. Composed of ground corn, wheat bran and middlings, corn gluten feed and alfalfa meal. Contains not more than 12 per cent. of crude fiber, and not less than 4 per cent. fat and 14 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Iroquois Scratching Grains. Buffalo Cereal Co., Buffalo, N. Y. Composed of corn, oats, barley, buckwheat, Kaffir corn, wheat, sunflower seed. Contains not more than 5 per cent. crude fiber, and not less than 3 per cent. fat and 10 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat.

Feeding Stuffs—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Peerless Baby Chick Feed. E. A. Clark & Co., Portland, Me. Composed of cracked wheat, hulled oats, cracked Kaffir, cracked corn and millet seed. Contains not more than 4 per cent. crude fiber, and not less than 3 per cent. fat and 12 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was found in accord with guarantee in fiber, but over 1½ per cent. below in protein and over one-half per cent. below in fat.
Peerless Growing Feed. E. A. Clark & Co., Portland, Me. Composed of ground oats, wheat bran, wheat meal, corn meal, bone meal, granulated milk and powdered charcoal. Contains not more than 5 per cent. crude fiber, and not less than 4 per cent. fat and 14 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was found in accord with guarantee in protein but one-half per cent. below in fat and 2 per cent. high in fiber.
Peerless Intermediate Chick Feed. E. A. Clark & Co., Portland, Maine. Composed of cracked corn, wheat, Kaffir corn, hulled oats, barley and millet seed. Contains not more than 4 per cent. crude fiber, and not less than 3 per cent. fat and 12 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was found in accord with guarantee in fiber but over 1½ per cent. below in protein and over one-half per cent. below in fat.
Peerless Poultry Mash. E. A. Clark & Co., Portland, Me. Composed of ground oats, fish meal, corn meal, alfalfa meal, wheat bran, wheat meal, gluten, milk albumen, meat meal and powdered charcoal. Contains not more than 10 per cent. crude fiber, and not less than 3 per cent. fat and 20 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat.
Peerless Screened Scratch Feed. E. A. Clark & Co., Portland, Maine. Composed of cracked corn, wheat, oats, buckwheat, barley, Kaffir corn and sunflower seed. Contains not more than 5 per cent. crude fiber, and not less than 3 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat. It contained many weed seeds of several varieties.
Yankee Cereal (with fish) Mash. O. L. Clark, Freeport, Maine. Composed of corn meal, bran, fish meal, ground oats, rolled oats, charcoal, alfalfa and milk albumen. Contains not more than 6.5 per cent. crude fiber, and not less than 3.5 per cent. fat and 16 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat. No weed seeds were found.
Yankee Chick Feed. O. L. Clark, Freeport, Me. Composed of cracked corn, cracked wheat, cracked Milo maize, flaxseed, hulled oats. Contains not more than 6 per cent. crude fiber, and not less than 3 per cent. fat and 9 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat.
Yankee Dry Mash. O. L. Clark, Freeport, Me. Composed of corn meal, bran, fish meal, ground oats, rolled oats, charcoal, alfalfa and milk albumen. Contains not more than 6.5 per cent. crude fiber, and not less than 4 per cent. fat and 16 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
Yankee Growing Feed. O. L. Clark, Freeport, Me. Composed of Homcoline, corn meal, bran, bone meal, meat meal, alfalfa, and dried milk. Contains not more than 6 per cent. crude fiber, and not less than 6.5 per cent. fat and 19 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Yankee Scratch Feed. O. L. Clark, Freeport, Maine. Composed of cracked corn, wheat, buckwheat, oats, Kaffir corn, hemp and sunflower seed. Contains not more than 4.5 per cent. crude fiber, and not less than 3 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	Two official samples were both about one-half per cent. below guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. It contained a few weed seeds.
Conkey's Starting Food for Chicks. The G. E. Conkey Co., Cleveland, O. Composed of gentian root, mustard seed, sulphur, iron sulphate, bone ash, corn, wheat, hulled oats, wheat middlings, meat, bone and salt. Contains not more than 4 per cent. crude fiber, and not less than 4 per cent. fat and 12 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Wirthmore Gritless Chick Feed. Chas. M. Cox Co., Boston, Mass. Composed of cracked Milo maize, white corn, yellow corn, wheat, hulled oats, Kaffir corn, green peas and yellow peas. Contains not more than 3½ per cent. crude fiber, and not less than 3 per cent. fat and 11 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in the former but one-half per cent. low in fat. No weed seeds were found in either sample.
Wirthmore Gritless Intermediate Chick Feed. Chas. M. Cox Co., Boston, Mass. Composed of cracked white corn, cracked yellow corn, wheat, Kaffir corn, buckwheat and peas. Contains not more than 3½ per cent. crude fiber, and not less than 3 per cent. fat and 11 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was found in accord with guarantee in fiber and practically so in fat, but over one-half per cent. below in protein.
Wirthmore Growing Feed. Chas. M. Cox Co., Boston, Mass. Composed of ground wheat, corn, oats, barley, peas, Kaffir corn, Milo maize, and buckwheat. (In 1915 omitted Kaffir corn and added beet pulp, wheat middlings and salt.) Contains not more than 4½ per cent. crude fiber, and not less than 4 per cent. fat and 12 per cent protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Wirthmore Growing Feed, with Scraps. Chas. M. Cox Co., Boston, Mass. Composed of ground wheat, corn, oats, barley, peas, Kaffir corn, Milo maize, and choice fine ground beef scraps. Contains not more than 4½ per cent. crude fiber, and not less than 4½ per cent. fat and 15 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Wirthmore Poultry Mash, All Grain. Chas. M. Cox Co., Boston, Mass. Composed of ground oats, ground barley, gluten feed, alfalfa meal, wheat bran, ground corn, wheat middlings, and about ¾ of 1 per cent. salt. Contains not more than 9½ per cent. crude fiber, and not less than 3 per cent. fat and 13 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
Wirthmore Poultry Mash, Fish & Scrap. Chas. M. Cox Co., Boston, Mass. Composed of ground oats, ground barley, gluten feed, alfalfa meal, wheat bran, ground corn, choice fine ground beef scraps, fish meal, wheat middlings, and about $\frac{3}{4}$ of 1 per cent. salt. Contains not more than $9\frac{1}{2}$ per cent. crude fiber, and not less than 4 per cent. fat and 17 per cent. protein. Registered in 1914 and 1915.	Two official samples were both in accord with guarantee in protein and fiber but both over $\frac{3}{4}$ per cent. below in fat. No weed seeds were found in either sample.
Wirthmore Scratch Feed. Chas. M. Cox Co., Boston, Mass. Composed of wheat, Kaffir corn, sunflower seed, buckwheat, barley, oats, cracked corn and Milo maize. Contains not more than 5 per cent. crude fiber, and not less than 3 per cent. fat and 11 per cent. protein. Registered in 1914 and 1915.	Of 4 samples examined, one official sample was up to guarantee in protein and 2 official and one dealer's sample were $\frac{1}{3}$, $\frac{2}{3}$, and 1 per cent. below, respectively. One sample was examined for fiber and fat and found in accord with guarantee in both. All the samples contained many weed seeds of several varieties.
Colonial Developing Feed. Albert Dickinson Co., Chicago, Ill. Composed of corn, wheat, Kaffir corn, hulled oats, buckwheat, millet and grit. Contains not more than 5 per cent. crude fiber, and not less than 2.5 per cent fat and 10 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat.
Crescent Chick Feed. Albert Dickinson Co., Chicago, Ill. Composed of corn, wheat, Kaffir corn, hulled oats, millet and grit. Contains not more than 5 per cent. crude fiber, and not less than 2.5 per cent. fat and 10 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Dickinson's Globe Chick Feed with grit. Albert Dickinson Co., Chicago, Ill. Composed of corn, wheat, Kaffir corn, hulled oats, millet, grit. Contains not more than 5 per cent. crude fiber and not less than 2.5 per cent. fat and 10 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was found in accord with guarantee in fiber and fat, but over one-half per cent. below in protein.
Globe Egg Mash. Albert Dickinson Co., Chicago, Ill. Composed of wheat bran, wheat middlings, alfalfa meal, corn feed meal, corn bran, linseed oil cake, meat scraps, salt one-half of one per cent. Contains not more than 10 per cent. crude fiber, and not less than 3 per cent. fat and 16 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat.
Globe Scratch Feed. Albert Dickinson Co., Chicago, Ill. Composed of corn, wheat, rye, barley, oats, Kaffir corn, buckwheat, sunflower, linseed oil cake, grit. Contains not more than 5 per cent. crude fiber, and not less than 2.5 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat.
King Pigeon Feed. Albert Dickinson Co., Chicago, Ill. Composed of corn, wheat, Kaffir corn, peas, buckwheat, millet, hemp and grit. Contains not more than 5 per cent. crude fiber, and not less than 2.5 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
Queen Poultry Mash. Albert Dickinson Co., Chicago, Ill. Composed of alfalfa meal, corn feed meal, wheat meal, ground corn bran, wheat bran, meat scraps, linseed oil cake, salt one-half of one per cent. Contains not more than 10 per cent. crude fiber, and not less than 2.5 per cent. fat and 11 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat.
Poultry Scratch Feed Brand LA-IN. Eastern Grain Co., Portland, Me. Composed of corn, wheat, barley, oats, buckwheat, Kaffir corn, sunflower seeds. Contains not more than 15 per cent. crude fiber, and not less than 5 per cent. fat and 10 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was found in accord with guarantee in protein and fiber, but over 3 per cent. below in fat.
Elmore Chick Feed. Elmore Milling Co., Oneonta, N. Y. Composed of millet seed, cracked wheat, cracked Kaffir corn, oat meal, cracked corn. Contains not more than 3.5 per cent. crude fiber, and not less than 3.5 per cent. fat and 10 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was found in accord with guarantee in protein and practically so in fiber, but one-half per cent. below in fat. It was misbranded in that the guarantees were not stated on the label.
Elmore Dry Mash. Elmore Milling Co., Oneonta, N. Y. Composed of wheat bran, wheat middlings, corn meal, hominy feed, old process oil meal, corn gluten feed, alfalfa meal, ground barley, salt. Contains not more than 7 per cent. crude fiber, and not less than 4 per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in fiber, 1 per cent. below in fat, and nearly 6 per cent. below the certificate guarantee in protein. The label on the packages from which the sample was taken were misbranded in that the protein guarantee on them was given as 10 per cent. Even on that lower basis the goods were deficient in protein. The sample contained very many weed seeds.
Elmore Egg Mash. Elmore Milling Co., Oneonta, N. Y. Composed of corn meal, rolled oats, ground barley, wheat flour middlings, hominy feed, wheat bran, meat and bone meal, corn gluten feed, alfalfa meal, old process oil meal, salt. Contains not more than 8 per cent. crude fiber, and not less than 4 per cent. fat and 18 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was in accord with guarantee in protein and fat and practically so in fiber.
Elmore Scratch Feed. Elmore Milling Co., Oneonta, N. Y. Composed of wheat, cracked corn, barley, buckwheat, oats, Kaffir corn, sunflower seed. Contains not more than 5 per cent. crude fiber, and not less than 3.5 per cent. fat and 10 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
O-NE-ON-TA Scratch Feed. Elmore Milling Co., Oneonta, N. Y. Composed of wheat, cracked corn, barley, buckwheat, oats, Kaffir corn, sunflower seed. Contains not more than 5 per cent. crude fiber, and not less than 3.5 per cent. fat and 10 per cent. protein. Not registered in 1914. Registered in 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in the latter but over 3 per cent. high in fiber. Both lots were misbranded in that the guarantees were not stated on the labels.

Feeding Stuffs—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Farmers' Union Scratch Feed. Farmers' Union Grain & Supply Co., Waterville, Me. Composed of wheat, cracked corn, barley, buckwheat, oats, Kaffir corn, sunflower seed. Contains not more than 5 per cent. crude fiber, and not less than 3.5 per cent. fat and 10 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was found in accord with guarantee in fiber, but one-half per cent. below in protein and nearly one per cent. below in fat.
Anchor Brand Scratch Feed. Globe Elevator Co., Buffalo, N. Y. Made from a combination of various seeds with buckwheat, cracked corn, Kaffir corn, wheat, barley, oats, cracked peas. On 1914 certificate: Contains not more than 5 per cent. crude fiber, and nor less than 4 per cent. fat and 12 per cent. protein. On 1915 certificate: Contains not more than 6 per cent. crude fiber, and not less than 3 per cent. fat and 12 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Blue Ribbon Laying Mash. Globe Elevator Co., Buffalo, N. Y. Composed of wheat bran, wheat middlings, wheat flour, ground oats, corn meal, corn gluten meal, pea meal, ground alfalfa, linseed oil meal, meat meal, fish scrap, ground bone. Contains not more than 10 per cent. crude fiber, and not less than 3 per cent. fat and 20 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Blue Ribbon Scratch Feed. Globe Elevator Co., Buffalo, N. Y. Composed of cracked corn, wheat, barley, Kaffir corn, oats, buckwheat, sunflower seeds, green split peas. Contains not more than 4 per cent. crude fiber, and not less than 4 per cent. fat and 12 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was found in accord with guarantee in fiber, but over 1 per cent. below in protein and overi 1 per cent. below in fat. It contained some weed seeds.
An Unlabeled Chick Feed, shipped by D. H. Grandin Milling Co., Jamestown, N. Y. Unregistered. Misbranded. Case pending.	The only official sample carried 10.75 per cent. protein, 3.19 per cent. fat and 3.10 per cent. fiber.
Greene's Chicken Feed. Greene Chick Feed Co., Marblehead, Mass. No certificate filed. Claims on package: Crude fiber not stated; fat not less than 3 per cent.; protein not less than 11 per cent. When these goods were sampled, they were not registered. Since then a certificate has been filed for "Greene's Chick Feed; fiber 3 per cent., fat 3 per cent., protein 10 per cent." Although this does not agree either in name or guarantees with the package label, it was probably intended to cover these goods.	The only official sample obtained was found in accord with guarantee in protein and fat and carried over 9 per cent. fiber.
Greene's "First Feed." Greene Chick Feed Co., Marblehead, Mass. "First Feed" is made from white corn, steam cooked; yellow corn germ meal; shredded codfish, steam cooked; ground hulled oats, steam cooked; dried milk, steam cooked; entire wheat, cod livers, steam cooked; ground flaxseed, gluten meal, steam cooked; dried blood, steam cooked; shell lime and finely ground meat scraps, steam cooked. Contains not more than 5 per cent. crude fiber, and not less than 3 per cent. fat and 17 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.

Feeding Stuffs—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Greene's 5% Meat Mash. Greene Chick Feed Co., Marblehead, Mass. Composed of meat scraps, corn meal, wheat, shell lime, hominy feed, flax screenings, oats, wheat bran, salt. Contains not more than 7 per cent. crude fiber, and not less than 3 per cent. fat (on 1915 certificate, not less than 5 per cent. fat) and 12 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat. It carried the 1914 fat guarantee of 3 per cent. On that basis it was up to guarantee in fat but slightly high in fiber. It was not up to the 1915 fat guarantee. It contained very many weed seeds.
Greene's Growing Feed for Chickens. Greene Chick Feed Co., Marblehead, Mass. Composed of fish scraps, yellow and white corn, dried milk, wheat, oats, corn cockle, barley, yellow foxtail, winter rape, mustard, salt, meat scraps. Contains not more than 5 per cent. crude fiber and not less than 3 per cent. fat and 12 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was in accord with guarantee in protein and fat but over 3 per cent. high in fiber.
Greene's Intermediate Chick Feed. Greene Chick Feed Co., Marblehead, Mass. Composed of yellow and white corn, wheat, oats, recleaned field seed, Kaffir corn. Contains not more than 3 per cent. fiber and not less than 3 per cent. fat and 10 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was in accord with guarantee in protein and fat and carried 6.27 per cent. fiber.
Greene's Old Fashioned Meat Scraps. Greene Chick Feed Co., Marblehead, Mass. Composed of meat, bone and gristle. Contains not more than 3 per cent. crude fiber, and not less than 5 per cent. fat and 30 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat.
Greene's Poultry Food. Greene Chick Feed Co., Marblehead, Mass. Composed of fish, meat and bone. Contains not more than 5 per cent. crude fiber, and not less than 3 per cent. fat and 40 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Greene's Scratch Feed. Greene Chick Feed Co., Marblehead, Mass. Composed of corn, wheat, oats, barley, screenings, sunflower seed. Contains not more than 5 per cent. crude fiber, and not less than 3 per cent. fat and 10 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Xtragood Scratch Feed. Griswold & Mackinnon, St. Johnsbury, Vt. Composed of wheat, cracked corn, barley, oats, buckwheat, Kaffir corn, milo maize, and sunflower seed. Contains not less than 3 per cent. fat and 11 per cent. protein. Not registered in 1914. Registered in 1915.	Two official samples were both misbranded in that the guarantees on the label were not in accord with the filed certificate. Both labels gave the protein guarantee as 10 per cent. On that basis they were up to guarantee, but on the basis of the certificate guarantee of 11 per cent., they were both over one-half per cent. below. One sample was examined for fiber and fat. It was up to the label guarantee of 2.5 per cent. in fat but below the certificate guarantee of 3 per cent. It was in accord with the label guarantee of 5 per cent. in fiber.
Dry Mash. J. B. Ham Co., Lewiston, Me. Composed of corn meal, ground oats, wheat bran, wheat middlings, linseed meal, meat scraps, charcoal and alfalfa. Contains not more than 12 per cent. crude fiber, and not less than 3½ per cent. fat and 15 per cent. protein. Registered in 1914 and 1915.	One dealer's sample was up to guarantee in protein. The only official sample obtained was in accord with guarantee in protein, fiber and fat. No weed seeds were found.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
H-8 Special Scratch Feed. E. T. Hathaway, Yarmouthville, Me. Composed of corn, cracked corn, oats, wheat, buckwheat, barley, Kaffir corn, sunflower seed, and a small amount of charcoal. Contains not more than 5 per cent. crude fiber, and not less than 2 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat. It contained very many weed seeds.
Orono Brand Dry Mash. E. T. Hathaway, Yarmouthville, Me. Composed of corn meal, wheat bran, wheat middlings, gluten meal, linseed meal, beef scrap, alfalfa and a little charcoal. Contains not more than 7.5 per cent. crude fiber, and not less than 6.5 per cent. fat and 20 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein and fiber but over one-half per cent. below in fat.
Hecker's No. 1 Scratch Feed. Hecker Cereal Co., New York, N. Y. Composed of wheat, Kaffir corn, cracked corn, barley, buckwheat, cracked peas, sunflower seed, Contains not more than 5 per cent. crude fiber, and not less than 3 per cent. and 10 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Hecker's No. 2 Scratch Feed. Hecker Cereal Co., New York, N. Y. Composed of wheat, Kaffir corn, barley, cracked corn, oats, buckwheat. Contains not more than 5 per cent. crude fiber, and not less than 3 per cent. fat and 10 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Hen-o-la Dry Mash. Hen-e-ta Bone Co., Newark, N. J. Composed of corn meal, corn gluten feed, wheat bran, wheat middlings, old process linseed oil meal, and "Hen-e-ta" (composed of phosphorus, lime, soda and silica). Contains not more than 4 per cent. crude fiber, and not less than 2 per cent. fat and 12 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Intermediate Chick Feed. Wm. S. Hills Co., Boston, Mass. No certificate filed. Guarantees not stated on label. Unregistered; misbranded; case pending.	The only official sample obtained carried 10.44 per cent. protein, 2.52 per cent. fat and 2.02 per cent. fiber.
Purity Growing Feed. Wm. S. Hills Co., Boston, Mass. Composed of corn meal, hominy, middlings, beef scraps, fish meal and oatmeal. Contains not more than 14 per cent. crude fiber; and not less than 6 per cent. fat and 19 per cent. protein. Registered in 1914 and 1915.	Of 2 official samples, one was up to guarantee in protein; the other was over 4 per cent. below. The sample that was low in protein was examined for fiber and fat and found in accord with guarantee in both.
Purity Poultry Mash. Wm. S. Hills Co., Boston, Mass. Composed of beef scraps, oil meal, alfalfa meal, bran, corn meal, chick cracked corn, ground oats, barley, fish meal, middlings. Contains not more than 10 per cent. crude fiber, and not less than 4 per cent. fat and 17 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat.
Purity Scratch Feed. Wm. S. Hills Co., Boston, Mass. Composed of corn, wheat, Kaffir corn, oats, barley, buckwheat and sunflower seeds. Contains not more than 6 per cent. crude fiber, and not less than 3 per cent. fat and 10 per cent. protein. Not registered in 1914. Registered in 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in the former and practically so in fat. It contained some weed seeds.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
The H-O Co.'s Algrane Scratching Feed. The H-O Co., Buffalo, N. Y. Composed of whole wheat, oats, Kaffir corn, buckwheat, wheat screenings, cracked corn, Milo maize, sunflower seed, hulled oats, cracked bone, barley. Contains not more than 9 per cent. crude fiber, and not less than 3.5 per cent. fat and 11 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
The H-O Co.'s Chick Feed. The H-O Co., Buffalo, N. Y. Composed of cracked bone, cut oatmeal, cracked wheat, cracked Kaffir corn, cracked peas, millet. Contains not more than 9 per cent. crude fiber and not less than 3 per cent. fat and 12 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
The H-O Co.'s Dry Poultry Mash. The H-O Co., Buffalo, N. Y. Composed of oat middlings, corn gluten feed, wheat middlings, rolled oats, alfalfa meal, ground corn, hominy feed, cracked wheat, wheat bran, ground grain screenings. Contains not more than 9 per cent. crude fiber, and not less than 3.5 per cent. fat and 18 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
The H-O Co.'s Poultry Feed. The H-O Co., Buffalo, N. Y. Composed of ground corn, corn gluten feed, wheat middlings, oat middlings, wheat bran, hominy feed, rolled oats, ground peas, ground grain screenings, molasses. Contains not more than 9 per cent. crude fiber, and not less than 4.5 per cent. fat and 17 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
The H-O Co.'s Steam-Cooked Chick Feed. The H-O Co., Buffalo, N. Y. Composed of cracked corn, cut oat meal, cracked wheat, cracked Kaffir corn, cracked peas, millet. Contains not more than 9 per cent. crude fiber, and not less than 3 per cent. fat and 12 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Dirigo Little Chick Feed. Oscar Holway Co., Auburn, Me. Composed of wheat, Kaffir corn, millet, corn, oat groats, pigeon grass and charcoal. Contains not more than 5 per cent. crude fiber, and not less than 2.5 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Dirigo Scratch Grains. Oscar Holway Co., Auburn, Me. Composed of barley, buckwheat, corn, charcoal, Kaffir corn, wheat and sunflower seed. Contains not more than 5 per cent. crude fiber, and not less than 2.5 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat. It contained many weed seeds.
Hopkins Dry Mash. A. R. Hopkins Co., Bangor, Me. Composed of corn meal, beef scraps, wheat bran, linseed meal, white middlings and Buffalo gluten. Contains not more than 8 per cent. crude fiber, and not less than 6 per cent. fat and 22 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat.

Feeding Stuffs—Continued.

Brand, Maker and Guaranties.	Results of Examination.*
Hopkins Scratch Grains (On 1915 certificate: Hopkins Scratch Feed). A. R. Hopkins Co., Bangor, Me. Composed of cracked corn, wheat, Kaffir corn, oats, barley, buckwheat, sunflower seed and grit. Contains not more than 4 per cent. crude fiber, and not less than 3 per cent. fat and 9.5 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Ideal Scratch Feed, No. 2. E. T. & H. K. Ide, St. Johnsbury, Vt. Composed of corn, wheat, Kaffir corn, oats, buckwheat, barley, sunflower seed. Contains not more than 10 per cent. crude fiber, and not less than 3 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Dry Feed. W. A. Jennison, Bangor, Me. Composed of wheat bran, hominy feed, gluten feed, meat scrap, linseed oil meal, wheat middlings. Contains not more than 9 per cent. crude fiber, and not less than 5 per cent. fat and 22 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was found in accord with guarantee in protein, fiber and fat.
K & W Red Star Chick Feed. (Registered in 1915 as K. & W. Chick Feed). Kendall & Whitney, Portland, Me. Composed of corn, wheat, Kaffir corn, hulled oats, millet. Contains not more than 5 per cent. crude fiber, and not less than 2.5 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat.
K. & W. Red Star Mash Feed. (Registered in 1915 as K. & W. Mash Feed). Kendall & Whitney, Portland, Me. Composed of alfalfa meal, corn feed meal, wheat meal, ground corn bran, wheat bran, meat scraps, oil cake, salt ½ of 1 per cent. Contains not more than 10 per cent. crude fiber, and not less than 2.5 per cent. fat and 11 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in fiber but 1 per cent. below in protein and over 1 per cent. below in fat. The sample consisted of an unbroken 8½ pound package.
K. & W. Red Star Scratch Feed. (Registered in 1915 as K. & W. Scratch Feed). Kendall & Whitney, Portland, Me. Composed of corn, wheat, rye, barley, oats, Kaffir corn, buckwheat, sunflower seed, oil cake. Contains not more than 5 per cent. crude fiber, and not less than 2.5 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat.
Monmouth Dry Mash. E. M. Marks, Monmouth, Me. Composed of wheat bran, wheat middlings, ground oats, corn meal, ground alfalfa, beef scraps, gluten feed, stock feed, cottonseed. Contains not more than 10 per cent. crude fiber and not less than 5 per cent. fat and 18 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein and fat, but over 1½ per cent. high in fiber.
"Elm City" Scratch Feed. Merrill & Mayo Co., Waterville, Me. Composed of corn, wheat, rye, barley, oats, Kaffir corn, buckwheat, sunflower, oil cake. Contains not more than 5 per cent. crude fiber, and not less than 2.5 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guaranteein protein and fat, but slightly high in fiber.

Feeding Stuffs—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Fidelity Scratch Feed. A. Nowak & Son, Buffalo, N. Y. Composed of cracked corn, whole wheat, Milo maize, whole barley, buckwheat, sunflower seeds. Contains not more than 5 per cent. crude fiber, and not less than 3 per cent. fat and 10 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat.
Justice Chick Feed. A. Nowak & Son, Buffalo, N. Y. Composed of cracked corn, cracked wheat, milo maize, split green peas, millet. Contains not more than 5 per cent. crude fiber, and not less than 2 per cent. fat and 11 per cent. protein. Registered as Husted Chick Feed by the Consolidated Milling Corporation, Buffalo, N. Y., in 1914. Registered in 1915.	The only official sample obtained was misbranded in that the label carried no guarantees. It was in accord with the certificate guarantee in fat and fiber but 1½ per cent. below in protein. It contained many weed seeds.
Justice Growing Mash. Nowak Milling Corporation, Buffalo, N. Y. Composed of oat meal, corn gluten feed, linseed oil meal, corn feed meal, wheat bran and wheat middlings. Contains not more than 7 per cent. crude fiber, and not less than 5 per cent. fat and 15 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Justice Laying Mash. Nowak Milling Corporation, Buffalo, N. Y. Composed of linseed oil meal, ground oats, wheat flour, wheat bran, wheat middlings, corn feed meal, corn gluten feed, alfalfa meal, ground bone and meat scrap. Contains not more than 10 per cent. crude fiber, and not less than 3 per cent. fat and 20 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Justice Scratch Feed. (Formerly Husted Scratch Feed). A. Nowak & Son, Buffalo, N. Y. Composed of cracked corn, whole wheat, Milo maize, whole barley, buckwheat, split green peas, sunflower seeds. Contains not more than 5 per cent. crude fiber, and not less than 3 per cent. fat and 10 per cent. protein. Registered in 1914 by Consolidated Milling Corporation, Buffalo, N. Y., as Husted Scratch Feed. Registered in 1915.	The only official sample obtained was misbranded in that the label carried no guarantees. It was in accord with the certificate guarantees in protein and fiber, but over one-half per cent. below in fat. It contained a few weed seeds.
Lay-Egg-O Dry Mash. A. Nowak & Son, Buffalo, N. Y. Composed of corn feed meal, corn gluten feed, wheat bran, wheat middlings, Heneta (phosphorus, lime, sodium and silica). Phosphorus 2 per cent. (equivalent to 6 per cent. bone ash). Contains not more than 4 per cent. crude fiber, and not less than 3 per cent. fat and 12 per cent. protein. Registered in 1914 by The Consolidated Milling Corporation, Buffalo, N. Y. Registered in 1915	The only official sample obtained was in accord with guarantee in protein and fat but over one-half per cent. high in fiber.
Fattening Feed. Park & Pollard Co., Boston, Mass. Composed of corn, wheat, barley, Kaffir corn, oats and salt. Contains not more than 8 per cent. crude fiber, and not less than 3½ per cent. fat and 10 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
Gritless Chick Feed. Park & Pollard Co. Boston, Mass. Composed of cracked: Corn, wheat, Kaffir corn, Milo. Whole: Millet seed and oats and shredded fish. Contains not more than 5 per cent. crude fiber, and not less than 3½ per cent. fat and 11 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was found in accord with guarantee in protein and fiber but over 1 per cent. low in fat. It contained many weed seeds.
Growing Feed. Park & Pollard Co., Boston, Mass. Composed of ground: Corn, wheat, barley, oats, meat, bone, alfalfa, Kaffir corn, wheat bran, wheat middlings, buckwheat, beet pulp, calcium carbonate and salt. Contains not more than 8 per cent. crude fiber, and not less than 3½ per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both.
Intermediate Chick Feed. Park & Pollard Co., Boston, Mass. Composed of cracked corn, wheat, buckwheat, oats, millet, Kaffir corn and Milo. Contains not more than 5 per cent. crude fiber, and not less than 3½ per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in the former but over ¾ per cent. low in fat. It contained some weed seeds.
"Lay or Bust" Dry Mash. Park & Pollard Co., Boston, Mass. Composed of ground: Wheat bran, wheat middlings, corn, wheat, oats, barley, Kaffir corn, buckwheat, alfalfa, fish, meat, bone, beet pulp, calcium carbonate and salt. Contains not more than 12 per cent. crude fiber, and not less than 3½ per cent. fat and 18 per cent. protein. Registered in 1914 and 1915.	Of 3 official samples, 2 were up to guarantee in protein, the other slightly below. 2 were examined for fiber and fat and found in accord with guarantee in both. In 2 samples no weed seeds were found, in the other a few.
Margaret Mahaney's Turkey Feed. Park & Pollard Co., Boston, Mass. Composed of ground: Wheat, barley, linseed oil meal, oats, meat, bone, calcium hydroxide, calcium carbonate and salt. Contains not more than 12 per cent. crude fiber, and not less than 3½ per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Red Ribbon Chick Feed. Park & Pollard Co., Boston, Mass. Composed of cracked: Corn, wheat, oats, Kaffir corn, Milo and whole millet seed. Contains not more than 5 per cent. crude fiber, and not less than 3½ per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	Three official samples were all up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in the former, but over one-half per cent. below in fat. 2 samples were examined for weed seeds; one contained some, the other many.
Red Ribbon Scratch Feed. Park & Pollard Co., Boston, Mass. Composed of cracked corn, wheat, buckwheat, barley, oats, Kaffir corn, Milo and sunflower seed. Contains not more than 5 per cent. crude fiber, and not less than 3½ per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. One contained some, the other many, weed seeds.
Screened Scratch Feed. Park & Pollard Co., Boston, Mass. Composed of cracked corn, wheat, buckwheat, barley, oats, Kaffir corn, Milo and sunflower seed. Contains not more than 5 per cent. crude fiber, and not less than 3½ per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	Three official samples were all up to guarantee in protein. One was examined for fiber and fat found in accord with guarantee in the former, but over one-half per cent. below in fat. One sample contained some, the other many, weed seeds.
Chick Mash. Pendexter Bros., Cornish, Me. Unregistered. Unlabeled. Case pending.	The only official sample obtained carried 20.38 per cent. protein, 4.86 per cent. fat and 6.60 per cent. fiber.

Feeding Stuffs—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Cornish Dry Mash for Laying Hens. Pendexter Bros., Cornish, Maine. Composed of bran, meal, meat scraps, linseed meal, gluten, alfalfa, molasses feed, charcoal, wheat middlings and salt. Contains not more than 9 per cent. crude fiber and not less than 4½ per cent. fat and 16 per cent. protein.	The only official sample obtained was in accord with guarantee in protein, fiber and fat. It was misbranded in that it was absolutely unlabeled.
Pilco All Grain Scratch Feed. Pilliod Milling Co., Swanton, O. Composed of cracked corn, wheat, oats, barley, buckwheat, rye and wheat screenings. Contains not more than 4 per cent. crude fiber, and not less than 4 per cent. fat and 9 per cent. protein. Not registered in 1914. Registered in 1915.	Two official samples were both misbranded in that they carried no guarantees on the labels. Both were up to the certificate guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in the former but over 1 per cent. below in fat. It contained many weed seeds.
Purina Chick Feed. Purina Mills Branch, Ralston Purina Co., St. Louis, Mo. Composed of wheat, corn, millet, Kaffir or Milo maize, recleaned wheat screenings. Contains not more than 4 per cent. crude fiber, and not less than 3 per cent. fat and 11 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in fiber and fat but over one-half per cent. below in protein.
Purina Chicken Chowder with Charcoal. Purina Mills, (Ralston Purina Co.) St. Louis, Mo. Composed of wheat middlings, wheat bran, corn meal, alfalfa, linseed meal, granulated meal, salt. Contains not more than 9 per cent. crude fiber, and not less than 3 per cent. fat and 17 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Purina Scratch Feed. Purina Mills, (Ralston Purina Co.) St. Louis, Mo. Composed of wheat, corn, barley, Kaffir or Milo maize, sunflower, recleaned wheat screenings. Contains not more than 4 per cent. crude fiber, and not less than 3 per cent. fat and 11 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
American Poultry Food. Quaker Oats Co., Chicago, Ill. Composed of hominy feed, cottonseed meal, ground barley, wheat mixed feed and rye shorts. Contains not more than 9 per cent. crude fiber, and not less than 3.5 per cent. fat and 12 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Blue Ribbon Scratch Grains. Quaker Oats Co., Chicago, Ill. Composed of whole wheat, whole Kaffir corn, whole barley, cracked Indian corn, whole buckwheat, sunflower seeds. Contains not more than 5 per cent. crude fiber, and not less than 2.5 per cent. fat and 10 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Quaker Chick Feed. Quaker Oats Co., Chicago, Ill. Composed of cracked wheat, cracked Kaffir corn, cracked Indian corn, whole millet seed, oatmeal, charcoal, marble grit, wild buckwheat, with not to exceed one-half of one per cent. miscellaneous wild seeds occurring in above seeds and grains. Contains not more than 5 per cent. crude fiber, and not less than 2.5 per cent. fat and 10 per cent. protein. Not registered in 1914. Registered in 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. It contained very many weed seeds; the presence of weed seeds is plainly stated on the label and the certificate.

Feeding Stuffs—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Quaker Poultry Mash. Quaker Oats Co., Chicago, Ill. Composed of meat scraps, oatmeal, wheat bran, altalfa meal, yellow hominy feed, gluten feed, ground grain screenings. Contains not more than 10 per cent. crude fiber, and not less than 4 per cent. fat and 17.5 per cent. protein. Registered in 1914 and 1915.	Two official samples were both in accord with guarantee in protein, fiber and fat. One sample was examined for weed seeds; none were found.
Quaker Scratch Grains. Quaker Oats Co., Chicago, Ill. Composed of whole wheat, whole Kaffir corn, whole barley, cracked Indian corn, whole buckwheat, sunflower seeds. Contains not more than 5 per cent. crude fiber, and not less than 2.5 per cent. fat and 10 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
Schumacher Little Chick Feed. Quaker Oats Co., Chicago, Ill. Composed of cracked wheat, cracked Kaffir corn, cracked Indian corn, whole millet seed, oatmeal, charcoal, marble grit, wild buckwheat with not to exceed one-half of one per cent. miscellaneous wild seeds occurring in above seeds and grains. Contains not more than 5 per cent. crude fiber, and not less than 2.5 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein and fiber but slightly below in fat.
Schumacher Poultry Mash. Quaker Oats Co., Chicago, Ill. Composed of oatmeal, meat scraps, alfalfa meal, wheat bran, with ground screenings not exceeding mill run, yellow hominy feed, corn gluten feed, ground grain screenings. Contains not more than 10 per cent. crude fiber, and not less than 4 per cent. fat and 17.5 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Schumacher Scratch Grains. Quaker Oats Co., Chicago, Ill. Composed of whole wheat, whole Kaffir corn, whole barley, cracked Indian corn, whole buckwheat, sunflower seeds. Contains not more than 5 per cent. crude fiber, and not less than 2.5 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both.
Scribner's Chick Feed. D. & C. E. Scribner Co., Brunswick, Me. On 1914 certificate: Composed of cracked wheat, cracked corn, millet seed, hulled oats, charcoal. Contains not more than 7 per cent. crude fiber, and not less than 4 per cent. fat and 12 per cent. protein. On 1915 certificate: Composed of corn, wheat, Kaffir corn, oats, millet seed, charcoal, meat meal and fish meal. Contains not more than 12 per cent. crude fiber, and not less than 3 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Scribner's Growing Feed. D. & C. E. Scribner Co., Brunswick, Me. Composed of ground oats, red dog, meat meal, fish scraps, middlings and corn meal. Contains not more than 12 per cent. crude fiber, and not less than 3 per cent. fat and 14 per cent. protein. Not registered in in 1914. Registered in 1915.	No goods of this brand were found by inspectors.

FEEDING STUFFS—Continued.

BRAND, MAKER AND GUARANTIES.	RESULTS OF EXAMINATION.
Scribner's Intermediate Chick Feed. D. & C. E. Scribner Co., Brunswick, Me. Composed of cracked corn, hulled oats, wheat, millet, Kaffir corn, clover. Contains not more than 7 per cent. crude fiber, and not less than 4 per cent. fat and 12 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Scribner's Laying Mash. D. & C. E. Scribner Co., Brunswick, Me. Composed of bran, middlings, hominy, alfalfa, corn meal, meat scrap, fish meal and bone meal. Contains not more than 12 per cent. crude fiber, and not less than 3 per cent. fat and 18 per cent. protein. Registered in 1914 and 1915.	Two official samples were both misbranded in that the protein guarantee on the labels was 20 per cent. instead of 18 per cent. as stated on the certificate. Both of the samples carried less than 15 per cent. protein. 2 samples examined last year were equally as bad. One sample was examined for fiber and fat and found in accord with guarantee in both. Both samples contained a few weed seeds.
Scribner's Scratch Feed. D. & C. E. Scribner Co., Brunswick, Me. On 1914 certificate: Composed of cracked corn, wheat, Kaffir corn, barley, buckwheat, oats, sunflower seed, charcoal. Contains not more than 7 per cent. crude fiber, and not less than 3 per cent. fat and 12 per cent. protein. On 1915 certificate: Composed of cracked corn, wheat, oats, Kaffir corn, India or buckwheat, charcoal. Contains not more than 12 per cent. crude fiber, and not less than 3 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Star Scratch Feed. F. A. Waldron & Son, Portland, Me. Composed of cracked corn, oats, barley, buckwheat, wheat, Kaffir corn. Contains not more than 4 per cent. fiber, and not less than 3.5 per cent. fat and 10.5 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Wentworth Brothers' Dry Feed for Growing Chicks. Wentworth Brothers, Cornish, Me. Composed of corn meal, wheat bran, wheat middlings, ground oats, animal meal, charcoal and salt. Contains not more than 7 per cent. crude fiber, and not less than 5 per cent. fat and 18 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was in accord with guarantee in protein and fiber and practically so in fat.
Wentworth Brothers' Dry Feed for Laying Hens. Wentworth Bros., Cornish, Me. Composed of corn meal, wheat middlings, wheat bran, alfalfa meal, meat scraps, oil meal, charcoal and salt. Contains not more than 8½ per cent. crude fiber, and not less than 5½ per cent. fat and 20 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein and fiber but over 1 per cent. below in fat.
Wentworth Brothers' Dry Feed for Young Chicks. Wentworth Bros., Cornish, Me. Composed of corn meal, oatmeal, middlings, linseed meal, meat scraps, charcoal and salt. Contains not more than 5 per cent. crude fiber, and not less than 5 per cent. fat and 16 per cent. protein. Not registered in 1914. Registered in 1915.	The only official sample obtained was up to guarantee in protein but slightly below in fat and slightly high in fiber.

Feeding Stuffs—Continued.

Brand, Maker and Guaranties.	Results of Examination.
ALFALFA MEALS.	
Red Star Brand Alfalfa Meal. Chas. M. Cox Co., Boston, Mass. Alfalfa. Contains not more than 29.5 per cent. crude fiber, and not less than 1.4 per cent. fat and 16.6 per cent. protein. Not registered in 1914. Registered in 1915.	Two official samples were both up to guarantee in protein. One was examined for fiber and fat and found in accord with guarantee in both. No weed seeds were found.
Alfalfa Meal. Albert Dickinson Co., Chicago, Ill. Alfalfa hay. Contains not more than 35 per cent. crude fiber, and not less than 1 per cent. fat and 12 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Alfalfa. Park & Pollard Co., Boston, Mass. Ground alfalfa hay. Contains not more than 30 per cent. crude fiber, and not less than 1¼ per cent. fat and 12 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was in accord with guarantee in protein, fiber and fat. No weed seeds were found.
Peters' Lucern Alfalfa Meal. M. C. Peters Mill Co., Omaha, Nebr. Alfalfa hay. Contains not more than 33 per cent. crude fiber, and not less than .5 per cent. fat and 12 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Ground Alfalfa. Sperry Flour Co., Stockton, Calif. No certificate filed; claims on package: Crude fiber not over 28.5 per cent.; fat not less than 2.5 per cent.; protein not less than 14 per cent. Unregistered; case pending.	The only official sample obtained was found in accord with guarantee in protein, but over 1 per cent. below in fat and 1 per cent. high in fiber.
DRIED MEAT AND FISH WASTES.	
Bradley's Superior Meat Meal. American Agricultural Chemical Co., New York, and other places. Dried meat and bones. Contains not more than 15 per cent. crude fiber, and not less than 8 per cent. fat and 30 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Ground Meat Scraps. American Agricultural Chemical Co., N. Y. Contains not less than 10 per cent. fat and 45 per cent. protein. Not registered in 1914. Registered in 1915.	No goods of this brand were found by inspectors.
AGCO. American Glue Co., Boston, Mass. Made from fish, by the Lane-Libby Fisheries company of Vinalhaven, Maine. Contains not more than 1 per cent. crude fiber, and not less than 2.5 per cent. fat and 50 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Star Brand Beef Scraps. Beach Soap Co., Lawrence, Mass. Contains not less than 15 per cent. fat and 40 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was up to guarantee in protein but nearly 7 per cent. below in fat.
Animal Meal. Bowker Fertilizer Co., Boston, Mass. Composed of cooked bone and cooked meat. Contains not less than 5 per cent. fat and 40 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.

FEEDING STUFFS—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Ground Beef Scraps. (Registered in 1915 as Ground Meat Scraps). Bowker Fertilizer Co., Boston, Mass. Contains not less than 5 per cent. fat and 40 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was found in accord with guarantee in protein and fat.
Breck's Ground Beefscraps. Joseph Breck & Sons, Corp., Boston, Mass. Composed of ground tallow scraps. Contains not less than 12 per cent. fat and 48 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Dow's Beef Scrap. John C. Dow Co., Boston, Mass. Made from dried meat. Contains not less than 12 per cent. fat, and 43 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fat and found up to guarantee.
Dow's Favorite Poultry Meal. John C. Dow Co., Boston, Mass. Composed of dried meat and bone. Contains not less than 10 per cent. fat and 32 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Hinckley Poultry Food. Hinckley Rendering Co., Somerville, Mass. Composed of bone and meat. Contains not less than 8.12 per cent. fat and 35.5 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Red Star Brand Fish Scrap. International Glue Co., Boston, Mass. Dried fish. Contains not less than 2 per cent. fat and 45 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was found in accord with guarantee in protein and fat.
Lord's Egg Maker. Lord Bros. Co., Portland, Me. Contains not more than 2½ per cent. crude fiber, and not less than 3 per cent. fat and 45 per cent. protein. Not registered in 1914. Registered in 1915.	No samples of this brand were obtained by inspectors.
Poultry Scraps. New England Dressed Meat & Wool Co., Somerville, Mass. Animal food products and bone meal. Contains not less than 10 per cent. fat and 50 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Blue Ribbon Meat Scraps. Park & Pollard Co., Boston, Mass. Contains not more than 2 per cent. crude fiber, and not less than 13 per cent. fat and 45 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Portland Bone & Meat Meal for Hogs and Chicks. Portland Rendering Co., Portland, Me. Made from meat and bone. Contains not less than 8 per cent. fat and 35 per cent. protein. Registered in 1914 and 1915.	The only official sample obtained was found up to guarantee in fat but 2 per cent. below in protein.
Portland Bone Meal for Cattle & Poultry. Portland Rendering Co., Portland, Maine. Made from bone. Contains not less than 5 per cent. fat and 20 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Portland Cracked Bone for Poultry. Portland Rendering Co., Portland, Me. Made from bone. Contains not less than 5 per cent. fat and 10 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.

Feeding Stuffs—Continued.

Brand, Maker and Guaranties.	Results of Examination.
Portland Poultry Food (Feed). Prepared from Cooked Meat and Bone Scraps. Portland Rendering Co., Portland, Me. Contains not less than 8 per cent. fat and 40 per cent. protein. Registered in 1914 and 1915.	Of 2 official samples, one was up to guarantee in protein, the other over 1 per cent. below. One was examined for fat and found up to guarantee.
Shay's Pure Ground Beef Scrap. C. M. Shay Fertilizer Co., Groton, Conn. Beef scrap with butchers' trimmings. Contains not less than 10 per cent. fat and 40 per cent. protein. Registered in 1914. Not registered in 1915.	No goods of this brand were found by inspectors.
Whitman & Pratt's Animal Meal. Whitman & Pratt Rendering Co., Lowell, Mass. Meat tankage and bone. Contains not less than 10 per cent. fat and 33 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.
Whitman & Pratt's Beef Scraps. Whitman & Pratt Rendering Co., Lowell, Mass. Ground beef scrap and bone. Contains not less than 10 per cent. fat and 45 per cent. protein. Registered in 1914 and 1915.	Two official samples were both up to guarantee in protein. One was examined for fat and found over 1 per cent. below.
Whitman and Pratt's Extra Quality Beef Scraps. Whitman & Pratt Rendering Co., Lowell, Mass. Ground beef scraps. Contains not less than 10 per cent. fat and 55 per cent. protein. Registered in 1914 and 1915.	No goods of this brand were found by inspectors.

September, 1915.

MAINE
AGRICULTURAL EXPERIMENT STATION,
ORONO, MAINE.

ANALYSTS.

James M. Bartlett
Royden L. Hammond
Elmer R. Tobey
Herman H. Hanson
Edward E. Sawyer
Walter H. Rogers

Official Inspections

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SEED INSPECTION.

The Commissioner of Agriculture is the executive of the law regulating the sale of agricultural seeds in Maine. It is the duty of the Maine Agricultural Experiment Station to make the analyses of the samples collected by the Commissioner, and it is the duty of the Director to publish the results of the analyses of the samples of agricultural seeds, together with the names of the persons from whom the samples were obtained, and such additional information as may seem advisable.

Note. All correspondence relative to the inspection laws should be addressed to the Bureau of Inspections, Department of Agriculture, Augusta, Maine.

The Seed Inspection Law.

The first law regulating the sale of seeds was enacted by the Legislature of 1897. This was revised by the Legislature of 1905. This was again revised by the Legislature of 1911 so as to conform with the requirements recommended by the Association of Official Seed Analysts and agreed to by the American Seed Dealers Association. The chief requirements of the law follow. The full text of the law will be sent on request to the Commissioner of Agriculture, Augusta.

1. *Kind of seeds coming under the law.* The law applies to the sale, distribution, transportation, or the offering or exposing for sale, distribution, or transportation of the seeds of alfalfa, barley, Canadian blue grass, Kentucky blue grass, brome grass, buckwheat, alsike clover, crimson clover, red clover, medium clover, white clover, field corn, Kaffir corn, meadow fescue, flax, hungarian, millet, oats, orchard grass, rape, redtop, rye, sorghum, timothy and wheat for seeding purposes.

2. *The brand.* Each lot or package shall be plainly marked with the name of the seed and its minimum percentage of purity.

3. *Mixtures.* Mixtures must be plainly marked with the name of the seed and the percentage of purity. In case the mixtures contain seeds not included in 1 these need not be named. (e. g., a mixture consisting of half redtop, 90 per cent pure, quarter Kentucky blue grass, 85 per cent pure and the remainder seeds not named in the law, could be marked "Redtop 45 per cent pure, Kentucky blue grass 21 per cent pure." The statement of the remaining constituents may or may not be named.)

4. *Adulteration.* A seed is adulterated if its purity falls below its guaranty or if it contains the seed of any poisonous plant.

5. *Misbranding.* A seed is misbranded if the package or label bears any statement, design or device which is false or misleading in any particular, or if it does not carry the statements named in 2.

Results of the Inspection.

The inspectors visited most of the handlers of seeds in the State during the spring and early summer months. The results of the examination of the samples collected are given in the following tables.

A list of weed seeds found in seeds examined in 1915.

NOMENCLATURE, GRAY'S MANUAL, 17TH EDITION, 1908.

	Common Name.	Scientific Name.
1.	Apetalous peppergrass	Lepidium apetalum Willd.
2.	American wild mint	Mentha canadensis (L.) Brig.
3.	Barnyard grass	Echinochloa crusgalli (L.) Beauv.
4.	Beaked nightshade	Solanum rostratum Dunal.
5.	Black medick	Medicago lupulina L.
6	Bladder ketmia	Hibiscus trionum L.
7.	Bird's foot trefoil	Lotus corniculatus L.
8.	Blue field madder	Sherardia arvensis L.
9.	Blue vervain	Verbena hastata L.
10.	Bracted plantain	Plantago aristata Michx.
11.	Canada thistle	Cirsium arvense (L.) Scop.
12.	Catnip	Nepeta cataria L.
13.	Charlock	Brassica arvensis L.
14.	Chicory	Cichorium intybus L.
15.	Clarkia	Clarkia sp.
16.	Common chickweed	Stellaria media (L.) Cyrill.
17.	Common nightshade	Solanum nigrum L.
18.	Common St. John's wort	Hypericum perforatun L.
19.	Corn cockle	Agrostemma githago L.
20.	Corn gromwell	Lithospermum arvense L.
21.	Corn mayweed	Matricaria inodora L.
22.	Crabgrass	Digitaria sanguinalis (L.) Scop.
23.	Crane's bill	Geranium maculatum L.
24.	Dock	Rumex sp.
25.	Ergot	*Claviceps purpurea (Fr.)Tul.
26.	Evening primrose	Oenothera biennis L.
27.	False flax	Camelina microcarpa Andrz.
28.	Five finger	Potentilla monspeliensis L.
29.	Flax dodder	Cuscuta epilinum Weihe.
30.	Fowl meadow grass	Glyceria nervata (Willd.) Trin.
31.	Goosefoot	Chenopodium album L.
32.	Green foxtail	Setaria viridis (L.) Beauv.
33.	Heal-all	Prunella vulgaris L.
34.	Hedge mustard	Sisymbrium officinale (L.) Scop.
35.	Hoary alyssum	Berteroa incana (L.) D. C.
36.	Indian mallow	Abutilon theophrasti Medic.
37.	Knot-grass	Polygonum aviculare L.
38.	Lady's thumb	Polygonum persicaria L.
39.	Mayweed	Anthemis cotula L.
40.	Mint.	Mentha sp.
41.	Moth mullen	Verbascum blatteria L.
42.	Mouse-ear chickweed	Cerastium vulgatum L.
43.	Mustard	Brassica nigra (L.) Koch.
44.	Night flowering catchfly	Silene noctiflora L.
45.	Ole-witch grass	Panicum capillare L.
46.	Ovoid spike rush	Eleocharis ovata (Roth.) R. & S.
47.	Ox-eye daisy	Chrysanthemum leucanthemum L.
48.	Pale persicaria	Polygonum lapathifolium L.
49.	Pennsylvania persicaria	Polygonum pennsylvanicum L.
50.	Peppergrass	Lepedium virginicum L.
51.	Pigweed	Amaranthus retroflexus L.
52.	Pimpernel	Anagallis arvensis L.
53.	Plantain	Plantago major L.
54.	Poison hemlock	Conium maculatum L.
55.	Purslane	Portulaca oleracea L.
56.	Ragweed.	Ambrosia artemisiifolia L.

* Sclerotia of the fungus.

A list of weed seeds found in seeds examined in 1915—Concluded.

NOMENCLATURE, GRAY'S MANUAL, 17TH EDITION, 1908.

Common Name.	Scientific Name.
57. Ribgrass	Plantago lanceolata L.
58. Rugel's plantain	Plantago rugelii Done.
59. Russian thistle	Salsola Kali tenuifolia G. F. W. Mey.
60. Sand rocket	Diplotaxis muralis (L.) D. C.
61. Sedge	Carex unidentified
62. Sheep sorrel	Rumex acetosella L.
63. Shepherd's purse	Capsella bursa-pastoris (L.) Medic.
64. Slender crabgrass	Digitaria filiformis (L.) Koeler.
65. Small flowered crane's bill	Geranium pusillum Burm. f.
66. Spring sida.	Sida spinosa L.
67. Spurge	Euphorbia preslii Guss.
68. Suckling clover	Trifolium bubium Sibth.
69. Sunflower	Helianthus annuus L.
70. Tumble-weed	Amaranthus graecizans L.
71. Virginia three-seeded mercury	Acalypha virginica L.
71. Wall speedwell.	Veronica arvensis L.
73. White vervain	Verbena urticaefolia L.
74. Whorled mallow	Malva verticillata L.
75. Wild buckwheat	Polygonum convolvulus L
76. Wild carrot	Daucus carota L.
77. Willow herb	Epilobium adenocaulon Haussk.
78. Winged pigweed.	Cycloloma atriplicifolium (Spreng.)Cou t.
79. Wormseed mustard	Erysimum cherianthoides L.
80. Yarrow	Achillea millefolium L.
81. Yellow daisy	Rudbeckia hirta L.
82. Yellow foxtail	Setaria glauca (L.) Beauv.
83. Yellow rocket	Barbarea vulgaris R. Br.
84. Yellow-wood sorrel	Oxalis corniculata L.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1915, arranged alphabetically by towns and dealers.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
	ALFALFA.	%	%	
7577	Auburn. Oscar Holway Co. Alfalfa	99.7	99.9	
7747	Dover. V. L. Warren. Alfalfa	99.5	100.0	
7565	Lewiston. Haskell Implement & Seed Co. Alfalfa	98.0	98.9	

* The numbers refer to weeds named in the table on pages 199 and 200. E. g. 1 is for Apetalous peppergrass, 2 is American wild mint, etc.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1915, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
	ALSIKE CLOVER.			
†7538	Ashland. H. B. Bartlett & Co. Globe Alsike	99.0	98.8	5, 34, 31, 24.
†7440	Auburn. Oscar Holway & Co. "Arab" Alsike	98.0	98.4	24, 31.
7573	Auburn. Oscar Holway Co. Alsyke	96.0	97.3	44.
7574	Auburn. Oscar Holway Co. Alsyke	98.0	98.5	
7579	Auburn. Oscar Holway Co. Alsyke	95.0	95.7	62, 44
7546	Auburn. Wilson & Co. Alsyke	98.0	96.5	62, 44, 5, 32, 53, 31, 57, 27, 42.
7771	Blaine, Young & Russell. Alsike	99.0	98.6	5, 24.
7734	Brewer. Harlow Bros. Alsike	98.0	97.2	62, 5, 44, 57, 28.
7658	Bridgton. Cumberland & Oxford Produce Exchange. Alsike	99.0	98.2	24.
7784	Bucksport. E. B. Gardner & Co. Alsike	93.0	95.4	44, 32, 53, 28.
7775	Caribou. Caribou Grange Store. Alsike	99.5	99.1	31.
7820	Carmel Whitten & Friend. Alsike	95.8	95.4	44, 62, 53.
7792	Castine, Parker & Wescott. Alsike	96.0	96.0	62, 68, 5, 39.
7855	Cherryfield. A. M. Mathews. Alsike	96.0	95.0	62, 44, 11.
7852	Cherryfield. J. Monohon. Alsike	98.0	98.6	62, 24.
7748	Corinna. J. H. Gray. Alsike	97.0	96.3	62, 44, 68, 39, 24.
7738	Dexter. G. A. Dustin. Alsike	97.0	98.7	44.
7652	East Brownfield. E. D. Walker. Alsike	98.25	98.0	44.

* The numbers refer to weeds named in the table on pages 199 and 200. E. g. 1 is for Apetalous peppergrass, 2 is American wild mint, etc.
† Sample taken under directions with guaranty and sent by dealer.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1915, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
7685	Easton. C. W. Spear. Alsike	93.0	94.4	62, 68, 44, 57.
7836	Eastport. E. S. Martin & Sons. Alsike	93.0	92.5	5, 44, 62, 31.
7869	Ellsworth Falls. Whitcomb-Haynes Co. Alsike	96.0	97 0	44, 62, 50.
7768	Farmington. W. W. Small Co. Alsike	95.0	89.0	62, 44, 39, 24, 5, 58, 45, 28, 63, 32.
7701	Fort Kent. J. H. Audibert. Alsike	90.0	92.0	62, 32, 5, 44, 68,
†7502	Foxcroft. A. W. Gilman & Co. Pan American Alsike	97.0	98.0	5, 44.
7746	Foxcroft. A. J. McNaughton. Alsike	95.0	94.6	62, 68, 39, 57, 44, 11, 72.
†7523	Gardiner. Gray-Hildreth Co. Export Alsike	98.5	99.1	5, 44.
7742	Guilford. H. Douglas & Co. Alsike	98.4	97.8	5, 24.
7645	Houlton. Houlton Grange Store. Alsike	99.0	99.5	
†7513	Houlton. John Watson & Co. Boot Globe Alsyke	99.0	99.4	62, 32, 5, 34, 68, 28.
†7514	Houlton. John Watson & Co. Boot Ace Alsyke	95.0	91.3	62, 44, 5, 61, 45, 53, 57, 11, 39, 68, 47.
†7515	Houlton. John Watson & Co. Boot Ace Alsyke	95.0	93.1	62, 44, 58, 45, 24, 32, 68, 31, 11, 5.
†7521	Houlton. John Watson & Co. Globe Aslyke	99.0	99.5	5, 31.
†7542	Houlton. John Watson & Co. Globe Alsyke	990.	99.1	28.
†7562	Houlton. John Watson & Co. "Boss Alsyke"	98.9	98.5	62, 44, 45, 1, 5.
7642	Houlton. John Watson & Co. Alsike	99.0	99.2	

* The numbers refer to weeds named in the table on pages 199 and 200. E. g. 1 is for Apetalous peppergrass, 2 is American wild mint, etc.
† Sample taken under directions with guaranty and sent in by dealer.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1915, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
7643	Houlton. John Watson & Co. Alsike	95.4	95.4	62, 44, 68.
†7660	Houlton. John Watson & Co. Globe Alsyke	99.24	98.7	24, 62.
†7663	Houlton. John Watson & Co. Ace Alsyke	95.39	95.3	62, 68, 39, 44, 32, 33.
†7705	Houlton. John Watson & Co. Alsyke	98.9	99.2	62, 24, 1.
7626	Kennebunk. Wm. Bartlett. Alsike	90.0	85.5	62, 44, 24, 31, 39, 11, 53, 61, 5, 28.
7655	Kezar Falls. W. T. Norton. Alsike	95.0	91.8	44, 62, 5, 24, 1.
7555	Lewiston. Ham & Co. Alsike	93.0	92.0	62, 42, 5, 44, 53, 57, 28, 24, 33, 27.
7558	Lewiston. Haskell Implement & Seed Company Alsyke	98.0	98.8	24.
7766	Livermore Falls. H. A. Morrison. Alsike	98.0	97.8	44, 24, 42.
†7622	Livermore Falls. T. Hersey Record. "Eureka" Alsike	99.0	98.4	62, 24.
7649	Ludlow. O. A. Stevens. Alsike	96.0	95.4	44, 11, 53, 50.
7876	Machisa. L. W. Longfellow. Alsike	93.0	90.2	62, 68, 44, 39, 57, 53.
7878	Machias. Machias Lumber Co. Alsike	95.0	93.7	62, 24.
7678	Mars Hill. E. M. Smith. Alsike	98.5	98.6	
7677	Mars Hill. Seth L. Snow. Alsike	96.0	96.5	44, 62.
7718	Masardis. F. A. Greenlaw. Alsike	95.0	92.3	62, 68, 44, 32.
7729	Milo. E. W. Wentworth. Alsike	98.0	98.0	5, 24.

*The numbers refer to weeds named in the table on pages 199 and 200. E. g. 1 is for Apetalous peppergrass, 2 is American wild mint, etc.
† Sample taken under directions with guaranty and sent in by dealer.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1915, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
	Newport. Judkins & Gilman.			
†7484	Export Alsike	98.25	97.8	5, 44.
	North Anson. Porter & Marston.			
7808	Alsike	96.0	94.0	62, 44, 68, 11.
	North Berwick. Johnson Bros.			
7637	Alsike	90.0	86.5	62, 44, 5, 39, 24, 53, 34, 26, 11, 58, 45.
	North Sullivan. H. E. Robertson.			
7859	Alsike	90.0	91.2	62, 44, 5, 31, 57, 39, 79.
	Old Town. C. E. Lunt.			
7799	Alsike	95.0	98.8	5.
	Patten. I. B. Gardner & Sons.			
7721	Alsike	95.0	94.3	62, 68, 53, 31, 33.
	Pembroke. C. Laughlin.			
7847	Alsike	97.0	95.5	44, 5, 12.
	Portland. Kendall & Whitney.			
7596	Alsike	96.0	96.0	44, 28.
	Presque Isle. E. W. Fernald.			
7772	Alsike	95.0	95.1	62, 44, 68, 5, 58.
	Princeton. H. H. Allen.			
7831	Alsike	98.0	94.1	62, 68, 24, 57.
	Sherman Mills. J. E. Seavey.			
7724	Alsike	93.0	94.0	62, 68, 44, 11, 57.
	Skowhegan. D. A. & W. E. Porter.			
†7506	Pan American Alsike	97.0	97.6	5, 62, 24, 32, 58.
	Springvale. Ross & Bradford.			
7631	Alsike	88.0	87.5	62, 44, 5, 58, 24, 31, 39. 27.
	Stockton. Goodhue & Co.			
7793	Alsike	94.0	89.7	62, 31, 24, 45, 11, 5, 53.
	Van Buren. A. E. Hammond.			
7699	Alsyke	96.0	95.6	5, 24, 44, 63.
	Van Buren. Jos. O. Martin & Son.			
7698	Alsike	93.0	93.2	62, 68, 45.
	Vassalboro. W. A. Marriner.			
7612	Alsike	96.0	97.7	5.

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Table, showing the results of examination of samples of seeds collected by the inspectors in the spring of 1915, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
	Walnut Hill. J. L. Dunn.			
7815	Alsike	93.0	93.5	62, 5, 31, 68.
	West Jonesport. Cummings & Norton.			
7880	Alsike	99.0	98.2	5, 44.
	Winn. Henry Jarvis & Sons.			
7828	Alsike	95.8	94.8	44, 53, 42, 62, 28.
	Winthrop. Jones & Co.			
7770	Alsike	95.0	94.4	62, 5, 44, 31, 11, 53.
	BARLEY.			
	Auburn. Wilson & Co.			
7549	Barley	95.0	97.4	
	Portland. Kendall & Whitney.			
7600	Barley	98.0	97.7	
	Sanford. Wentworth & Plaisted.			
7633	Barley	98.0	87.9	32, 13, 31.
	BUCKWHEAT.			
	Auburn. Oscar Holway & Co.			
7567	Japanese buckwheat	99.0	98.5	56.
	Auburn. Oscar Holway & Co.			
7568	Buckwheat	99.0	99.8	
†7529	Gardiner. Gray-Hildreth Co.			
	Japanese buckwheat	98.0	98.5	56, 13, 32, 82.
	Portland. Allen, Sterling & Lothrop.			
7604	Japanese buckwheat	98.0	99.9	
	Portland. Allen, Sterling & Lothrop.			
7605	Silverhull buckwheat	98.0	99.8	
	Portland. Kendall & Whitney.			
7601	Japanese buckwheat	98.0	99.8	
	HUNGARIAN.			
	Auburn. Oscar Holway Co.			
7586	Hungarian	96.0	96.4	82, 32, 56, 38, 48, 45.
	Auburn. Oscar Holway Co.			
7587	Hungarian	97.0	98.5	32, 45, 64.
	Wilson & Co.			
7548	Hungarian	98.0	99.5	48, 31.
	Bath. Bath Grain Co.			
7692	Hungarian	99.0	99.6	48.

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Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1915, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds
7726	Brownville. E. M. Chase. Hungarian	98.0	99.0	48, 32.
7829	Calais. S. H. Phelan. Hungarian	97.0	98.3	38, 32.
7888	Columbia Falls. R. M. Allen. Hungarian	98.0	99.2	32, 31, 48.
7871	Columbia Falls. Chandler's Cash Store. Hungarian	97.0	94.8	32.
7754	East Corinth. J. K. Farrar. Hungarian	98.0	98.0	82, 48, 32, 3, 31.
7812	East Gray. Gray Milling Co. Hungarian	97.7	97.3	32, 31, 51, 45, 82.
†7528	Gardiner. Gray-Hildreth Co. Hungarian	97.0	97.0	32, 82, 38, 45, 3, 22, 64, 56, 49.
7826	Hermon. L. I. Leathers. Hungarian	97.0	97.6	45, 82, 32, 38, 64.
7590	Lewiston. J. B. Ham & Co. Hungarian	99.0	78.5	48, 37, 61.
7564	Lewiston. Haskell Implement & Seed Company. Hungarian	98.0	99.0	48, 32.
7801	Milford. Spruce Bros. & Co. Hungarian	98.0	98.8	66, 70.
†7487	Newport. Judkins & Gilman Co. Hungarian	98.0	98.8	48, 38, 31, 32, 45, 82, 70.
7843	Pembroke. Hobart-Pattengall & Co. Hungarian	97.5	97.7	48, 32, 38, 56, 45.
7825	Portland. Allen, Sterling & Lothrop. Hungarian	98.0	99.3	48, 51.
7603	Portland. Kendall & Whitney. Hungarian	98.0	99.2	48, 31.
7630	Springvale. Ross & Bradford. Hungarian	98.0	99.0	48, 31, 32, 45.
7613	Waterville. Merrill & Mayo. Hungarian	98.0	98.4	38, 45, 48, 9.

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Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1915, arranged alphabetically by towns and dealers—Continued.

Station number.	KIND OF SEED, NAME AND TOWN OF DEALER.	PURITY. Guaranty.	PURITY. Found.	*Kinds of Noxious Weed Seeds.
	JAPANESE MILLET.			
7584	Auburn. Oscar Holway Co. Japanese Millett	98.0	97.8	32.
7547	Auburn. Wilson & Co. Japanese millett	95.0	99.0	51.
7785	Bucksport. E. B. Gardner & Co. Japanese millet	96.0	97.3	82, 32.
7756	Camden. J. C. Curtis. Japanese millet	96.0	98.1	48, 56.
7814	East Gray. Gray Milling Co. Japanese millet	97.5	97.5	32.
†7527	Gardiner. Gray-Hildreth Co. Japanese millet	94.0	92.7	82, 38, 32, 49, 56.
7665	Harrison. Caswell & Chapman. Japanese millet	97.0	98.0	32, 59.
†7496	Lewiston. J. B. Ham & Co. Japanese millet	95.0	96.2	82, 56, 38, 32, 49, 48, 64.
7556	Lewiston Ham & Co. Japanese millet	92.0	92.2	4, 82, 45, 32.
7566	Lewiston. Haskell Implement & Seed Company. Japanese millet	98.0	96.0	82, 32, 56, 31.
7767	Livermore Falls. Geo. Chandler. Japanese millet	98.0	98.0	32.
7818	Norridgewock. Brackett & Russell. Japanese millet	97.6	97.5	59, 82, 75.
7809	North Anson. Porter & Marston. Japanese millet	97.5	98.5	32, 82, 78.
7787	Orland. A. R. Buck. Japanese millet	96.0	96.6	82, 49, 38.
7722	Patten. I. B. Gardner & Sons. Japanese millet	98.2	98.2	82.
7723	Patten. Quincy & Rowe. Japanese millet	89.4	90.5	82.
7608	Portland. Allen, Sterling & Lothrop. Japanese millet	97.0	90.7	32, 82, 56, 38.

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Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1915, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guraanty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
7602	Portland. Kendall & Whitney. Japanese millet	90.0	96.0	82, 32, 69.
7832	Princeton. H. H. Allen Japanese millet	96.8	95.8	56, 82, 49, 32, 59.
7624	Saco Saco Grain & Milling Co. Japanese millet	90.0	87.0	82, 36, 38.
7807	Skowhegan. D. A. & W. E. Porter. Japanese millet	89.4	90.0	82, 75.
7794	Stockton. Goodhue & Co. Japanese millet	96.0	97.1	32, 78, 45, 51, 82, 59.
	MONMOUTH CLOVER.			
†7437	Auburn. Oscar Holway Co. Mammoth clover	98.0	99.3	24, 57, 58, 5.
7589	Auburn. Oscar Holway Co. Mammoth clover	99.5	99.8	
7648	Bridgewater. A. H. Bradstreet & Sons. Mammoth clover	99.0	99.3	24.
7647	Bridgewater. Fred M. Snow. Mammoth clover	98.0	99.1	58, 24.
7683	Fort Fairfield. S. Nightengale & Sons. Mammoth clove-	99.0	99.5	24, 57.
†7517	Houlton. John Watson & Co. Mammoth clover	99.0	99.7	24.
†7519	Houlton. John Watson & Co. Mammoth clover	99.0	99.5	24.
†7540	Houlton. John Watson & Co. Mammoth clover	99.0	99.5	24, 31, 64
†7707	Houlton. John Watson & Co. Mammoth clover	98.7	97.7	57, 7, 5, 70, 24, 33.
7681	Limestone. Louis Cyr. Mammoth clover	98.0	98.0	56, 57, 62.
7679	Van Buren. H. A. Gagnon. Mammoth clover	98.0	98.3	32, 58, 31, 12.
7696	Van Buren. W. F. Paridis. Mammoth clover	99.2	99.6	

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Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1915, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
	OATS.			
7550	Auburn. Wilson & Co. Oats	98.0	100.0	
7687	Bowdoinham. C. P. Bates. Oats	-	98.0	82.
7688	Bowdoinham. W. B. & E. P. Kendall. Oats	-	99.3	82.
7689	Bowdoinham. W. B. & E. P. Kendall. Oats	-	91.6	56, 31, 13, 44, 1, 43, 82, 38, 3, 37.
7656	Cornish. Pendexter Bros. C. Oats	98.73	98.3	
7635	Freeport. Ralph E. Bailey & Co. Oats	97.0	97.7	
7654	Fryeburg. C. E. Fox. Oats	96.0	95.9	
7657	Hiram. Seth Clemons. Oats	99.0	99.0	
7606	Portland. Allen, Sterling & Lothrop. Oats	97.0	99.0	
7607	Portland. Allen, Sterling & Lothrop. Oats	97.0	99.2	
7598	Portland. Kendall & Whitney. Oats	98.0	98.2	56.
7599	Portland. Kendall & Whitney. Oats	96.0	96.4	
†7544	Portland. F. A. Waldron & Son. Oats	-	95.1	69.
7769	Sabattus. Judson Bangs Co. Oats	97.0	99.5	19.
	RAPE.			
7581	Auburn. Oscar Holway Co. Rape	99.0	99.5	
	RED CLOVER.			
†7537	Ashland. H. B. Bartlett & Co. Globe clover	99.0	99.8	53, 38.
†7438	Auburn. Oscar Holway Co. "Aspec" Red Clover	99.0	99.4	32, 58, 24, 57, 31, 56.

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Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1915, arranged alphabetically by towns and dealers.—Continued.

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7571	Auburn. Oscar Holway Co. Clover	98.0	98.0	1, 57, ,62.
7572	Auburn. Oscar Holway Co. Clover	95.0	99.0	
7585	Auburn. Oscar Holway Co. Clover	99.0	99.8	
7691	Augusta. Webber & Hewitt. Clover.	98.0	99.0	32.
7735	Brewer. S. S. Herrick & Co. Red Clover	98.0	97.0	32, 62, 76, 58, 56, 44, 82, 45, 5.
7783	Bucksport. Andrew Ginn. Red clover	98.0	98.0	57, 76, 58.
7782	Bucksport. H. L. Marks. Red clover	98.0	99.2	58, 32, 24.
7682	Caribou. Shaw & Mitton. Red clover	98.0	98.4	57, 31.
7823	Carmel. W. C. Haskell. Red clover	98.0	98.3	57, 32, 5.
7821	Carmel. Whitten & Friend. Red clover	98.0	98.2	32, 57, 39.
7788	Castine. A. W. Clark. Red clover	99.0	99.0	32, 76, 58.
7753	Charleston. F. J. Dority. Red clover	98.0	98.6	32, 57, 24.
7752	Charleston. W. L. Farmer. Red clover	99.5	99.4	82, 31, 32.
7854	Cherryfield. Davis & Webb. Red clover	96.0	93.1	32, 57, 44, 24, 31, 5, 58.
7851	Cherryfield. A. L. Stewart & Son. Red clover	97.0	98.0	32, 45, 38.
7883	Columbia. G. W. Coffin. Red clover	98.0	98.5	62, 38, 31, 32.
7890	Columbia Falls. B. B. Tibbetts. Red clover	97.0	99.0	32, 58.

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	Corinna. Eastern Grain Co.			
7749	Red clover	98.5	98.0	57, 22, 24.
	Dexter. Dexter Grain Store Co.			
7739	Red clover	99.25	99.2	32.
	East Brownfield. E. O. Walker.			
7651	Clover	99.5	99.6	31.
	East Gray. Gray Milling Co.			
7813	Red clover	98.0	98.5	14. 57, 38.
	Easton. C. W. Spear..			
7684	Red clover	96.0	98.0	32.
	Ellsworth. F. B. Aiken.			
7862	Red clover	99.0	98.0	57, 5.
	Ellsworth. C. W. Grindall.			
7865	Red clover	99.0	99.1	38.
	Ellsworth. A. W. Joy.			
7863	Red clover	99.0	99.7	
	Fort Kent. Fort Kent Mill Co.			
7715	Red clover	96.0	98.0	57, 3.
	Fort Kent. F. E. Michaud.			
7702	Red clover	98.0	98.7	57, 32, 38, 31.
	Fort Kent. H. W. Nadeau.			
7703	Red clover	98.0	99.3	37, 23, 64.
	Fort Kent. Ramsey & Daigle.			
7713	Red clover	98.0	99.0	57, 32.
	Foxcroft. A. W. Gilman & Co.			
†7501	Pan American Red Clover	98.0	97.[illegible]	24, 32, 38. 58, 62.
	Foxcroft. A. W. Gilman, & Co.			
†7503	Eureka Clover	99.5	99.6	32, 24, 62.
	Gardiner. Gray-Hildreth Co.			
†7525	Pan American Red Clover	98.0	97.7	58, 24, 32, 38, 37, 57, 64.
	Gardiner. Gray-Hildreth Co.			
7618	Red clover	99.8	98.6	24, 26, 31, 57.
	Gardiner. Wm. W. Wood & Sons.			
7619	Red clover	99.0	99.1	57.
	Guilford. John Scales.			
7743	Red clover	98.0	96.5	32, 57, 58, 31, 3.

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7620	Hallowell. Frank S. Wingate. Red clover	99.0	98.7	24.
7884	Harrington. W. W. Plummer. Red clover	95.0	95.3	57, 32, 76, 31, 58, 62.
7827	Hermon. L. I. Leathers. Red clover.	99.3	97.0	58.
7641	Houlton. Putnam Hardware Co. Red clover	99.5	99.3	32.
†7511	Houlton. John Watson & Co. Ace clover	98.0	98.6	32, 57, 33, 24, 38.
†7512	Houlton. John Watson & Co. Ace clover	98.0	98.4	32, 57, 7, 53, 24, 5, 38. 44, 33.
†7516	Houlton. John Watson & Co. Globe clover	99.0	99.7	32, 12.
†7518	Houlton. John Watson & Co. Globe clover	99.0	99.3	32, 58, 56, 3.
†7539	Houlton. John Watson & Co. Globe clover	99.0	99.8	32.
7644	Houlton. John Watson & Co. Red clover	99.6	99.5	57, 32, 58.
†7662	Houlton. John Watson & Co. Globe clover	99.6	99.3	32, 58, 24, 57.
†7708	Houlton. John Watson & Co. Red clover	98.7	98.0	57, 7, 33, 24, 14, 38.
†7710	Houlton. John Watson & Co. Ace clover	98.0	98.4	57, 32, 56, 5, 62, 7.
7666	Jonesport. B. B. Mansfield. Red clover	99.0	99.4	24.
7627	Kennebunk. Wm. Bartlett. Clover	95.0	96.5	57, 5, 62, 45.
7554	Lewiston. Ham & Co. Clover	97.0	97.9	32, 58, 5, 58, 24.
7557	Lewiston. Haskell Implement & Seed Company. Red clover	99.0	99.6	

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†7621	Livermore Falls. T. Hersey Record. Eureka red clover	99.6	99.5	32, 31.
7877	Machias. Machias Lumber Co. Red clover	98.0	97.7	32, 57, 53, 7,5.
7874	Machiasport. W. S. Cates. Red clover	98.0	94.8	57, 32.
7679	Mars Hill. York & Fenderson. Red clover	99.0	99.5	
7834	Milltown. S. S. Pineo. Red clover	98.0	97.7	33.
7730	Milo. Henry Cotter Co. Red clover	98.0	97.5	32, 22, 37.
7646	Monticello. Lee Good. Red clover	99.5	99.0	
7751	Newport. Hanson & Pingree. Red clover	98.0	97.7	57, 5, 58, 32, 24.
†7486	Newport. Judkins & Gilman. Eureka red clover	99.5	99.8	32, 62, 38.
7798	Old Town. C. E. Lunt. Red clover	99.0	99.5	32.
7786	Orland. A. R. Buck. Red clover	98.0	97.8	57, 32, 7, 76.
7844	Pembroke. Hobart-Pattengall & Co. Red clover	99.0	96.3	
7842	Perry. J. F. Gove & Son Red clover	98.0	99.4	57.
7824	Portland. Allen, Sterling & Lothrop. Red clover	99.0	99.4	31.
7594	Portland. Kendall & Whitney. Clover	97.0	99.2	
7595	Kendall & Whitney, Clover	99.0	99.2	57.
7717	St. Francis. C. E. Jones. Red clover	98.0	98.5	32.
7716	St. Francis. Raymond Pelletier. Red clover	98.0	99.1	57,5.

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7796	Searsport. Grain & Grocery Co. Red clover	98.0	97.5	32, 57, 45, 58.
7725	Sherman Station. J. P. & F. L. Rush. Red clover	99.5	99.0	38.
7694	Washburn. Aroostook Co-operative Store Co. Red clover	99.5	99.0	
7611	Waterville. G. A. Kennison. Red clover	98.0	99.1	58, 32, 31.
7817	Welchville. Robinson Grain Co. Red clover	98.0	98.7	31, 63, 51.
7779	Winterport. Isaac Rankin. Red clover	96.0	95.5	32, 58, 57, 24, 5, 76, 74.
	REDTOP.			
†7441	Auburn. Oscar Holway Co. "Afac" red top	92.0	93.2	80, 61, 40, 42, 53, 25.
7582	Auburn. Ocsar Holway Co. Red top	80.0	61.0	80, 28, 61, 53, 50, 64, 45.
7583	Auburn. Oscar Holway Co. Red top	90.0	90.2	80, 61, 42, 40, 81.
7690	Augusta. G. D. Haskell & Son. Red top	92.0	88.0	25.
7848	Augusta. G. D. Haskell & Son. Red top	90.0	91.8	25.
7737	Brewer. H. Brastow & Son. Red top	90.0	90.2	80, 25, 53, 40, 61, 28.
7732	Brewer. A. C. Moore. Redtop	92.0	91.0	80, 25, 53.
7781	Bucksport. H. L. Marks. Redtop	90.0	89.8	25, 80, 53, 61, 72.
7889	Columbia Falls. R. M. Allen. Redtop	90.0	87.6	80, 25, 61, 53.
7887	Columbia Falls. C. F. Wilson. Redtop	92.0	91.2	80, 25, 61, 40, 45.
7853	Cherryfield. G. R. Campbell & Co. Redtop	92.0	92.4	80, 25, 61.
7850	Cherryfield. A. L. Stewart & Sons. Redtop	90.0	91.2	80, 25, 61, 53, 40.

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7811	Fairfield. Fairfield Grain Co. Red top	90.0	90.8	80, 61, 40 42, 25.
†7530	Gardiner. Gray-Hildtryh Co. Red top	89.0	90.4	80, 25, 61, 53, 62, 40.
†7543	Houlton. John Watson & Co. Globe red top	96.0	98.2	80, 25, 61.
†7498	Lewiston. J. B. Ham & Co. Red top	90.0	93.7	80, 61, 40, 50, 28.
7563	Lewiston. Haskell Implement & Seed Co. Red top	80.0	88.4	80, 61, 40, 28.
†7488	Newport. Judkins & Gilman Co. Red top	90.0	90.3	80, 25, 61, 40, 55, 53.
7597	Portland. Kendall & Whitney. Red top	95.0	91.6	80, 61, 23, 30.
7745	Sangerville. Drake & Carr. Red top	92.0	92.6	80, 25, 53, 41, 42.
7795	Searsport. Grain & Grocery Co. Redtop	92.0	90.8	80, 25, 61, 40, 42, 72.
†7495	Skowhegan. D. A. & W. E. Porter. Red top	89.0	89.7	80, 61, 53, 25.
	RYE.			
7666	Norway. H. E. Gibson. Winter Rye	99.5	99.6	19.
	TIMOTHY.			
†7536	Ashland. H. B. Bartlett & Co. Pine Tree Timothy	99.5	99.6	26, 31, 28, 9, 50, 61, 55.
7719	Ashland. H. B. Bartlett & Co. Timothy	99.5	99.6	
7569	Auburn. Oscar Holway Co. Timothy	99.5	99.5	25.
7570	Auburn. Oscar Holway Co. Timothy	99.5	99.5	
7575	Auburn. Oscar Holway Co. Timothy	99.0	99.0	53, 28.
7576	Auburn. Oscar Holway Co. Timothy	98.0	98.6	53, 31, 28, 41 ,25.

* The numbers refer to weeds named in the table on pages 199 and 200. E. g. 1 is Apetalous peppergrass. 2 is American wild mint, etc.
† Sample taken under directions with guaranty and sent in by dealer.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1915, arranged alphabetically by towns and dealers—Continued.

Station number.	KIND OF SEED, NAME AND TOWN OF DEALER.	PURITY. Guaranty.	PURITY. Found.	*Kinds of Noxious Weed Seeds.
7833	Auburn. Oscar Holway Co. Timothy	99.5	99.8	
7551	Auburn. Prout Bros. Timothy	97.7	98.0	28, 26, 81, 73.
7545	Auburn. Wilson & Co. Pine Tree Timothy	99.5	99.6	58.
7693	Bath. Kimball Bros. Co. Timothy	99.5	99.6	
7736	Brewer. H. Brastow & Sons. Timothy	99.7	99.7	81.
7733	Brewer. Harlow Bros. Timothy	99.4	98.4	58, 9, 61, 81.
7731	Brewer. A. C. Moore. Timothy	98.0	98.2	28, 58, 9, 81, 40, 26.
7659	Bridgton. Cumberland & Oxford Produce Exchange. Timothy	99.0	99.0	28, 61.
7727	Brownville. O. P Gerry. Timothy	99.5	99.5	28.
7763	Canton. G. W. Carson. Timothy	99.5	99.5	50.
7773	Caribou. Jos. H. Glenn. Timothy	99.8	99.8	77,15.
7774	Caribou. Caribou Grange Store. Timothy	99.8	99.8	77.
7822	Carmel. W. C. Haskell. Timothy	98.0	98.5	62, 50, 28, 58, 70.
7805	Carmel. Whitten & Friend. Timothy	99.5	99.6	50.
7789	Castine. A. W. Clark. Timothy	99.5	99.6	28.
7791	Castine. Parker & Wescott. Timothy	99.6	99.2	45, 72.
7790	Castine. Patterson Bros. Timothy	99.5	99.5	

* The numbers refer to weeds named in the table on pages 199 and 200. E. g. 1 is for Apetalous peppergrass. 2 is American wild mint, etc.
† Sample taken under directions with guaranty and sent in by dealer.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1915, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
7856	Cherryfield. A. M. Mathews. Timothy	99.5	99.5	31.
7868	Cherryfield. J. Monohon. Timothy	97.6	97.7	28, 58, 50, 81, 84, 26, 25, 61.
7882	Columbia. G. W. Coffin. Timothy	99.0	99.3	
7881	Columbia. H. L. Worcester. Timothy	99.0	99.5	9, 61, 28.
7849	Columbia Falls. Chandler's Cash Store. Timothy	99.5	99.7	62.
7891	Columbia Falls. B. B. Tibbetts. Timothy	99.0	99.5	
7886	Columbia Falls. C. F. Wilson. Timothy	99.0	91.3	25, 80.
7740	Dexter. S. L. Small. Timothy	99.5	99.5	26, 44.
7650	East Brownfield. E. D. Walker. Timothy	99.5	99.4	62.
7872	East Machias. E. E. Wiswell & Son. Timothy	98.0	99.7	
7838	Eastport. G. W. Capen Co. Timothy	99.5	99.6	32, 45.
7840	Eastport. G. W. Capen Co. Timothy	99.0	99.3	62, 77.
7835	Eastport. E. S. Martin & Sons. Timothy	99.0	99.0	58, 81, 46, 28.
7861	Ellsworth. F. B. Aiken. Timothy	99.0	98.5	28, 26, 50, 9.
7864	Ellsworth. C. W. Grindal. Timothy	99.5	99.5	64.
7700	Fort Kent. J. H. Audibert. Timothy	99.5	99.5	50, 58, 28, 9.
7714	Fort Kent. U. Dumond. Timothy	99.5	99.5	26, 28.

* The numbers refer to weeds named in the table on pages 199 and 200. E. g. 1 is for Apetalous peppergrass. 2 is American wild mint, etc.
† Sample taken under directions with guaranty and sent in by dealer.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1915, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
7704	Fort Kent. J. M. Duprey. Timothy	99.5	99.3	9, 50, 28, 26.
†7504	Foxcroft. A. W. Gilman & Co. Imperator Timothy	98.75	99.0	28, 58, 81.
†7505	Foxcroft. A. W. Gilman & Co. Gold Medal Timothy	99.5	99.8	26.
7857	Franklin. F. P. Gott. Timothy	99.5	99.6	28, 9.
7870	Franklin. D. C. Bragdon. Timothy	99.6	99.6	50.
†7524	Gardiner. Gray-Hildreth Co. Pan American Timothy	99.5	99.4	58, 28, 81, 26, 62.
7741	Guilford. H. Douglass & Co. Timothy	99.4	99.3	9.
7885	Harrington. O. S. Plummer & Son. Timothy	99.5	99.5	31, 26.
7640	Houlton. Almon H. Fogg. Timothy	99.0	99.7	62.
†7507	Houlton. John Watson & Co. Pine Tree Timothy	99.5	99.5	61, 31, 50, 28, 9, 26, 44
†7508	Houlton. John Watson & Co. Pine Tree Timothy	99.5	99.3	50, 9, 31, 28, 26, 45, 58, 61
†7509	Houlton. John Watson & Co. Pine Tree Timothy	99.5	99.6	50, 61, 58, 31, 62, 45, 26, 9.
†7510	Houlton. John Watson & Co. Pine Tree Timothy	99.5	99.7	83, 26.
†7520	Houlton. John Watson & Co. Pine Tree Timothy	99.5	99.4	28, 53, 31, 61.
†7541	Houlton. John Watson & Co. Pine Tree Timothy	99.5	99.4	28, 50, 9, 53, 25, 40.
†7561	Houlton. John Watson & Co. Boss Timothy	99.7	98.7	62, 28, 53, 33, 50, 77, 45, 83, 31, 80, 61.
†7661	Houlton. John Watson & Co. Pine Tree Timothy	99.5	99.6	62, 28.

* The numbers refer to weeds named in the table on pages 199 and 200. E. g. 1 is for Apetalous peppergrass. 2 is Amei can wild mint, etc.
† Sample taken under directions with guaranty and sent in by dealer.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1915, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
†7706	Houlton. John Watson & Co. Boss Timothy	99.7	99.4	28, 81, 53.
†7709	Houlton. John Watson & Co. Pine Tree Timothy	99.5	99.6	53, 45, 77, 31, 28, 26.
7816	Intervale. J. W. Rideout & Co. Timothy	97.8	98.0	28, 81, 26, 25, 61, 50, 58.
7720	Island. Falls. Island Falls Grange Store. Timothy	99.5	99.7	77, 26.
7867	Jonesport. B. V. Mansfield. Timothy	99.5	99.6	50.
7755	Kenduskeag. A. M. Foss. Timothy	98.0	98.0	28, 26, 50, 34, 45, 58.
7553	Lewiston. E. P. Ham & Co. Timothy	99.5	99.5	
†7497	Lewiston. J. B. Ham & Co. Pan American Timothy	99.5	99.6	50, 61, 28, 79.
7591	Lewiston. J. B. Ham & Co. Timothy	98.0	98.7	50, 41.
†7623	Livermore Falls. T. Hersey Record. Gold Medal Timothy	99.7	99.7	26.
7839	Lubec. J. M. Pike. Timothy	97.8	97.3	28, 58, 25, 45.
7837	Lubec. S. B. Stuart & Co. Timothy	99.5	99.3	50.
7875	Machias. L. W. Longfellow. Timothy	99.5	99.6	50.
7873	Machiasport. E. S. Cates. Timothy	99.5	95.2	61, 32.
7800	Milford. Spruce Bros. & Co. Timothy	99.4	99.3	28, 53.
7802	Milford. E. W. Stuart. Timothy	99.4	98.8	28, 26, 58, 50, 51, 9, 45, 31
7728	Milo. C. W. Wentworth. Timothy	99.0	98.5	26, 28, 58, 81, 34, 45, 61, 40, 11, 51.
†7485	Newport. Judkins & Gilman Co. Pan American Timothy	99.5	99.3	50, 61.

* the numbers refer to weeds named in the table on pages 199 and 200. E. g. 1 is for Apetalous peppergrass: 2 is American wild mint, etc.
† Samples taken under direction with guaranty and sent in by dealer.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1915, arranged alphabetically by towns and dealers—Continued.

Station number.	Kind of Seed, Name and Town of Dealer.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
7750	Newport. Judkins & Gilman Co. Timothy	99.3	99.5	50, 61.
7819	Norridgewock. Norridgewock Farmer's Union. Timothy	99.5	98 7	53, 25, 79.
7638	North Berwick. D. W. Bragdon. Timothy	99.5	99.2	26.
7636	North Berwick. Johnson Bros. Timothy	97.0	97.8	28, 58, 50, 26, 31.
7616	North Newbury. C. A. Staples & Son. Timothy	99.5	99.6	
7858	North Sullivan. Hooper, Harvey & Co. Timothy	99.5	99.3	50, 61, 33, 26.
7860	North Sullivan. H. E. Robertson. Timothy	97.7	98.4	28, 50, 79, 31, 62.
7617	North Vassalboro. W. A. Lord. Timothy	99.0	99.3	58.
7803	Old Town. Old Town Supply Co. Timothy	99.5	99.6	
7804	Old. Town. Old Town Supply Co. Timothy	99.5	99.6	53.
7846	Pembroke. C. Laughlin. Timothy	99.5	99.4	62.
7841	Perry. J. F. Gove & Son. Timothy	98.0	99.0	28, 24, 26, 62, 58.
7592	Portland. Kendall & Whitney. Timothy	99.5	99.5	28, 26.
7593	Portland. Kendall & Whitney. Timothy	98.0	98.9	81, 2.
7680	Presque Isle. E. M. Fernald. Timothy	98.6	99.0	58.
7830	Princeton. H. H. Allen. Timothy	99.5	99.3	50.
7765	Rumford. A. S. Burgess. Timothy	98.0	98.7	58.
7744	Sangerville. Sanders Bros. & Co. Timothy	98.0	99.5	26.

* The numbers refer to weeds named in the table on pages 199 and 200. E. g. 1 is for Apetalous peppergrass. 2 is American wild mint, etc.
† Sample taken under directions with guaranty and sent in by dealer.

Table showing the results of examination of samples of seeds collected by the inspectors in the spring of 1915, arranged alphabetically by towns and dealers.—Concluded.

Station number.	Kind of Seed, Name and Town of Dealers.	Purity. Guaranty.	Purity. Found.	*Kinds of Noxious Weed Seeds.
7797	Searsport. Whitcomb & Son. Timothy	99.5	99.7	
†7494	Skowhegan. D. A. & W. E. Porter. Pan American Timothy	99.5	99.3	58, 62, 28, 81.
7810	Skowhegan. S. W. Gould. Timothy	98.0	98.4	53, 61.
7671	South Windham. Fred Scott. Timothy	98.0	98.2	28, 53, 81, 26, 50.
7632	Springvale. S. D. Hanson. Timothy	99.5	99.7	58.
7629	Springvale. Rowe & Bartlett. Timothy	99.5	99.1	53.
7695	Stockholm. Louis Anderson. Timothy	99.8	99.8	
7609	Westbrook. John Lawrence. Timothy	97.7	98.0	28, 26, 58, 25, 41.
7615	West Hampden. C. L. & R. G. Barrows. Timothy	99.4	99.4	58, 9.
7879	West Jonesport. Cummings & Norton. Timothy	99.0	99.4	28, 31, 53.
7845	West Pembroke. E. H. Fisher. Timothy	98.0	98.8	62, 50, 53, 25, 31.
7780	Winterport. Chas. R. Hill. Timothy	99.6	99.5	58.
7778	Winterport. Isaac Rankin. Timothy	98.0	98.6	58, 28, 2, 25.
	VETCH.			
7587	Auburn. Oscar Holway Co. Vetch	96.0	98.1	
	WHITE CLOVER.			
7580	Auburn. Oscar Holway Co. White Clover	95.0	96.8	53, 28, 31, 5.
†7526	Gardiner. Gray-Hildreth Co. White Clover	95.0	95.7	62, 16, 57, 35, 5, 42, 83, 29, 68.
	MIXTURE.			
7670	South Paris. N. D. Bolster Co. Lawn Grass	–	83.3	62, 42, 61, 2, 25, 41, 80.

* The numbers refer to weeds named in the table on pages 199 and 200. E. g. 1 is for Apetalous peppergrass. 2 is American wild mint, etc.
† Sample taken under directions with guaranty and sent in by dealer.

Table showing results of examination of samples of seed in 1915.

Name of Weeds.	Kind of Seed and Number of Samples.									
	Red clover.	Alsike clover.	Mammoth clover.	Timothy.	Redtop.	Japanese millet.	Hungarian.	Oats.	White clover.	Alfalfa.
Number of samples examined	100	97	19	132	23	23	27	15	3	6
Apetalous peppergrass	1	3	–	–	–	–	–	1	–	–
American wild mint	–	–	–	4	–	–	–	–	–	–
Barnyard grass	8	–	–	–	–	–	4	1	–	1
Beaked nightshade	–	–	–	–	–	1	–	–	–	–
Black medick	16	55	2	–	–	–	1	–	3	–
Bladder ketmia	–	–	–	–	–	–	1	–	–	–
Bird's foot trefoil	9	–	2	–	–	–	–	–	–	–
Blue field madder	1	–	–	–	–	–	–	–	–	–
Blue vervain	–	–	1	21	–	–	1	–	–	–
Bracted plantain	2	–	–	–	–	–	–	–	–	–
Canada thistle	–	12	–	2	–	–	–	–	–	–
Catnip	3	1	2	1	–	–	–	–	–	–
Charlock	–	–	–	–	–	–	–	1	–	–
Chicory	3	–	–	–	–	–	–	–	–	–
Clarkia	–	–	–	1	–	–	–	–	–	–
Common chickweed	–	–	–	–	–	–	–	–	1	–
Common nightshade	–	–	–	–	–	–	2	–	–	–
Common St. John wort	–	–	–	1	–	–	–	–	–	–
Corn cockle	–	–	–	–	–	–	–	1	–	–
Corn gromwell	1	–	–	–	–	–	–	–	–	–
Corn mayweed	–	–	–	1	–	–	–	–	–	–
Crabgrass	2	–	–	–	–	–	4	–	–	–
Crane's bill	2	–	–	–	–	–	–	–	–	–
Dock	29	36	11	2	–	–	–	–	1	–
Ergot	–	–	–	20	17	–	–	–	–	–
Evening primrose	2	1	–	42	–	–	–	–	–	–
False flax	–	7	–	–	–	–	–	–	–	–
Five finger	–	11	–	58	5	–	–	–	1	–
Flax dodder	–	–	–	–	–	–	–	–	1	–
Fowl meadow grass	–	–	–	–	1	–	–	–	–	–

Table showing results of examination of samples of seed in 1915
—Continued.

Names of Weeds.	Kind of Seed and Number of Samples.									
	Red clover.	Alsike clover.	Mammoth clover.	Timcthy.	Redtop.	Japanese millet.	Hungarian.	Oats.	White clover.	Alfalfa.
Goosefoot	24	22	4	21	-	1	11	1	1	1
Green foxtail	59	11	5	4	-	15	20	-	-	2
Heal-all	7	3	1	3	-	-	-	-	-	-
Hedge mustard	-	4	-	3	-	-	-	-	-	-
Hoary alyssum	-	-	-	-	-	-	-	-	1	-
Indian mallow	-	-	-	-	-	1	-	-	-	-
Knot grass	5	-	-	-	-	-	2	1	-	-
Lady's thumb	21	1	1	-	-	6	11	1	-	-
Mayweed	2	14	-	3	1	-	-	-	-	-
Mint	-	-	-	4	12	-	-	-	-	-
Moth mullen	-	-	-	6	2	-	-	-	-	-
Mouse ear chickweed	-	7	-	-	6	-	-	-	1	-
Mustard	1	1	-	-	-	-	1	1	-	-
Night flowering catch fly	8	61	1	4	-	-	-	1	-	-
Ole-witch grass	6	8	-	15	2	1	12	-	-	-
Ovoid spike rush	-	1	-	1	-	-	-	-	-	-
Ox-eye daisy	-	1	-	1	-	-	-	-	-	-
Pale persicaria	-	-	-	-	-	2	16	-	-	-
Pennsylvania persicaria	-	-	-	-	-	4	2	-	-	-
Peppergrass	-	6	-	36	2	-	-	-	-	-
Pigweed	2	1	-	3	-	2	3	-	-	-
Pimpernel	1	-	-	-	-	-	-	-	-	-
Plantain	5	19	-	15	11	-	-	-	1	-
Poison hemlock	-	-	-	3	-	-	-	-	-	-
Purslane	-	1	-	1	1	-	-	-	-	-
Ragweed	6	-	1	-	-	7	5	2	-	-
Ribgrass	48	13	6	1	-	-	-	-	1	-
Rugel's plantain	31	11	7	42	-	-	2	-	-	-
Russian thistle	-	-	-	-	-	4	-	-	-	2

Table showing results of examination of samples of seed in 1915
—Concluded.

Names of Weeds.	Kind of Seed and Number of Samples.									
	Red clover.	Alsike clover.	Mammoth clover.	Timothy.	Redtop.	Japanese millett.	Hungarian.	Oats.	White clover.	Alfalfa.
Sand rocket	–	–	–	1	–	–	–	–	–	–
Sedge	–	4	–	19	19	–	1	–	–	–
Sheep sorrel	13	57	3	21	1	–	–	–	2	–
Shepherd's purse	–	6	–	–	–	–	–	–	–	–
Slender crabgrass	6	–	1	1	1	1	6	–	–	–
Small flowered crane's bill	–	–	–	–	–	–	–	–	1	–
Spring sida	–	–	–	–	–	–	1	–	–	–
Spurge	2	–	–	–	–	–	2	–	–	–
Suckling clover	–	20	–	–	–	–	–	–	1	–
Sunflower	–	–	–	–	–	1	–	1	–	–
Tumble-weed	–	–	1	2	–	–	5	–	–	–
Virginia three-seeded murcury	1	–	–	–	–	–	–	–	–	–
Wall speedwell	–	1	–	1	2	–	–	–	–	–
White vervain	–	–	–	5	–	–	–	–	–	–
Whorled mallow	1	–	–	–	–	–	–	–	–	–
Wild buckwheat	–	–	–	–	–	2	–	–	–	–
Wild carrot	–	11	–	–	–	–	–	–	–	–
Willow herb	–	1	–	8	–	–	–	–	–	–
Winged pigweed	–	–	–	–	–	2	–	–	–	–
Wormseed mustard	1	1	–	4	–	–	–	–	–	–
Yarrow	–	–	–	6	21	–	–	–	–	–
Yellow daisy	–	–	–	21	1	–	–	–	–	–
Yellow foxtail	3	–	–	–	–	17	11	3	–	–
Yellow rocket	–	2	–	3	–	–	–	–	1	–
Yellow-wood sorrel	–	–	–	2	–	–	–	–	–	–

DECEMBER, 1915.

MAINE
AGRICULTURAL EXPERIMENT STATION
ORONO, MAINE.
CHAS. D. WOODS, Director.

ANALYSTS.

James M. Bartlett
Royden L. Hammond
Elmer R. Tobey
Herman H. Hanson
Edward E. Sawyer
Walter H. Rogers

Official Inspections

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FERTILIZER INSPECTION.

The Commissioner of Agriculture is the executive of the law regulating the sale of commercial fertilizers in Maine. It is the duty of the Director of the Maine Agricultural Experiment Station to make the analyses of the samples collected by the Commissioner, and to publish the results of the analyses of the samples of commercial fertilizers, together with the names of the persons from whom the samples were obtained, the names of the manufacturers thereof and such additional information as may seem advisable.

The outlines of the requirements of the law begin on page 226 and the explanation of the tables on page 228. The tabulated results of analyses begin on page 230. The discussion of the results of analyses and an article on fertilizers without potash in 1916 follow the tables.

NOTE. All correspondence relative to the inspection laws should be addressed to the Commissioner of Agriculture, Augusta, Maine.

Outline of the Requirements of the Law.

The following are the chief points of the law and the regulations. The full text of the law will be sent on application to the Commissioner of Agriculture, Augusta, Maine.

1. *Kind of materials coming under the law.* The law applies to the sale, distribution, transportation, or the offering or exposing for sale, distribution or transportation, any materials used for fertilizing purposes the price of which exceeds $10 per ton, and to lime, marl and wood ashes intended for fertilizing purposes at whatever price they are sold.

2. *The Brand.* Every lot or package shall be plainly marked with:

The number of net pounds in the package.

The name or trade mark under which it is sold.

The name and principal address of the manufacturer or shipper.

The minimum percentage of nitrogen, or its equivalent in ammonia, in available form.

The minimum percentage of available phosphoric acid (soluble and reverted).

The minimum percentage of total phosphoric acid.

The minimum percentage of potash soluble in water.

In the case of lime, marl and wood ashes each package shall, in addition to the above, be plainly marked with:

The minimum and maximum percentage of total lime (calcium oxide).

The minimum and maximum percentage of total magnesia (magnesium oxide).

The minimum and maximum percentage of lime combined as carbonate (calcium carbonate).

The minimum and maximum percentage of magnesium combined as carbonate (magnesium carbonate).

The minimum percentage of lime-sulphur (calcium sulphate) in gypsum or land plaster.

If a fertilizer (including lime, marl and wood ashes) is sold in bulk or put up in packages belonging to the purchaser, upon the request of the purchaser he shall be furnished with a copy of the statements named above.

3. *Manufacturers' certificate.* Before manufacturing, selling or distributing a commercial fertilizer a ceritfied copy of the statements named in 2 shall be filed with the Commissioner of Agriculture.

4. *Manufacturers' samples.* When the Commissioner of Agriculture shall so request, the manufacturer shall furnish a sealed package containing not less than two pounds of the commercial fertilizer.

5. *Registration fee.* A registration fee is assessed on any brand offered for sale, distribution or transportation in the State as follows: $10 for the nitrogen, $10 for the phosphoric acid, $5 for the potash and $10 for the lime contained or said to be contained in the fertilizer. The filing of the certificate and the payment of the fee is required from only one person for a given brand.

6. *Registration may be refused or canceled.* The Commissioner of Agriculture may refuse to register any commercial fertilizer which bears a name that is misleading or deceptive or which would tend to mislead or deceive as to the materials of which it is composed. The Commissioner of Agriculture also has power to cancel the registration of a fertilizer manufactured, sold, distributed or transported in violation of any of th provisions of the law.

7. *Adulteration.* A fertilizer is adulterated if its weight, composition, quality, strength or purity varies from its fixed guaranty or if it contains any materials deleterious to growing plants.

8. *Misbranding.* A fertilizer is misbranded if; the package or label carries any statement, design or device that is false or misleading in any particular; the container does not carry the statements named in 2; the printed statements attached to the container differ from the statements in the certificate; and if the registration fee has not been paid.

9. *Analysis for correspondents.* A special law provides for the analysis of samples of fertilizers on sale in Maine taken in accordance with the law and the payment of an analysis fee of $10. If the analysis proves to be of public importance the analysis fee will be returned. Otherwise the money will be used in the enforcement of the law. Blanks with full directions will be furnished by the Commissioner of Agriculture on request.

10. *Written guaranty, the dealers' safeguard.* No prosecution will lie against any person handling commercial fertilizers provided he obtains at the time of purchase a written guaranty signed by the person residing in the United States from whom the purchase was made to the effect that the commercial fertilizer is not adulterated or misbranded within the meaning of the Maine law regulating the sale of commercial fertilizers. After a person has been duly notified that an article of commercial fertilizer appears to be adulterated or misbranded the written guaranty will not protect further sales.

11. *Hearing.* The person who is believed to have violated the law regulating the sale of commercial fertilizer will be granted a hearing at which he may appear in person, or by attorney, or by letter. The notice of the hearing will name the time and place of the hearing and a copy of the charge. Failure to appear will not prejudice the case. The hearing will be private and every opportunity will be given for explanation and the establishment of innocence. If the time appointed is not a convenient one, postponement within reasonable limit will be granted.

12. *Penalty.* Violations of the law are punishable by a fine not exceeding one hundred dollars for the first offense and not exceeding two hundred dollars for each subsequent offense.

RESULTS OF THE INSPECTION.

The tables giving the analyses of the samples collected by the Commissioner of Agriculture during the year 1915, follow.

The table on the even pages gives the Station number of the sample, the name and residence of the person from whom the sample was obtained and the month the sample was drawn.

The table on the even pages gives the Station number of the samples and the detailed analyses. By means of the Station numbers the two tables are readily compared.

EXPLANATION OF THE TABLES.

Under the head of "Nitrogen" in the tables are found seven columns of figures under the following headings:

1. *The nitrogen from nitrates.* In this column is given the percentage of nitrogen present as nitrate. Nitrate nitrogen is wholly and quickly available.

2. *Nitrogen from ammonia salts.* In this column is given the nitrogen from ammonium salts, chiefly sulphate. Ammonia nitrogen is not as quickly available as nitrate nitrogen.

3-4-5. *Organic Nitrogen.* The organic nitrogen is valuable in proportion as the percentage of the active is greater than the inactive, and the amount of water soluble is large or small. A fertilizer showing more than twice as much active as inactive insoluble nitrogen would be rated as high grade. Also in one carrying a quite large percentage of water soluble and small amounts of active and inactive water insoluble the nitrogen would be likewise rated as high grade. One showing a small amount of water soluble and a larger amount of inactive than active would be classed as a poor grade of organic nitrogen. The percentage of inactive as compared with the total organic is the measure of the value of the organic nitrogen in the goods. With a fair amount of organic nitrogen soluble in water, a large per cent of active and a small amount of inactive, the organic nitrogen is considered good. If but a small amount is soluble in water and less active than inactive is found the organic nitrogen would be considered low grade.

3. *Water soluble organic nitrogen.* This is the soluble nitrogen from organic materials, such as dried blood, dried fish or meat, tankage, cottonseed meal, etc. It dissolves in water and is quickly and completely available to the plant.

4. *Active water insoluble organic nitrogen.* The nitrogen in this column is that portion of the organic nitrogen which is insoluble in water but is converted into ammonia by the action of permanganate of potash. It is quite available.

5. *Inactive organic nitrogen.* This is the portion of the organic nitrogen that is not converted into ammonia by the action of the permanganate solution. It is only slowly available.

6. *Total nitrogen found.* 7. *Total nitrogen guaranteed.*

Phosphoric Acid. The table shows the percentages of water soluble, insoluble in weak acid found, and of available and total phosphoric acid found and guaranteed.

Potash. The table shows the percentages of water soluble potash found and guaranteed.

Descriptive List of Fertilizer Samples, 1915.

Station number.	Maker and Brand.	Sample Obtained. From	Sample Obtained. Month.
	AMERICAN AGRICULTURAL CHEM. CO., NEW YORK CITY N. Y.		
3193	A. A. C. Co. Aroostook Potato Manure	Jackson & Hall, Belfast	April
3245	A. A. C. Co. Aroostook Potato Manure	Charles Parsons, Presque Isle	May
3381	A. A. C. Co. Aroostook Potato Manure	George W. Hale, Grimes	May
3158	A. A. C. Co. Grass and Oats	Jackson & Hall, Belfast	April
3612	A. A. C. Co. Grass and Oats	G. H. Simpson, Winslow	June
3614	A. A. C. Co. Grass and Oats	P. R. Pushard, West Dresden	June
3159	A. A. C. Co. Special Aroostook Complete Manure	Jackson & Hall, Belfast	April
3230	A. A. C. Co. Special Northern Maine Potato Manure	Harry R. Burleigh, Houlton	May
3469	A. A. C. Co. Special Northern Maine Potato Manure	Herbert Thompson, Washburn	June
3192	A. A. C. Co. Top Dresser	Jackson & Hall, Belfast	April
3149	Bradley's Alkaline Bone with Potash	Jackson & Hall, Belfast	April
3536	Bradley's Alkaline Bone with Potash	Saco Grain & Milling Co., Saco	June
3603	Bradley's Alkaline Bone with Potash	H. McLaughlin, Bangor	June
3168	Bradley's Corn Phosphate	Jackson & Hall, Belfast	April
3273	Bradley's Corn Phosphate	Jones & Co., Winthrop	May
3576	Bradley's Corn Phosphate	H. McLaughlin, Bangor	June
3142	Bradley's Eclipse Phosphate	R. B. Dunning & Co., Bangor	April
3172	Bradley's Eclipse Phosphate	Jackson & Hall, Belfast	April
3418	Bradley's Eclipse Phosphate	Listers Agricultural Chemical Works, Portland	May
3599	Bradley's Eclipse Phosphate	H. McLaughlin, Bangor	June
3141	Bradley's Eureka Fertilizer	R. B. Dunning & Co., Bangor	April
3491	Bradley's Eureka Fertilizer	E. P. Ham, Lewiston	June
3544	Bradley's Eureka Fertilizer	Clay & Whitney, Sebago Lake	June
3139	Bradley's Extra Complete Manure	R. B. Dunning & Co., Bangor	April

Guaranties and Results of Analysis of Fertilizer Samples, 1915.

	Nitrogen.							Phosphoric Acid.						Potash		
			Organic.			Total.				Available.		Total.				
Station number.	% As nitrate.	% As ammonia.	% As water soluble.	% As active insoluble.*	% As inactive insoluble.	% Found.	% Guaranteed.	% Soluble.	% Insoluble.	% Found.	% Guaranteed.	% Found.	% Guaranteed.	% Found.	% Guaranteed.	Remarks.
3193	1.80	1.40	0.03	0.82	0.36	4.41	4.12	4.31	0.94	9.59	9.0	10.53	10.0	4.66	4.0	
3245	1.32	1.20	0.80	0.57	0.45	4.34	4.12	4.27	1.82	8.75	9.0	10.57	10.0	4.01	4.0	
3381	1.58	1.38	0.18	0.52	0.29	3.95	4.12	4.94	1.74	8.71	9.0	10.45	10.0	4.00	4.0	
3158	-	-	-	-	-	-	-	6.22	0.54	11.17	11.0	11.71	12.0	2.22	2.0	
3612	-	0.02	-	-	-	0.14	-	6.70	0.70	11.26	11.0	11.96	12.0	2.31	2.0	
3614	-	0.02	-	-	-	0.16	-	5.79	1.07	10.72	11.0	12.09	12.0	2.57	2.0	
3159	1.04	0.94	0.10	0.53	0.23	2.84	2.88	4.15	1.22	8.30	8.0	9.52	9.0	4.00	4.0	
3230	1.44	1.28	0.36	0.29	0.17	3.54	3.70	6.19	1.16	10.16	10.0	11.32	11.0	4.23	4.0	
3469	1.16	1.36	0.30	0.71	0.26	3.79	3.70	6.41	1.33	9.77	10.0	11.10	11.0	4.08	4.0	
3192	2.72	1.10	-	0.52	0.30	4.64	4.94	2.41	0.42	7.19	7.0	8.61	8.0	3.71	3.0	
3149	-	-	-	-	-	-	-	8.02	0.75	10.89	11.0	11.64	12.0	2.50	2.0	
3536	-	-	-	-	-	-	-	6.73	0.54	11.47	11.0	12.01	12.0	2.26	2.0	
3603	-	-	-	-	-	0.17	-	7.81	0.93	10.92	11.0	11.85	12.0	2.24	2.0	
3168	0.66	0.68	0.26	0.35	0.21	2.16	2.06	4.18	1.53	8.61	8.0	10.14	9.0	1.61	1.5	
3273	0.62	0.58	0.26	0.42	0.18	2.06	2.06	3.67	1.71	8.11	8.0	9.82	9.0	1.70	1.5	
3576	0.72	0.54	0.32	0.51	0.22	2.31	2.06	4.21	1.84	7.73	8.0	9.57	9.0	1.71	1.5	
3142	0.27	0.51	0.15	0.35	0.23	1.51	1.03	4.07	1.80	7.82	8.0	9.62	9.0	3.28	2.0	
3172	0.06	0.16	0.25	0.42	0.29	1.18	1.03	4.42	1.39	8.47	8.0	9.86	9.0	2.05	2.0	
3418	0.06	0.30	0.35	0.39	0.18	1.26	1.03	3.35	2.30	7.16	8.0	9.46	9.0	2.07	2.0	
3599	-	0.28	0.47	0.30	0.22	1.27	1.03	3.29	2.42	6.54	8.0	8.96	9.0	2.16	2.0	
3141	0.32	0.35	0.02	0.24	0.17	1.10	1.03	4.59	1.34	8.05	8.0	9.39	9.0	2.21	2.0	
3491	0.16	0.06	0.36	0.60	0.20	1.38	1.03	3.30	1.66	8.01	8.0	9.67	9.0	2.37	2.0	
3544	-	0.32	0.37	0.43	0.23	1.35	1.03	2.97	2.40	6.79	8.0	9.19	9.0	2.78	2.0	
3139	1.24	1.24	0.64	-	-	3.12	3.29	6.46	0.78	10.31	10.0	11.09	11.0	4.25	4.0	

* In high grade organic ammoniates the figures in this column are considerably larger than those in the next column.

Description of Samples—Continued.

Station number.	Maker and Brand.	Sample Obtained.	
		From	Month.
3234	Bradley's Extra Complete Manure	M. L. Stantial, Houlton	May
3380	Bradley's Extra Complete Manure	John S. Pierce, Caribou	May
3471	Bradley's Extra Complete Manure	J. M. Hovey, Mars Hill	June
3598	Bradley's Extra Complete Manure	H. McLaughlin, Bangor	June
3140	Bradley's Potato Fertilizer	R. B. Dunning & Co., Bangor	April
3169	Bradley's Potato Fertilizer	Jackson & Hall, Belfast	April
3590	Bradley's Potato Fertilizer	H. McLaughlin, Bangor	June
3611	Bradley's Revised High Grade Potato & Root Special	H. McLaughlin, Bangor	June
3138	Bradley's Special Complete Manure for Potatoes & Vegetables	R. B. Dunning & Co., Bangor	April
3171	Bradley's Special Complete Manure for Potatoes & Vegetables	Jackson & Hall, Belfast	April
3379	Bradley's Special Complete Manure for Potatoes & Vegetables	John S. Pierce, Caribou	May
3489	Bradley's Special Complete Manure for Potatoes & Vegetables	E. P. Ham, Lewiston	June
3160	Bradley's Special Niagara Phosphate	Jackson & Hall, Belfast	April
3287	Bradley's Special Niagara Phosphate	Wm. M. Wood & Sons, Gardiner	May
3594	Bradley's Special Niagara Phosphate	H. McLaughlin, Bangor	June
3144	Bradley's Special Potato Manure	R. B. Dunning & Co., Bangor	April
3409	Bradley's Special Potato Manure	Listers Agricultural Chemical Works, Portland	May
3490	Bradley's Special Potato Manure	E. P. Ham, Lewiston	June
3137	Bradley's X L Superphosphate of Lime	R. B. Dunning & Co., Bangor	April
3165	Bradley's X L Superphosphate of Lime	Jackson & Hall, Belfast	April
3408	Bradley's X L Superphosphate of Lime	Listers Agricultural Chemical Works, Portland	May
3424	Clark's Cove Bay State Fertilizer	Listers Agricultural Chemical Works, Portland	May
3528	Clark's Cove Bay State Fertilizer	Listers Agricultural Chemical Works, Portland	June
3406	Clark's Cove Bay State Fertilizer G G	Listers Agricultural Chemical Works, Portland	May

Guaranties and Results of Analysis of Fertilizer Samples, 1915—Continued.

Station number.	% As nitrate.	% As ammonia.	% As water soluble.	% As active insoluble. *	% As inactive insoluble.	% Found.	% Guaranteed.	% Soluble.	% Insoluble.	% Found.	% Guaranteed.	% Found.	% Guaranteed.	% Found.	% Guaranteed.	Remarks.
	Nitrogen.							Phosphoric Acid.						Potash		
			Organic.			Total.				Available.		Total.				
3234	1.08	1.06	0.28	0.72	0.30	3.44	3.29	5.47	1.06	9.88	10.0	10.94	11.0	4.46	4.0	
3380	1.46	0.92	0.42	0.36	0.16	3.32	3.29	6.16	1.30	9.70	10.0	11.00	11.0	4.20	4.0	
3471	1.10	1.00	0.23	0.69	0.27	3.29	3.29	5.58	1.17	9.61	10.0	10.78	11.0	4.09	4.0	
3598	1.24	0.96	0.12	0.65	0.32	3.29	3.29	5.61	0.82	9.83	10.0	10.65	11.0	4.36	4.0	
3140	0.62	0.86	0.01	0.38	0.23	2.10	2.06	4.13	0.98	8.53	8.0	9.51	9.0	3.45	3.0	
3169	0.64	0.76	0.02	0.41	0.16	2.00	2.06	4.99	1.38	8.83	8.0	10.21	9.0	3.30	3.0	
3590	0.68	0.70	0.20	0.38	0.22	2.18	2.06	4.26	1.74	8.15	8.0	9.89	9.0	3.58	3.0	
3611	0.54	0.58	0.13	0.54	0.20	1.79	1.65	5.85	1.38	10.55	10.0	11.93	11.0	2.23	2.0	
3138	1.08	1.24	0.13	0.54	0.31	3.30	3.29	5.04	0.69	8.61	8.0	9.3[illegible]	9.0	4.36	4.0	
3171	1.28	1.00	0.12	0.74	0.26	3.40	3.29	3.75	0.93	8.56	8.0	9.49	9.0	4.40	4.0	
3379	1.20	0.98	0.42	0.56	0.24	3.40	3.29	4.16	1.56	8.23	8.0	9.79	9.0	3.67	4.0	
3489	1.32	0.66	0.34	0.79	0.44	3.55	3.29	3.96	0.91	7.80	8.0	8.71	9.0	4.00	4.0	
3160	0.14	0.08	0.30	0.26	0.17	0.95	0.82	4.47	1.17	8.57	8.0	9.74	9.0	1.17	1.0	
3287	–	0.22	0.29	–	–	0.90	0.82	3.70	1.28	8.05	8.0	9.33	9.0	1.12	1.0	
3594	–	0.12	0.31	0.34	0.18	0.95	0.82	3.29	1.72	8.06	8.0	9.78	9.0	1.34	1.0	
3144	0.66	0.86	0.05	0.59	0.32	2.48	2.47	3.76	0.93	8.24	8.0	9.17	9.0	3.26	3.0	
3409	0.72	0.64	0.39	0.62	0.42	2.79	2.47	4.34	1.59	7.98	8.0	9.57	9.0	3.00	3.0	
3490	0.84	0.48	0.45	0.65	0.31	2.73	2.47	3.83	1.48	7.80	8.0	9.28	9.0	3.07	3.0	
3137	0.89	0.99	0.04	0.49	0.23	2.64	2.47	4.78	1.28	9.58	9.0	10.86	10.0	2.46	2.0	
3165	0.74	0.90	0.06	0.45	0.22	2.37	2.47	5.39	1.47	9.57	9.0	11.04	10.0	2.08	2.0	
3408	0.82	0.30	0.56	0.59	0.25	2.52	2.47	3.99	2.27	8.54	9.0	10.81	10.0	2.40	2.0	
3424	0.78	0.42	0.37	0.52	0.21	2.30	2.47	2.66	2.67	8.89	9.0	11.56	10.0	2.32	2.0	
3528	0.60	0.46	0.50	0.38	0.30	2.24	2.47	2.84	2.79	8.76	9.0	11.55	10.0	2.37	2.0	
3406	0.68	0.30	0.39	0.54	0.24	2.15	2.06	3.38	1.98	7.91	8.0	9.81	9.0	1.58	1.5	

* In high grade organic ammoniates the figures in this column are considerably larger than those in the next column.

Description of Samples—Continued.

Station number.	Maker and Brand.	Sample Obtained.	
		From	Month.
3527	Clark's Cove Bay State Fertilizer G G	Listers Agricultural Chemical Works, Portland	June
3607	Clark's Cove Bay State Fertilizer G G	H. McLaughlin, Bangor	June
3231	Clark's Cove Special Great Planet Manure A. A	M. L. Stantial, Houlton	May
3545	Clark's Cove Special Great Planet Manure A. A	Henry C. Welch, Sebago Lake	June
3163	Crocker's Ammoniated Corn Phosphate	Jackson & Hall, Belfast	April
3568	Crocker's New Rival Ammoniated Super-Phosphate	Jackson & Hall, Belfast	June
3633	Crocker's New Rival Ammoniated Super-Phosphate	A. G. Dill, Lewiston	June
3178	Crocker's Potato, Hop & Tobacco Fertilizer	Jackson & Hall, Belfast	April
3602	Crocker's Potato, Hop & Tobacco Fertilizer	H. McLaughlin, Bangor	June
3174	Crocker's Special Potato Fertilizer	Jackson & Hall, Belfast	April
3167	Darling's Special Blood, Bone & Potash	Jackson & Hall, Belfast	April
3235	Darling's Special Blood, Bone & Potash	M. L. Stantial, Houlton	May
3363	Darling's Special Blood, Bone & Potash	Williams & Solomon, Ft. Fairfield	May
3446	Darling's Special Blood, Bone & Potash	Thomas Thibideau, Hampden Plantation	May
3656	Darling's Special Blood, Bone & Potash	Leigh J. White, Ft. Fairfield	October
3170	Extra Complete Manure	Jackson & Hall, Belfast	April
3501	Extra Complete Manure	S. G. Otis, Hallowell	June
3547	Fine Ground Bone	Henry C. Welch, Richville	June
3199	5-9-4 Mixture in bulk	A. A. C. Co. Mixing and Distributing Plant, Searsport	April
3201	5-10-4 Mixture in bulk	A. A. C. Co. Mixing and Distributing Plant, Searsport	April
3200	4-10-4 Mixture in bulk	A. A. C. Co. Mixing and Distributing Plant, Searsport	April
3202	4½-10-4 Mixture in bulk	A. A. C. Co. Mixing and Distributing Plant, Searsport	April
3197	Genuine German Kainit	Jackson & Hall, Belfast	April
3550	Grass & Lawn Top Dressing	Coe-Mortimer Co., Belfast	June

Guaranties and Results of Analysis of Fertilizer Samples, 1915—Continued.

Station number.	Nitrogen. Organic. % As nitrate.	% As ammonia.	% As water soluble.	% As active insoluble. *	% As inactive insoluble.	Total. % Found.	% Guaranteed.	Phosphoric Acid. % Soluble.	% Insoluble.	Available. % Found.	% Guaranteed.	Total. % Found.	% Guaranteed.	Potash % Found.	% Guaranteed.	Remarks.
3527	0.68	0.26	0.47	0.44	0.29	2.14	2.06	3.46	2.28	7.56	8.0	9.84	9.0	1.87	1.5	
3607	0.40	0.70	0.18	0.55	0.26	2.09	2.06	5.42	2.21	8.09	8.0	10.30	9.0	1.90	1.5	
3231	1.28	0.96	0.12	0.73	0.33	3.42	3.29	3.32	1.15	8.10	8.0	9.25	9.0	4.27	4.0	
3545	0.98	1.12	0.37	0.57	0.30	3.34	3.29	4.07	1.88	7.58	8.0	9.46	9.0	4.28	4.0	
3163	0.68	0.68	0.16	0.39	0.19	2.10	2.06	4.02	1.24	8.54	8.0	9.78	9.0	1.83	1.5	
3568	-	0.32	0.37	0.34	0.17	1.20	1.03	3.29	2.30	7.24	8.0	9.54	9.0	2.46	2.0	
3633	-	0.08	0.36	0.67	0.36	1.47	1.03	2.90	2.05	7.90	8.0	9.95	9.0	2.00	2.0	
3178	0.82	0.52	0.01	0.44	0.25	2.04	2.06	5.02	1.17	8.45	8.0	9.62	9.0	3.35	3.0	
3602	0.60	0.78	0.19	0.46	0.19	2.22	2.06	3.59	1.42	8.10	8.0	9.52	9.0	3.09	3.0	
3174	1.28	0.96	0.34	0.74	0.24	3.56	3.29	3.99	0.93	8.37	8.0	9.30	9.0	4.25	4.0	
3167	1.62	1.34	0.10	0.72	0.36	4.14	4.11	4.15	0.94	9.22	9.0	10.16	10.0	4.21	4.0	
3235	1.34	1.48	0.05	0.86	0.38	4.11	4.11	5.79	0.71	9.58	9.0	10.29	10.0	4.28	4.0	
3363	1.30	1.38	0.36	0.68	0.32	4.04	4.11	4.96	1.74	8.66	9.0	10.40	10.0	4.06	4.0	
3446	1.36	1.32	0.34	0.68	0.39	4.09	4.11	5.23	1.93	8.84	9.0	10.77	10.0	4.00	4.0	
3656	-	-	-	-	-	4.36	4.11	5.81	1.47	9.62	9.0	11.09	10.0	3.89	4.0	Sample received from correspondent.
3170	1.32	1.00	0.22	0.72	0.30	3.56	3.29	4.47	1.24	10.15	10.0	11.39	11.0	4.36	4.0	
3501	1.46	1.04	0.08	0.69	0.37	3.64	3.29	5.15	1.38	9.82	10.0	11.20	11.0	4.08	4.0	
3547	-	-	-	-	-	2.42	2.47	-	-	-	-	24.08	22.9	-	-	
3199	1.52	1.22	0.09	0.83	0.34	4.00	4.11	5.42	1.01	9.07	9.0	10.08	10.0	4.00	4.0	Sampled from bulk goods at barrelling point.
3201	1.40	1.28	0.16	0.76	0.56	4.16	4.11	6.30	1.15	10.17	10.0	11.32	11.0	4.00	4.0	Sampled from bulk goods at barrelling point.
3200	1.20	0.90	0.32	0.64	0.34	3.40	3.29	6.24	0.94	10.06	10.0	11.00	11.0	4.01	4.0	Sampled from bulk goods at barrelling point.
3202	1.24	1.04	0.28	0.66	0.43	3.65	3.70	6.14	1.11	10.15	10.0	11.26	11.0	4.13	4.0	Sampled from bulk goods at barrelling point.
3197	-	-	-	-	-	-	-	-	-	-	-	-	-	15.05	12.0	Probably 1914 goods.
3550	0.50	1.70	0.40	0.59	0.28	3.47	3.91	1.60	1.28	7.41	5.0	8.69	6.0	2.56	2.0	

* In high grade organic ammoniates the figures in this column are considerably larger than those in the next column.

Description of Samples—Continued.

Station number.	Maker and Brand.	Sample Obtained.	
		From	Month.
3343	Great Eastern High Grade Potato Manure	Mrs. Finnigan, Houlton	May
3164	Great Eastern Northern Corn Special	Jackson & Hall, Belfast	April
3177	Great Eastern Potato Manure	Jackson & Hall, Belfast	April
3175	Great Eastern Revised General	Jackson & Hall, Belfast	April
3176	Great Eastern Special High Grade Potato Fertilizer	Jackson & Hall, Belfast	April
3244	Great Eastern Special High Grade Potato Fertilizer	Charles Parsons, Presque Isle	May
3356	Great Eastern Special High Grade Potato Fertilizer	C. F. Roberts, Caribou	May
3441	Great Eastern Special High Grade Potato Fertilizer	C. F. Roberts, Caribou	May
3535	Nitrate of Soda	Andrews & Horigan, Biddeford	June
3500	Otis' Potato Fertilizer	S. G. Otis, Hallowell	June
3502	Otis' Super-Phosphate	S. G. Otis, Hallowell	June
3421	Pacific Potato Special	Listers Agricultural Chemical Works, Portland	May
3560	Pacific Special Grass & Grain Fertilizer	G. W. Bates, N. Cornville	June
3601	Pacific Special Grass & Grain Fertilizer	H. McLaughlin, Bangor	June
3610	Pacific Special High Grade General Fertilizer	H. McLaughlin, Bangor	June
3179	Packers Union Special Animal Corn Fertilizer	Jackson & Hall, Belfast	April
3161	Packers Union Special Potato Manure	Jackson & Hall, Belfast	April
3173	Packers Union Special Universal Fertilizer	Jackson & Hall, Belfast	April
3257	Quinnipiac Special Market Garden Manure	A. H. Tapley, Ft. Fairfield	May
3514	Read's Farmer's Friend Super-Phosphate	H. B. D. Ayer, Vassalboro	June
3606	Read's Farmer's Friend Super-Phosphate	H. McLaughlin, Bangor	June
3552	Read's Practical Fertilizer	Coe-Mortimer Co., Belfast	June
3428	Read's Special Potato Manure	R. P. Greely, Yarmouth	May
3609	Read's Special Potato Manure	H. McLaughlin, Bangor	June

Guaranties and Results of Analysis of Fertilizer Samples, 1915—Continued.

Station number.	Nitrogen. Organic. % As nitrate.	% As ammonia.	% As water soluble.	% As active insoluble.*	% As inactive insoluble.	Total. % Found.	% Guaranteed.	Phosphoric Acid. % Soluble.	% Insoluble.	Available. % Found.	% Guaranteed.	Total. % Found.	% Guaranteed.	Potash % Found.	% Guaranteed.	Remarks.
3343	1.42	0.38	0.56	0.50	0.38	3.24	3.29	2.08	1.62	6.27	6.0	7.89	7.0	10.00	10.0	1914 goods.
3164	0.61	0.61	0.29	0.40	0.20	2.11	2.06	3.81	1.51	8.28	8.0	9.79	9.0	1.70	1.5	
3177	0.69	0.69	0.15	0.39	0.20	2.12	2.06	4.59	1.31	8.51	8.0	9.82	9.0	3.45	3.0	
3175	0.10	0.06	0.24	0.43	0.19	1.02	0.82	4.43	1.11	8.71	8.0	9.82	9.0	2.05	2.0	
3176	1.34	0.92	0.14	0.75	0.29	3.44	3.29	3.56	0.89	8.65	8.0	9.54	9.0	4.35	4.0	
3244	1.14	1.00	0.46	0.55	0.27	3.42	3.29	3.16	1.02	8.01	8.0	9.03	9.0	4.05	4.0	
3356	1.20	1.20	0.48	0.51	0.24	3.63	3.29	2.47	1.70	7.87	8.0	9.57	9.0	3.88	4.0	
3441	1.16	1.18	0.15	0.50	0.29	3.28	3.29	2.15	1.35	7.74	8.0	9.09	9.0	3.84	4.0	
3535	15.24	-	-	-	-	15.24	15.00	-	-	-	-	-	-	-	-	
3500	0.80	0.44	0.37	0.46	0.25	2.32	2.06	4.02	1.30	8.24	8.0	9.54	9.0	3.00	3.0	
3502	0.90	0.48	0.21	0.48	0.23	2.30	2.06	4.31	1.35	8.17	8.0	9.52	9.0	1.56	1.5	
3421	0.72	0.16	0.60	0.58	0.20	2.26	2.06	3.83	2.02	8.00	8.0	10.02	9.0	3.01	3.0	
3560	0.04	0.48	0.19	-	-	1.09	0.82	3.94	1.05	7.23	8.0	8.28	9.0	2.11	1.0	
3601	0.12	0.26	0.42	0.39	0.29	1.48	0.82	3.99	1.88	8.57	8.0	10.45	9.0	1.74	1.0	
3610	1.32	1.20	0.07	0.59	0.25	3.43	3.29	4.69	0.70	8.61	8.0	9.31	9.0	2.16	4.0	Potash very low
3179	0.68	0.54	0.01	0.28	0.16	1.67	1.65	6.70	1.45	11.10	10.0	12.55	11.0	2.14	2.0	
3161	0.74	0.42	0.31	0.40	0.19	2.06	2.06	3.75	1.43	8.31	8.0	9.74	9.0	4.00	4.0	
3173	0.12	0.14	0.30	0.38	0.22	1.16	0.82	4.40	1.19	8.54	8.0	9.73	9.0	2.08	2.0	
3257	1.10	1.20	0.26	0.54	0.26	3.36	3.29	3.73	1.57	8.00	8.0	9.57	9.0	4.06	4.0	
3514	0.62	0.72	0.18	0.45	0.19	2.16	2.06	1.63	1.58	7.83	8.0	9.41	9.0	2.95	3.0	
3606	0.64	0.64	0.32	0.38	0.22	2.20	2.06	4.50	1.82	7.75	8.0	9.57	9.0	3.77	3.0	
3552	0.40	0.42	0.21	-	-	1.41	1.03	4.75	0.82	8.57	8.0	9.39	9.0	2.19	2.0	
3428	1.10	0.96	0.24	0.67	0.31	3.28	2.88	4.23	1.22	8.03	8.0	9.25	9.0	3.83	4.0	
3609	0.74	0.88	0.06	0.90	0.34	2.92	2.88	3.96	1.26	8.28	8.0	9.54	9.0	4.55	4.0	

* In high grade organic ammoniates the figures in this column are considerably larger than those in the next column.

Description of Samples—Continued.

Station number.	Maker and Brand.	Sample Obtained.	
		From	Month.
3427	Read's Special Vegetable & Vine Fertilizer	R. P. Greely, Yarmouth	May
3515	Read's Special Vegetable & Vine Fertilizer	H. B. D. Ayer, Vassalboro	June
3147	Read's Sure Catch Fertilizer	Jackson & Hall, Belfast	April
3411	Read's Sure Catch Fertilizer	Listers Agricultural Chemical Works, Portland	May
3516	Read's Sure Catch Fertilizer	H. B. D. Ayer, Vassalboro	June
3600	Read's Sure Catch Fertilizer	H. McLaughlin, Bangor	June
3605	Soluble Pacific Guano	H. McLaughlin, Bangor	June
3166	Special A A Potato Grower	Jackson & Hall, Belfast	April
3232	Special A A Potato Grower	M. L. Stantial, Houlton	May
3443	Special A A Potato Grower	W. F. Paradis, Van Buren	May
3513	Special General Crop Grower	H. B. D. Ayer, Vassalboro	June
3233	Special Great Harvester Potato Manure	M. L. Stantial, Houlton	May
3482	Special Great Harvester Potato Manure	Hovey & Co., Bridgewater	June
3546	Special Great Harvester Potato Manure	Henry C. Welch, Richville	June
3143	Special High Grade Fertilizer	R. B. Dunning & Co., Bangor	April
3162	Special High Grade Fertilizer	Jackson & Hall, Belfast	April
3542	Standard Bone & Potash	M. A. Cobb, Yarmouth	June
3145	Standard Fertilizer	Jackson & Hall, Belfast	April
3419	Standard Fertilizer	Listers Agricultural Chemical Works, Portland	May
3608	Standard Fertilizer	H. McLaughlin, Bangor	June
3529	Standard Guano	A. A. C. Co. Storehouse, Portland	June
3512	Standard Special A Brand	Fairfield Grain Co., Fairfield	June
3407	Standard Special Complete Manure	Listers Agricultural Chemical Works, Portland	May
3146	Standard Special for Potatoes	Jackson & Hall, Belfast	April

Guaranties and Results of Analysis of Fertilizer Samples, 1915—Concluded.

	Nitrogen.							Phosphoric Acid.						Potash		
			Organic.			Total.				Available.		Total.				
Station number.	% As nitrate.	% As ammonia.	% As water soluble.	% As active insoluble.*	% As inactive insoluble.	% Found.	% Guaranteed.	% Soluble.	% Insoluble.	% Found.	% Guaranteed.	% Found.	% Guaranteed.	% Found.	% Guaranteed.	Remarks.
3427	0.80	0.78	0.31	0.50	0.21	2.60	2.47	5.42	1.34	8.02	8.0	9.36	9.0	3.07	3.0	
3515	0.92	0.88	0.21	0.34	0.18	2.53	2.47	4.07	1.45	8.07	8.0	9.52	9.0	3.18	3.0	
3147	-	-	-	-	-	-	-	6.97	0.59	10.02	10.0	10.61	11.0	2.30	2.0	
3411	-	-	-	-	-	-	-	6.70	1.40	9.45	10.0	10.85	11.0	4.01	2.0	
3516	-	-	-	-	-	-	-	1.69	1.8[illegible]	9.20	10.0	11.05	11.0	1.81	2.0	
3600	-	-	-	-	-	0.08	-	6.87	0.[illegible]	1021	10.0	10.89	11.0	2.61	2.0	
3605	0.60	0.74	0.16	0.55	0.18	2.23	2.06	3.48	1.16	8.36	8.0	9.52	9.0	1.78	1.5	
3166	1.28	1.04	0.08	0.87	0.37	3.64	3.70	4.78	1.16	10.00	10.0	11.16	11.0	4.39	4.0	
3232	1.22	1.50	0.36	0.42	0.22	3.72	3.70	4.21	1.35	9.94	10.0	11.29	11.0	4.32	4.0	
3443	1.50	1.22	0.46	0.30	0.15	3.63	3.70	6.67	1.37	9.57	10.0	10.94	11.0	4.03	4.0	
3513	0.56	0.52	0.24	0.26	0.16	1.74	1.65	3.99	1.66	8.05	8.0	9.71	9.0	2.12	2.0	
3233	1.40	1.56	0.37	0.52	0.25	4.10	4.11	4.51	1.28	10.00	10.0	11.28	11.0	4.01	4.0	
3482	1.40	1.60	0.41	0.31	0.16	3.88	4.11	6.76	1.25	9.52	10.0	10.77	11.0	4.20	4.0	
3546	1.58	1.30	0.02	0.80	0.32	4.02	4.11	5.87	1.06	9.24	10.0	10.30	11.0	4.33	4.0	
3143	0.65	0.96	-	0.81	0.38	2.80	2.88	4.26	0.87	8.51	8.0	9.38	9.0	4.29	4.0	
3162	0.70	0.92	0.19	0.84	0.39	3.04	2.88	5.58	0.96	9.17	8.0	10.13	9.0	3.85	4.0	
3542	-	-	-	-	-	-	-	5.68	1.05	10.19	10.0	11.24	11.0	2.32	2.0	
3145	0.64	0.70	0.12	0.46	0.22	2.14	2.06	5.63	1.02	9.12	8.0	10.14	9.0	1.60	1.5	
3419	0.68	0.34	0.38	0.50	0.24	2.14	2.06	3.59	1.84	8.11	8.0	9.95	9.0	1.57	1.5	
3608	0.56	0.74	0.19	0.44	0.24	2.17	2.06	3.57	1.34	8.36	8.0	9.70	9.0	3.88	1.5	
3529	-	0.22	0.46	0.35	0.24	1.27	1.03	3.16	2.82	6.81	8.0	9.63	9.0	2.25	2.0	
3512	0.16	0.10	0.13	0.40	0.22	1.01	0.82	4.40	1.33	8.41	8.0	9.74	9.0	1.02	1.0	
3407	0.96	1.00	0.46	0.74	0.30	3.46	3.29	3.99	1.72	8.01	8.0	9.73	9.0	4.03	4.0	
3146	0.36	0.70	0.30	0.34	0.20	1.90	2.06	6.14	0.69	8.94	8.0	9.63	9.0	3.31	3.0	

* In high grade organic ammoniates the figures in this column are considerably larger than those in the next column.

Description of Samples—Continued.

Station number.	Maker and Brand.	Sample Obtained. From	Sample Obtained. Month.
3425	Williams & Clark Americus Ammoniated Bone Super-Phosphate	Listers Agricultural Chemical Works, Portland	May
3279	Williams & Clark Americus Corn Phosphate	M. F. Norcross, Winthrop	May
3422	Williams & Clark Americus Corn Phosphate	Listers Agricultural Chemical Works, Portland	May
3561	Williams & Clark Americus Corn Phosphate	G. W. Bates, N. Cornville	June
3416	Williams & Clark Americus High Grade Special for Potatoes & Root Crops	Listers Agricultural Chemical Works, Portland	May
3558	Williams & Clark Americus High Grade Special for Potatoes & Root Crops	G. W. Bates, N. Cornville	June
3280	Williams & Clark Americus Potato Manure	M. F. Norcross, Winthrop	May
3405	Williams & Clark Americus Potato Manure	Listers Agricultural Chemical Works, Portland	May
3420	Williams & Clark Royal Bone Phosphate	Listers Agricultural Chemical Works, Portland	May
3559	Williams & Clark Royal Bone Phosphate	G. W. Bates, N. Cornville	June
	ARMOUR FERTILIZER WORKS, BALTIMORE, MD.		
3278	All Soluble	Robert A. Baird, Winthrop	May
3492	All Soluble	N. Beauregard & Co., Lewiston	June
3223	Bone, Blood & Potash	W. J. Moore, Hodgdon	April
3224	Bone, Blood & Potash	Arthur G. Estabrook, Amity	April
3312	Bone, Blood & Potash	Hopkins Bros., Ft. Fairfield	May
3345	Bone, Blood & Potash	A. J. Varney, Hodgdon	May
3347	Bone, Blood & Potash	W. J. Moore, Hodgdon	April
3348	Bone, Blood & Potash	W. J. Moore, Hodgdon	April
3362	Bone, Blood & Potash	Homer Fisher, Ft. Fairfield	May
3364	Bone, Blood & Potash	Henry Darkis, Fort Fairfield	May
3369	Bone, Blood & Potash	Geo. B. Armstrong	May
3373	Bone, Blood & Potash	Henry E. Dobbins, Ludlow	May

Guaranties and Results of Analysis of Fertilizer Samples, 1915—Continued.

Station number.	Nitrogen: % As nitrate.	Nitrogen: % As ammonia.	Nitrogen, Organic: % As water soluble.	Nitrogen, Organic: % As active insoluble.*	Nitrogen, Organic: % As inactive insoluble.	Nitrogen, Total: % Found.	Nitrogen, Total: % Guaranteed.	Phosphoric Acid: % Soluble.	Phosphoric Acid: % Insoluble.	Phosphoric Acid, Available: % Found.	Phosphoric Acid, Available: % Guaranteed.	Phosphoric Acid, Total: % Found.	Phosphoric Acid, Total: % Guaranteed.	Potash: % Found.	Potash: % Guaranteed.	Remarks.
3425	-	0.20	1.38	0.55	0.39	2.52	2.47	3.86	2.32	8.65	9.0	10.97	10.0	2.13	2.0	
3279	0.74	0.54	0.15	0.44	0.21	2.08	2.06	4.37	0.88	8.31	8.0	9.19	9.0	1.74	1.5	
3422	0.64	0.60	0.24	0.47	0.17	2.12	2.06	3.78	1.59	8.12	8.0	9.71	9.0	1.51	1.5	
3561	0.30	0.82	0.19	0.51	0.23	2.05	2.06	4.40	1.84	7.51	8.0	9.35	9.0	2.02	1.5	
3416	1.22	0.96	0.21	0.88	0.42	3.69	3.29	5.20	1.28	8.69	8.0	9.97	9.0	3.61	4.0	
3558	0.58	1.16	0.53	0.66	0.26	3.19	3.29	2.87	2.09	7.77	8.0	9.86	9.0	4.46	4.0	
3280	0.66	0.30	0.36	0.55	0.21	2.08	2.06	3.55	1.71	8.10	8.0	9.81	9.0	3.28	3.0	
3405	0.82	0.22	0.27	0.54	0.23	2.18	2.06	3.29	2.12	8.15	8.0	10.27	9.0	2.73	3.0	
3420	0.14	0.16	0.[illegible]3	0.44	0.19	1.26	1.03	3.09	2.68	7.21	8.0	9.89	9.0	2.11	2.0	
3559	-	0.32	0.42	0.46	0.20	1.40	1.03	3.01	1.80	7.61	8.0	9.41	9.0	2.50	2.0	
3278	0.48	0.48	0.76	0.68	0.52	2.92	2.88	5.53	1.58	8.10	8.0	9.68	8.5	4.01	4.0	
3492	0.46	0.32	0.91	0.65	0.56	2.90	2.88	5.93	1.24	8.58	8.0	9.82	8.5	4.13	4.0	
3223	1.10	0.82	0.12	1.15	0.67	3.86	4.11	1.50	0.94	8.14	8.0	9.08	9.0	6.34	7.0	1914 goods. Moisture 16.52 per cent.
3224	1.36	0.70	0.11	1.33	0.41	3.91	4.11	1.36	0.94	7.55	8.0	8.49	9.0	6.98	7.0	1914 goods. Moisture 12.88 per cent.
3312	0.64	1.76	0.38	0.71	0.47	3.96	4.11	5.07	0.76	7.49	8.0	8.25	9.0	7.03	7.0	1914 goods. Moisture 13.85 per cent.
3345	0.64	1.54	0.30	0.80	0.42	3.70	4.11	5.02	0.68	7.71	8.0	8.39	9.0	6.92	7.0	1914 goods. Moisture 15.70 per cent.
3347	1.14	0.76	0.43	1.24	0.47	4.04	4.11	1.40	0.85	8.70	8.0	9.55	9.0	6.38	7.0	1914 goods.
3348	1.30	0.68	-	1.27	0.53	3.78	4.11	1.34	0.69	7.83	8.0	8.52	9.0	7.15	7.0	1914 goods.
3362	1.22	0.78	0.58	0.73	0.87	4.20	4.11	5.97	0.87	8.19	8.0	9.06	9.0	4.26	4.0	Not registered in 1915.
3364	1.06	0.96	0.28	1.31	0.39	4.00	4.11	1.05	1.05	6.41	8.0	7.46	9.0	7.00	7.0	1914 goods.
3369	0.72	1.36	0.08	1.15	0.32	3.63	4.11	0.80	0.64	7.49	8.0	8.13	9.0	6.87	7.0	1914 goods.
3373	1.22	0.90	0.20	0.90	0.86	4.08	4.11	1.36	0.83	7.14	8.0	7.97	9.0	6.95	7.0	1914 goods. Moisture 11.94 per cent.

*** In high grade organic ammoniates the figures in this column are considerably larger than those in the next column.**

Description of Samples—Continued.

Station number.	Maker and Brand.	Sample Obtained.	
		From	Month.
3439	Bone, Blood & Potash	B. S. & J. B. Williams, Ft. Fairfield	May
3476	Bone, Blood & Potash	A. G. Whitcomb, Westfield	June
3531	Bone, Blood & Potash	Harry E. Dobbins, Ludlow	May
3532	Bone, Blood & Potash	A. G. Whitcomb, Westfield	June
3533	Bone, Blood & Potash	A. J. Varney, Houlton	May
3649	Bone, Blood & Potash	Horace McFarland, Ft. Fairfield	August
3277	Corn Grower	Robert A. Baird, Winthrop	May
3543	Corn Grower	M. A. Cobb, Yarmouth	June
3225	Double Value	Henry Smith, Houlton	April
3227	Double Value	H. R. Burleigh, Houlton	May
3344	Double Value	A. J. Varney, Hodgdon	May
3349	Double value	Henry Smith, Houlton	April
3350	Double Value	Harry R. Burleigh, Houlton	May
3359	Double Value	C. F. Roberts, Caribou	May
3370	Double Value	Augustus Parks, Houlton	May
3371	Double Value	C. F. Roberts, Caribou	May
3377	Double Value	C. F. Roberts, Van Buren	May
3228	5-8-4	Harry R. Burleigh, Houlton	May
3311	5-8-4	Hopkins Bros., Ft. Fairfield	May
3330	5-8-4	Holt & Hight, Skowhegan	May
3365	5-8-4	Henry Darkis, Ft. Fairfield	May
3366	5-8-4	A. J. Varney, Hodgdon	May
3372	5-8-4	Thomas P. Howard, Caribou	May
3631	5-8-4	J. E. Gray, Corinna	June

Guaranties and Results of Analysis of Fertilizer Samples, 1915—Continued.

Station number.	Nitrogen. % As nitrate.	% As ammonia.	Organic. % As water soluble.	% As active insoluble.*	% As inactive insoluble.	Total. % Found.	% Guaranteed.	Phosphoric Acid. % Soluble.	% Insoluble.	Available. % Found.	% Guaranteed.	Total. % Found.	% Guaranteed.	Potash % Found.	% Guaranteed.	Remarks.
3439	0.70	1.82	0.45	0.70	0.31	3.98	4.11	6.36	0.64	7.97	8.0	8.61	9.0	6.77	7.0	1914 goods. Moisture 16.1 per cent.
3476	0.60	1.72	0.45	0.77	0.32	3.87	4.11	5.87	0.70	7.85	8.0	8.55	9.0	6.56	7.0	1914 goods. Moisture 12.18 per cent.
3531	1.04	0.96	0.36	1.25	0.51	4.12	4.11	1.05	1.40	6.62	8.0	8.02	9.0	7.07	7.0	1914 goods.
3532	0.54	1.66	0.50	0.73	0.35	3.78	4.11	5.06	1.02	7.34	8.0	8.36	9.0	6.69	7.0	1914 goods.
3533	0.66	1.50	0.33	0.80	0.44	3.73	4.11	4.51	1.20	7.29	8.0	8.49	9.0	6.76	7.0	1914 goods.
3649	1.30	0.62	0.12	1.74	0.10	3.88	4.11	0.93	0.88	6.68	8.0	7.56	9.0	6.21	7.0	1914 goods. Moisture 16.99 per cent.
3277	0.16	0.48	0.37	0.49	0.34	1.84	1.65	5.04	0.85	7.92	8.0	8.77	8.5	2.16	2.0	
3543	–	0.62	0.38	0.48	0.21	1.69	1.65	5.87	0.94	7.45	18.0	8.39	8.5	2.14	2.0	
3225	0.76	1.14	0.17	1.16	0.48	3.71	4.11	1.75	0.91	7.78	8.0	8.69	9.0	9.43	10.0	1914 goods. Moisture 12.03 per cent.
3227	0.56	1.12	0.61	1.08	0.53	3.89	4.11	1.40	0.80	7.17	8.0	7.97	9.0	10.02	10.0	1914 goods. Moisture 11.08 per cent.
3344	0.74	1.54	0.44	0.61	0.37	3.70	4.11	6.73	0.91	8.23	8.0	9.14	9.0	10.01	10.0	1914 goods. Moisture 11.5 per cent.
3349	0.78	1.14	0.48	1.09	0.45	3.94	4.11	1.64	1.02	7.90	8.0	8.92	9.0	10.00	10.0	1914 goods.
3350	0.78	1.14	0.36	1.12	0.45	3.85	4.11	1.52	0.84	7.52	8.0	8.36	9.0	10.04	10.0	1914 goods.
3359	0.48	1.10	0.54	0.72	0.44	3.28	4.11	5.10	1.33	7.16	8.0	8.49	9.0	8.88	10.0	1914 goods.
3370	0.80	1.54	0.56	0.61	0.38	3.89	4.11	6.38	0.93	7.94	8.0	8.87	9.0	10.02	10.0	1914 goods.
3371	0.78	1.52	0.28	0.61	0.37	3.56	4.11	6.33	1.03	7.90	8.0	8.93	9.0	9.88	10.0	1914 goods.
3377	0.80	1.56	0.30	0.62	0.33	3.61	4.11	6.81	1.06	7.90	8.0	8.96	9.0	9.80	10.0	1914 goods. Moisture 11.5 per cent.
3228	0.82	1.78	0.20	0.58	0.32	3.71	4.11	6.03	0.96	7.84	8.0	8.80	9.0	4.13	4.0	
3311	0.72	1.74	0.33	0.87	0.27	3.93	4.11	5.07	0.64	7.85	8.0	8.49	9.0	6.64	4.0	
3330	1.68	0.04	0.32	1.25	0.48	3.77	4.11	7.15	0.85	8.40	8.0	9.25	9.0	4.34	4.0	
3365	1.08	0.94	0.38	1.18	0.48	4.06	4.11	0.94	0.85	7.22	8.0	8.07	9.0	7.06	4.0	
3366	0.68	1.34	0.45	1.02	0.39	3.88	4.11	2.65	0.85	7.28	8.0	8.13	9.0	6.63	4.0	
3372	1.54	0.08	0.80	0.81	0.95	4.18	4.11	6.38	0.76	8.09	8.0	8.85	9.0	4.77	4.0	
3631	0.56	1.34	0.63	0.77	0.67	3.97	4.11	5.74	2.12	7.85	8.0	9.97	8.5	3.88	4.0	

* In high grade organic ammoniates the figures in this column are considerably larger than those in the next column.

Description of Samples—Continued.

Station number.	Maker and Brand.	Sample Obtained.	
		From	Month.
3651	5-8-4	C. H. Armstrong, Ft. Fairfield	September
3212	5-10-4	Harry R. Burleigh, Houlton	April
3342	5-10-4	Herbert Laffaty, Caribou	May
3486	5-10-4	W. A. McLean, Patten	June
3213	4-8-4	Harry R. Burleigh, Houlton	April
3329	4-8-4	Holt & Hight, Skowhegan	May
3346	4-8-4	A. J. Varney, Hodgdon	May
3355	4-8-4		May
3440	4-8-4	Laffaty Real Estate Co., Caribou	May
	BALTIMORE PULVERIZING CO., BALTIMORE, MD.		
3314	Farmers' Union of Maine 5-8-4	A. A. Cheviott, Norridgewock	May
3324	Farmers' Union of Maine 5-8-4	Leo V. Winslow, Fairfield	May
3267	Farmers' Union of Maine 5-8-7	Charles C. Clements, Winterport	May
3315	Farmers' Union of Maine 5-8-7	A. A. Cheviott, Norridgewock	May
3316	Farmers' Union of Maine 5-8-7	Byron Lambert, Norridgewock	May
3338	Farmers' Union of Maine 5-8-7	Robert W. Betts, Thorndike	May
3387	Farmers' Union of Maine 5-8-7	A. C. Potter, Wytopitlock	May
3318	Farmers' Union of Maine 4-8-4	Byron Lambert, Norridgewock	May
3321	Farmers' Union of Maine 4-8-4	H. L. Heald, Norridgewock	May
3313	Farmers' Union of Maine 4-8-7	H. C. Albee, Norridgewock	May
3323	Farmers' Union of Maine 4-8-7	Leo V. Winslow, Fairfield	May
3320	Farmers' Union of Maine 4-6-4	Charles J. Savage, Norridgewock	May
3317	Farmers' Union of Maine 4-6-10	Byron Lambert, Norridgewock	May
3319	Farmers' Union of Maine 4-6-10	Clarence Rogers, Norridgewock	May

Guaranties and Results of Analysis of Fertilizer Samples, 1915—Continued.

Station number.	Nitrogen. Organic. % As nitrate.	% As ammonia.	% As water soluble.	% As active insoluble.*	% As inactive insoluble.	Total. % Found.	% Guaranteed.	Phosphoric Acid. % Soluble.	% Insoluble.	Available. % Found.	% Guaranteed.	Total. % Found.	% Guaranteed.	Potash % Found.	% Guaranteed.	Remarks.
3651	0.74	1.88	0.37	0.35	0.53	3.87	4.11	6.35	0.92	8.00	8.0	8.92	9.0	3.91	4.0	
3212	0.86	1.52	0.30	0.69	0.50	3.87	4.11	8.25	0.84	9.89	10.0	10.73	11.0	4.16	4.0	
3342	1.72	0.02	0.43	1.08	0.79	4.04	4.11	8.37	1.01	9.84	10.0	10.85	11.0	4.07	4.0	
3486	0.76	0.94	0.51	1.17	0.64	4.02	4.11	8.05	2.45	9.45	10.0	11.90	11.0	4.03	4.0	
3215	1.44	0.36	0.58	0.54	0.39	3.31	3.29	5.95	0.69	8.40	8.0	9.09	9.0	4.03	4.0	
3329	1.70	0.04	0.58	0.47	0.47	3.26	3.29	6.35	1.02	8.06	8.0	9.08	9.0	4.37	4.0	
3346	0.50	1.02	0.74	0.54	0.44	3.24	3.29	6.62	0.52	7.93	8.0	8.45	8.5	4.09	4.0	
3355	1.44	0.34	0.65	0.53	0.35	3.31	3.29	6.41	1.06	8.00	8.0	9.06	9.0	4.21	4.0	
3440	1.48	0.36	0.43	0.51	0.45	3.23	3.29	6.16	1.07	7.75	8.0	8.82	9.0	4.03	4.0	
3314	-	2.90	0.49	0.51	0.34	4.24	4.10	5.28	0.79	8.08	8.0	8.87	8.5	4.19	4.0	
3324	-	3.22	0.14	0.50	0.24	4.10	4.10	5.86	0.60	8.01	8.0	8.61	8.5	4.30	4.0	
3267	-	-	-	-	-	4.04	4.10	7.10	0.36	7.84	8.0	8.20	8.5	6.80	7.0	Sample received from correspondent.
3315	-	2.78	0.71	0.50	0.41	4.40	4.10	6.01	1.17	7.81	8.0	8.98	8.5	7.77	7.0	
3316	-	2.54	1.24	0.51	0.07	4.36	4.10	6.57	0.43	8.28	8.0	8.71	8.5	6.89	7.0	
3338	-	2.80	0.32	0.52	0.36	4.00	4.10	6.54	0.31	7.82	8.0	8.13	8.5	7.94	7.0	
3387	-	2.82	0.15	0.53	0.30	3.80	4.10	8.04	0.33	8.46	8.0	8.79	8.5	7.34	7.0	Sample received from correspondent.
3318	-	2.30	0.11	0.52	0.36	3.29	3.28	6.46	0.42	8.43	8.0	8.85	8.5	4.46	4.0	
3321	1.56	0.72	0.18	0.40	0.50	3.36	3.28	7.34	0.13	8.72	8.0	8.85	8.5	4.06	4.0	
3313	1.42	0.64	0.37	0.41	0.46	3.30	3.28	7.34	0.32	8.29	8.0	8.61	8.5	7.04	7.0	
3323	-	2.04	0.47	0.48	0.25	3.24	3.28	7.03	0.36	8.20	8.0	8.56	8.5	6.80	7.0	
3320	-	2.00	0.34	0.37	0.34	3.05	3.28	3.27	0.76	6.19	6.0	6.95	6.3	4.75	4.0	
3317	-	1.86	0.72	0.51	0.51	3.60	3.28	3.62	0.50	6.37	6.0	6.87	6.3	9.47	10.0	
3319	1.42	0.68	0.38	0.38	0.42	3.28	3.28	4.71	0.37	6.44	6.0	6.81	6.3	9.18	10.0	

* In high grade organic ammoniates the figures in this column are considerably larger than those in the next column.

Description of Samples—Continued.

Station number.	Maker and Brand.	Sample Obtained. From	Sample Obtained. Month.
	BOWKER FERTILIZER CO., BOSTON, MASS.		
3188	Bowker's All Round Fertilizer	Jackson & Hall, Belfast	April
3238	Bowker's All Round Fertilizer	S. A. Crockett, Houlton	May
3401	Bowker's All Round Fertilizer	Kendall & Whitney, Portland	May
3579	Bowker's All Round Fertilizer	H. McLaughlin, Bangor	June
3580	Bowker's All Round Fertilizer	H. McLaughlin, Bangor	June
3635	Bowker's Ammoniated Food for Flowers	Riker-Jaynes, Lewiston	June
3182	Bowker's Blood, Bone & Potash (Revised)	Jackson & Hall, Belfast	April
3237	Bowker's Blood, Bone & Potash (Revised)	S. A. Crockett, Houlton	May
3263	Bowker's Blood, Bone & Potash (Revised)	Harry Fowler, Ft. Fairfield	May
3402	Bowker's Brighton Phosphate	Kendall & Whitney, Portland	May
3393	Bowker's Corn Phosphate	Kendall & Whitney, Portland	May
3583	Bowker's Corn Phosphate	H. McLaughlin, Bangor	June
3187	Bowker's Farm & Garden Phosphate	Jackson & Hall, Belfast	April
3397	Bowker's Farm & Garden Phosphate	Kendall & Whitney, Portland	May
3585	Bowker's Farm & Garden Phosphate	H. McLaughlin, Bangor	June
3194	Bowker's Fresh Ground Bone	Jackson & Hall, Belfast	April
3404	Bowker's Fresh Ground Bone	Kendall & Whitney, Portland	May
3191	Bowker's Hill and Drill Phosphate	Jackson & Hall, Belfast	April
3399	Bowker's Hill and Drill Phosphate	Kendall & Whitney, Portland	May
3587	Bowker's Hill and Drill Phosphate	H. McLaughlin, Bangor	June
3196	Bowker's Nitrate of Soda	Jackson & Hall, Belfast	April
3190	Bowker's Potato Phosphate	Jackson & Hall, Belfast	April
3392	Bowker's Potato Phosphate	Kendall & Whitney, Portland	May
3189	Bowker's Potato & Vegetable Fertilizer (Revised)	Jackson & Hall, Belfast	April

Guaranties and Results of Analysis of Fertilizer Samples, 1915—Continued.

	Nitrogen.							Phosphoric Acid.						Potash		
			Organic.			Total.				Available.		Total.				
Station number.	% As nitrate.	% As ammonia.	% As water soluble.	% As active insoluble.*	% As inactive insoluble.	% Found.	% Guaranteed.	% Soluble.	% Insoluble.	% Found.	% Guaranteed.	% Found.	% Guaranteed.	% Found.	% Guaranteed.	Remarks.
3188	0.78	0.74	0.28	0.37	0.20	2.37	2.47	4.47	1.44	8.77	8.0	10.21	9.0	2.82	3.0	
3238	0.80	0.90	0.36	0.33	0.17	2.56	2.47	3.62	1.06	8.43	8.0	9.49	9.0	3.19	3.0	
3401	0.88	0.72	0.39	0.41	0.22	2.62	2.47	4.15	1.61	7.82	8.0	9.43	9.0	2.86	3.0	
3579	0.76	0.56	0.47	0.63	0.36	2.78	2.47	4.15	1.43	7.85	8.0	9.28	9.0	2.87	3.0	
3580	0.12	0.42	0.33	0.44	0.17	1.48	2.47	4.45	1.74	8.58	8.0	10.32	9.0	2.65	3.0	Nitrogen very low, Potash low.
3635	1.78	0.02	0.03	-	-	1.90	2.47	0.93	1.38	7.30	6.0	8.68	7.0	3.38	2.0	
3182	1.72	1.17	-	0.87	0.35	4.10	4.11	4.58	1.15	10.11	10.0	11.26	11.0	4.35	4.0	
3237	1.00	1.50	0.20	0.86	0.34	3.90	4.11	4.18	1.15	9.15	10.0	10.30	11.0	6.09	4.0	
3263	1.54	1.64	0.33	0.46	0.24	4.21	4.11	3.62	1.12	9.50	10.0	10.62	11.0	5.29	4.0	
3402	0.36	0.18	-	0.42	0.11	1.07	0.82	4.40	1.79	8.32	8.0	10.11	9.0	1.16	1.0	
3393	0.58	0.48	0.19	0.41	0.23	1.89	1.65	4.82	0.98	8.65	8.0	9.63	9.0	1.79	2.0	
3583	0.58	0.68	0.12	0.29	0.14	1.81	1.65	3.78	1.15	8.24	8.0	9.39	9.0	2.50	2.0	
3187	0.62	0.10	0.47	0.35	0.19	1.73	1.65	3.67	1.28	8.62	8.0	9.90	9.0	2.29	2.0	
3397	0.60	0.34	0.26	0.38	0.20	1.78	1.65	3.51	1.28	8.26	8.0	9.54	9.0	2.14	2.0	
3585	0.28	0.56	0.28	0.55	0.21	1.88	1.65	3.60	2.05	7.31	8.0	9.36	9.0	3.08	2.0	
3194	-	-	-	-	-	2.51	2.47	-	-	-	-	25.15	22.9	-	-	
3404	-	-	-	-	-	2.86	2.47	-	-	-	-	23.60	22.9	-	-	
3191	0.90	0.12	0.50	0.56	0.23	2.31	2.47	3.83	1.46	9.00	9.0	10.46	10.0	2.17	2.0	
3399	0.86	0.30	0.46	0.57	0.27	2.46	2.47	3.24	1.79	8.53	9.0	10.32	10.0	2.13	2.0	
3587	0.78	0.72	0.32	0.54	0.36	2.72	2.47	5.14	1.68	8.91	9.0	10.59	10.0	2.00	2.0	
3196	14.95	-	-	-	-	14.95	15.00	-	-	-	-	-	-	-	-	
3190	0.76	0.14	0.04	0.36	0.20	1.50	1.65	3.83	1.20	8.67	8.0	9.87	9.0	2.26	2.0	
3392	0.54	0.52	0.14	0.41	0.23	1.84	1.65	4.74	1.02	8.65	8.0	9.67	9.0	1.84	2.0	
3189	1.02	0.98	0.03	0.46	0.23	2.72	2.88	4.27	1.66	8.39	8.0	10.05	9.0	4.23	4.0	

* In high grade organic ammoniates the figures in this column are considerably larger than those in the next column.

Description of Samples—Continued.

Station number.	Maker and Brand.	Sample Obtained.	
		From	Month.
3395	Bowker's Potato & Vegetable Fertilizer (Revised)	Kendall & Whitney, Portland	May
3538	Bowker's Potato & Vegetable Fertilizer (Revised)	Saco Grain & Milling Co., Saco	June
3586	Bowker's Potato & Vegetable Fertilizer (Revised)	H. McLaughlin, Bangor	June
3186	Bowker's Square Brand Fertilizer	Jackson & Hall, Belfast	April
3400	Bowker's Square Brand Fertilizer	Kendall & Whitney, Portland	May
3581	Bowker's Square Brand Fertilizer	H. McLaughlin, Bangor	June
3185	Bowker's Sure Crop Phosphate	Jackson & Hall, Belfast	April
3240	Bowker's Sure Crop Phosphate	S. A. Crockett, Houlton	May
3403	Bowker's Sure Crop Phosphate	Kendall & Whitney, Portland	May
3183	Stockbridge A Brand Revised	Jackson & Hall, Belfast	April
3236	Stockbridge A Brand Revised	S. A. Crockett, Houlton	May
3477	Stockbridge A Brand Revised	J. E. York Potato House, Bridgewater	June
3488	Stockbridge A Brand Revised	C. W. Wescott, Patten	June
3573	Stockbridge A Brand Revised	H. McLaughlin, Bangor	June
3655	Stockbridge A Brand Revised	Fred A. Sheain, Mapleton	October
3181	Stockbridge Cereal Manure	Jackson & Hall, Belfast	April
3385	Stockbridge Cereal Manure	Shepard Morrell, Limestone	May
3398	Stockbridge Cereal Manure	Kendall & Whitney, Portland	May
3574	Stockbridge Cereal Manure	H. McLaughlin, Bangor	June
3184	Stockbridge Early Crop Manure	Jackson & Hall, Belfast	April
3394	Stockbridge Early Crop Manure	Kendall & Whitney, Portland	May
3180	Stockbridge General Crop Manure	Jackson & Hall, Belfast	April
3239	Stockbridge General Crop Manure	S. A. Crockett, Houlton	May
3396	Stockbridge General Crop Manure	Kendall & Whitney, Portland	May

Guaranties and Results of Analysis of Fertilizer Samples, 1915—Continued.

Station number.	Nitrogen. Organic. % As nitrate.	% As ammonia.	% As water soluble.	% As active insoluble.*	% As inactive insoluble.	Nitrogen. Total. % Found.	% Guaranteed.	Phosphoric Acid. % Soluble.	% Insoluble.	Available. % Found.	% Guaranteed.	Total. % Found.	% Guaranteed.	Potash. % Found.	% Guaranteed.	Remarks.
3395	0.98	1.08	0.07	0.48	0.26	2.87	2.88	3.70	1.85	7.94	8.0	9.79	9.0	4.00	4.0	
3538	0.96	0.94	0.27	0.57	0.28	3.02	2.88	4.67	1.35	8.06	8.0	9.41	9.0	4.37	4.0	
3586	0.72	0.90	0.18	0.94	0.36	3.10	2.88	4.00	1.02	8.52	8.0	9.54	9.0	4.27	4.0	
3186	0.76	0.16	0.50	0.44	0.26	2.12	2.06	3.56	1.39	8.39	8.0	9.78	9.0	3.29	3.0	
3400	0.76	0.14	0.52	0.46	0.22	2.10	2.06	2.44	1.67	7.74	8.0	9.41	9.0	3.44	3.0	
3581	0.66	0.72	0.27	0.39	0.24	2.28	2.06	2.97	1.28	8.24	8.0	9.52	9.0	3.57	3.0	
3185	0.08	0.28	0.07	0.29	0.52	1.24	0.82	5.23	1.12	9.85	9.0	10.97	10.0	2.59	2.0	
3240	0.16	0.10	0.22	0.33	0.21	1.02	0.82	4.21	2.17	8.87	9.0	11.04	10.0	2.18	2.0	
3403	0.18	0.14	0.29	0.30	0.18	1.09	0.82	5.20	1.75	9.26	9.0	11.01	10.0	1.91	2.0	
3183	1.70	1.48	0.84	–	–	4.24	4.11	4.98	0.52	9.69	9.0	10.21	10.0	4.46	4.0	
3236	1.36	1.52	0.42	0.52	0.30	4.12	4.11	4.56	1.40	9.00	9.0	10.40	10.0	4.21	4.0	
3477	1.34	1.54	0.36	0.59	0.25	4.08	4.11	5.26	1.47	8.75	9.0	10.22	10.0	3.89	4.0	
3488	1.24	1.20	0.42	0.85	0.49	4.30	4.11	4.71	1.54	8.43	9.0	9.97	10.0	3.70	4.0	
3573	1.70	1.64	0.02	0.71	0.23	4.30	4.11	5.15	0.56	9.18	9.0	9.74	10.0	4.45	4.0	
3655	–	–	–	–	–	3.85	4.11	5.23	1.15	8.93	9.0	10.08	10.0	3.90	4.0	Sample received from correspondent.
3181	1.21	0.95	0.11	0.69	0.32	3.28	3.29	4.85	1.02	10.56	10.0	11.58	11.0	4.07	4.0	
3385	1.20	0.88	0.31	0.75	0.26	3.40	3.29	5.23	1.20	9.65	10.0	10.85	11.0	4.34	4.0	
3398	1.20	1.00	0.25	0.61	0.28	3.34	3.29	5.93	1.20	9.93	10.0	11.13	11.0	4.05	4.0	
3574	1.18	1.16	0.06	0.59	0.20	3.19	3.29	5.45	0.59	9.90	10.0	10.49	11.0	4.39	4.0	
3184	2.66	0.62	0.56	0.47	0.27	4.58	4.94	2.01	0.40	8.31	7.0	8.71	8.0	3.22	3.0	
3394	3.00	1.04	0.10	0.45	0.33	4.92	4.94	1.67	0.51	7.78	7.0	8.29	8.0	3.86	3.0	
3180	1.04	1.04	0.28	0.61	0.30	3.27	3.29	4.78	1.48	8.85	8.0	10.33	9.0	4.09	4.0	
3239	0.88	0.92	0.52	0.76	0.26	3.34	3.29	4.34	2.17	8.56	8.0	10.73	9.0	3.75	4.0	
3396	1.24	1.24	–	0.69	0.27	3.44	3.29	3.96	2.12	7.64	8.0	9.76	9.0	4.20	4.0	

* In high grade organic ammoniates the figures in this column are considerably larger than those in the next column.

Description of Samples—Continued.

Station number.	Maker and Brand.	Sample Obtained. From	Sample Obtained. Month.
3487	Stockbridge General Crop Manure	C. W. Wescott, Patten	June
3584	Stockbridge General Crop Manure	H. McLaughlin, Bangor	June
3262	Stockbridge Manure A for Potatoes	Harry Fowler, Ft. Fairfield	May
	CHESAPEAKE CHEMICAL CO., BALTIMORE, MD.		
3480	C. C. Co.'s Maine Special	Harrison Stackpole, Bridgewater	June
	THE E. D. CHITTENDEN CO., BRIDGEPORT, CONN.		
3250	Chittenden's High Grade Potato	R. H. Stratton, Phair	May
3307	Chittenden's High Grade Potato	James Dorsey, Ft. Fairfield	May
3383	Chittenden's High Grade Potato	A. W. Parks, Limestone	May
	COE-MORTIMER CO., NEW YORK CITY, N. Y.		
3251	E. Frank Coe's Blood, Bone & Potash (Special)	P. H. Reed, Ft. Fairfield	May
3591	E. Frank Coe's Blood, Bone & Potash (Special)	H. McLaughlin, Bangor	June
3494	E. Frank Coe's Blue Brand Excelsior Guano	W. H. Osgood, Lewiston	June
3195	E. Frank Coe's Columbian Corn & Potato Fertilizer (Special)	Jackson & Hall, Belfast	April
3499	E. Frank Coe's Columbian Corn & Potato Fertilizer (Special)	E. P. Trafton, Gardiner	June
3537	E. Frank Coe's Columbian Corn & Potato Fertilizer (Special)	Saco Grain & Milling Co., Saco	June
3258	E. Frank Coe's Double Strength Potato Manure (Special)	J. R. Cary, Ft. Fairfield	May
3445	E. Frank Coe's Double Strength Potato Manure (Special)	McIver & Watson, Van Buren	May
3592	E. Frank Coe's Double Strength Potato Manure (Special	H. McLaughlin, Bangor	June.
3652	E. Frank Coe's Double Strength Potato Manure (Special)	C. H. Armstrong, Ft. Fairfield	September
3435	E. Frank Coe's Double Strength Top Dressing Manure (Special)	Sam H. Fitts, Freeport	May
3467	E. Frank Coe's Double Strength Top Dressing Manure (Special)	Earl E. Rouse, Washburn	June
3554	E. Frank Coe's Double Strength Top Dressing Manure (Special)	Coe-Mortimer Co., Belfast	June
3551	E. Frank Coe's Excelsior Potato Fertilizer (Special)	Coe-Mortimer Co., Belfast	June
3596	E. Frank Coe's Excelsior Potato Fertilizer (Special)	H. McLaughlin, Bangor	June

Guaranties and Results of Analysis of Fertilizer Samples, 1915—Continued.

Station number.	Nitrogen. % As nitrate.	% As ammonia.	Organic. % As water soluble.*	% As active insoluble.	% As inactive insoluble.	Total. % Found.	% Guaranteed.	Phosphoric Acid. % Soluble.	% Insoluble.	Available. % Found.	% Guaranteed.	Total. % Found.	% Guaranteed.	Potash % Found.	% Guaranteed.	Remarks.
3487	0.92	0.88	0.21	0.78	0.39	3.18	3.29	3.99	1.30	7.85	8.0	9.15	9.0	4.07	4.0	
3584	1.22	1.00	0.08	0.71	0.29	3.30	3.29	4.02	0.65	8.04	8.0	8.69	9.0	4.26	4.0	
3262	2.16	0.78	0.13	0.70	0.24	4.01	4.11	3.11	1.39	7.48	7.0	8.87	8.0	9.33	10.0	Probably 1914 goods.
3480	1.68	1.32	0.13	0.50	0.18	3.81	4.10	2.74	1.07	7.69	8.0	8.76	9.0	4.00	4.0	Moisture 15.75 per cent.
3250	0.10	3.32	0.49	0.34	0.15	4.40	4.10	4.88	0.76	8.11	8.0	8.87	9.0	4.25	4.0	
3307	–	3.00	0.24	0.83	0.43	4.50	4.10	6.92	1.07	8.58	8.0	9.65	9.0	4.47	4.0	
3383	–	2.98	0.45	0.69	0.57	4.69	4.10	6.16	0.98	8.29	8.0	9.27	9.0	4.72	4.0	
3251	1.44	1.14	0.78	0.73	0.31	4.20	4.11	4.35	1.40	10.02	10.0	11.42	11.0	4.00	4.0	
3591	1.42	1.40	0.33	0.75	0.35	4.25	4.11	4.94	1.17	9.58	10.0	11.05	11.0	3.52	4.0	
3494	1.70	1.22	0.12	0.78	0.26	4.08	3.29	5.36	1.00	10.01	10.0	11.01	11.0	3.82	4.0	
3195	0.12	0.52	0.24	0.38	0.20	1.46	1.23	5.10	1.11	9.61	9.0	10.72	10.0	2.45	2.0	
3499	0.64	0.42	0.24	–	–	1.62	1.23	1.15	1.75	9.00	9.0	10.75	10.0	2.00	2.0	
3537	0.30	0.30	0.39	0.30	0.21	1.50	1.23	4.31	1.70	8.76	9.0	10.46	10.0	2.07	2.0	
3258	1.20	1.24	0.44	0.64	0.25	3.77	3.70	5.26	1.43	10.17	10.0	11.60	11.0	4.19	4.0	
3445	1.26	1.36	0.20	0.66	0.26	3.74	3.70	6.22	1.25	10.11	10.0	11.36	11.0	3.94	4.0	
3592	1.18	1.32	0.36	0.67	0.35	3.88	3.70	6.70	1.10	9.67	10.0	10.77	11.0	3.68	4.0	
3652	1.18	1.29	0.51	0.67	0.23	3.88	3.70	7.07	1.06	10.31	10.0	11.37	11.0	3.82	4.0	
3435	3.17	2.85	0.17	1.00	0.25	7.44	8.23	1.44	0.61	6.44	6.0	7.05	7.0	4.19	4.0	Nitrogen low.
3467	4.06	2.02	0.04	0.33	0.07	6.52	8.23	3.40	0.89	6.84	6.0	7.73	7.0	4.30	4.0	Nitrogen very low.
3554	3.28	3.14	0.36	0.70	0.34	7.82	8.23	4.08	0.71	6.55	6.0	7.26	7.0	3.70	4.0	Nitrogen and potash both low.
3551	0.86	1.04	0.22	0.58	0.21	2.91	2.88	4.78	1.14	8.21	8.0	9.35	9.0	4.46	4.0	
3596	0.86	1.10	0.29	0.51	0.27	3.03	2.88	1.07	1.56	7.44	8.0	9.00	9.0	4.56	4.0	

* In high grade organic ammoniates the figures in this column are considerably larger than those in the next column.

Description of Samples—Continued.

Station number.	Maker and Brand.	Sample Obtained.	
		From	Month.
3431	E. Frank Coe's Famous Prize Brand Grain & Grass Fertilizer	Sam H. Fitts, Freeport	May
3597	E. Frank Coe's Famous Prize Brand Grain & Grass Fertilizer	H. McLaughlin, Bangor	June
3437	E. Frank Coe's High Grade Ammoniated Superphosphate (Special)	Sam H. Fitts, Freeport	May
3549	E. Frank Coe's High Grade Ammoniated Superphosphate (Special)	Coe-Mortimer Co., Belfast	June
3624	E. Frank Coe's High Grade Ammoniated Superphosphate (Special)	S. L. Small, Dexter	June
3339	E. Frank Coe's Standard Potato Fertilizer (Special)	Peter Harmon & Son, Thorndike	May
3378	E. Frank Coe's Standard Potato Fertilizer (Special)	Ezra Calkins, Ft. Fairfield	May
3430	E. Frank Coe's Standard Potato Fertilizer (Special)	Sam H. Fitts, Freeport	May
3468	E. Frank Coe's Standard Potato Fertilizer (Special)	O. K. Story, Washburn	June
3498	E. Frank Coe's Standard Potato Fertilizer (Special)	F. P. Trafton, Gardiner	June
3548	E. Frank Coe's Standard Potato Fertilizer (Special)	Coe-Mortimer Co., Belfast	June
3595	E. Frank Coe's Standard Potato Fertilizer (Special)	H. McLaughlin, Bangor	June
3623	E. Frank Coe's Standard Potato Fertilizer (Special)	S. L. Small, Dexter	June
3432	E. Frank Coe's XXV Ammoniated Phosphate	Sam. H. Fitts, Freeport	May
3556	E. Frank Coe's XXV Ammoniated Phosphate	D. A. & W. E. Porter, Skowhegan	June
3593	E. Frank Coe's XXV Ammoniated Phosphate	H. McLaughlin, Bangor	June
3203	4½-10-4 Mixture in bulk	Coe-Mortimer Co., Belfast	April
3495	Nitrate of Soda	W. H. Osgood, Lewiston	June
3553	Nitrate of Soda	Coe-Mortimer Co., Belfast	June

Guaranties and Results of Analysis of Fertilizer Samples, 1915—Continued.

Station number.	Nitrogen. % As nitrate.	% As ammonia.	Organic. % As water soluble.	% As active insoluble.*	% As inactive insoluble.	Total. % Found.	% Guaranteed.	Phosphoric Acid. % Soluble.	% Insoluble.	Available. % Found.	% Guaranteed.	Total. % Found.	% Guaranteed.	Potash % Found.	% Guaranteed.	Remarks.
3431	-	-	-	-	-	-	-	1.40	1.10	9.91	10.0	11.01	11.0	2.19	2.0	
3597	-	-	-	-	-	0.15	-	1.28	0.97	9.48	10.0	10.45	11.0	2.37	2.0	
3437	1.12	0.34	0.26	0.31	0.20	2.23	2.06	4.12	1.62	8.10	8.0	9.72	9.0	3.00	3.0	
3549	0.66	0.86	0.27	0.26	0.18	2.23	2.06	2.78	1.52	7.81	8.0	9.33	9.0	3.54	3.0	
3624	0.78	0.62	0.10	0.41	0.21	2.12	2.06	3.38	1.08	7.60	8.0	8.68	9.0	3.31	3.0	
3339	1.06	1.12	0.27	0.52	0.34	3.31	3.29	3.65	2.08	9.28	8.0	11.36	9.0	4.19	4.0	
3378	1.04	1.26	0.29	0.59	0.22	3.40	3.29	3.05	1.22	8.16	8.0	9.38	9.0	3.74	4.0	
3430	1.46	1.16	-	0.49	0.19	3.30	3.29	3.65	1.31	8.10	8.0	9.41	9.0	4.01	4.0	
3468	1.20	0.98	0.40	0.61	0.27	3.46	3.29	1.52	1.79	7.52	8.0	9.31	9.0	3.78	4.0	
3498	1.10	0.96	0.35	0.59	0.34	3.34	3.29	2.04	2.04	8.07	8.0	10.11	9.0	4.57	4.0	
3548	0.96	1.16	0.23	0.65	0.28	3.28	3.29	4.04	1.30	8.21	8.0	9.51	9.0	4.10	4.0	
3595	1.24	1.04	0.43	0.56	0.26	3.53	3.29	2.60	1.44	8.02	8.0	9.46	9.0	3.73	4.0	
3623	1.12	1.00	0.23	0.63	0.25	3.23	3.29	3.21	1.40	8.28	8.0	9.68	9.0	4.00	4.0	
3432	-	0.04	0.66	-	-	1.08	0.82	1.96	1.95	8.00	8.0	9.95	9.0	2.24	2.0	
3356	-	0.26	0.34	0.33	0.17	1.10	0.82	2.86	2.27	7.73	8.0	10.00	9.0	2.26	2.0	
3593	-	0.06	0.60	0.29	0.22	1.17	0.82	2.86	2.36	7.32	8.0	9.68	9.0	2.62	2.0	
3203	1.51	1.39	0.12	0.46	0.26	3.64	3.70	6.75	1.21	10.37	10.0	11.58	11.0	4.15	4.0	Sampled from bulk goods at barrelling point.
3495	15.74	-	-	-	-	15.74	15.00	-	-	-	-	-	-	-	-	
3553	15.00	-	-	-	-	15.00	15.00	-	-	-	-	-	-	-	-	

* In high grade organic ammoniates the figures in this column are considerably larger than those in the next column.

Description of Samples—Continued.

Station number.	Maker and Brand.	Sample Obtained.	
		From	Month.
	DOMINION FERTILIZER CO., LTD., ST. STEPHEN, N. B., CAN.		
3243	Dominion Five-Eight-Four	Darius McGuire, Presque Isle	May
3249	Dominion Five-Eight-Four	Darius McGuire, Presque Isle	May
3357	Dominion Five-Eight-Four	L. A. Denton, Caribou	May
3375	Dominion Five-Eight-Four	H. B. Kelly & Co., Caribou	May
3322	Dominion Four-Eight-Four	Forest Farley, Fairfield	May
3376	Dominion Four-Eight-Four	H. B. Kelly & Co., Caribou	May
3562	Dominion Four-Eight-Four	H. L. Sweet, Skowhegan	June
3325	Dominion Four and Half-Ten-Four	Ira Knowlen, Skowhegan	May
3564	Dominion Four and Half-Ten-Four	H. L. Sweet, Skowhegan	June
3326	Dominion Three-Eight-Three	Charles H. Fuller, Skowhegan	May
3563	Dominion Three-Eight-Three	H. L. Sweet, Skowhegan	June
3565	Dominion Two-Nine-Two	Jackson & Hall, Belfast	June
	ESSEX FERTILIZER CO., BOSTON, MASS.		
3271	Essex Complete Grass for Top Dressing and Seeding	E. T. Clifford, Winthrop	May
3269	Essex Complete Manure for Corn, Grain & Grass	E. T. Clifford, Winthrop	May
3429	Essex Complete Manure for Corn, Grain & Grass	R. P. Greely, Yarmouth	May
3136	Essex Complete Manure for Potatoes, Roots & Vegetables	Bangor Tallow Co., Bangor	April
3217	Essex High Grade Special	H. R. Burleigh, Houlton	April
3216	Essex Peerless Potato Manure	H. R. Burleigh, Houlton	April
3261	Essex Peerless Potato Manure	Frank Osborne, Ft. Fairfield	May
3358	Essex Peerless Potato Manure	L. A. Denton, Caribou	May
3128	Essex Special Corn Fertilizer	Bangor Tallow Co., Bangor	April

Guaranties and Results of Analysis of Fertilizer Samples, 1915—Continued.

Station number.	Nitrogen. % As nitrate.	Nitrogen. % As ammonia.	Nitrogen. Organic. % As water soluble.*	Nitrogen. Organic. % As active insoluble.	Nitrogen. Organic. % As inactive insoluble.	Nitrogen. Total. % Found.	Nitrogen. Total. % Guaranteed.	Phosphoric Acid. % Soluble.	Phosphoric Acid. % Insoluble.	Phosphoric Acid. Available. % Found.	Phosphoric Acid. Available. % Guaranteed.	Phosphoric Acid. Total. % Found.	Phosphoric Acid. Total. % Guaranteed.	Potash % Found.	Potash % Guaranteed.	Remarks.
3243	1.90	0.36	0.37	0.95	0.54	4.12	4.10	4.98	0.75	8.26	8.0	9.01	9.	4.13	4.0	
3249	1.38	0.06	0.77	1.00	0.58	3.79	4.10	5.10	1.66	8.23	8.0	9.89	9.0	4.28	4.0	
3357	1.90	-	0.80	0.84	0.60	4.14	4.10	5.42	0.97	8.01	8.0	8.98	9.0	4.16	4.0	
3375	2.08	0.08	1.21	0.67	0.14	4.18	4.10	5.87	0.66	8.19	8.0	8.85	9.0	4.31	4.0	
3322	0.92	0.72	0.41	0.61	0.66	3.32	3.30	6.71	0.56	8.56	8.0	9.12	9.0	4.40	4.0	
3376	0.78	0.52	0.62	0.78	0.72	3.42	3.30	5.95	1.29	8.33	8.0	9.62	9.0	3.63	4.0	
3562	1.34	0.20	0.35	0.72	0.49	3.10	3.30	5.53	1.56	8.23	8.0	9.79	9.0	4.53	4.0	
3325	1.18	0.44	0.65	0.61	0.67	3.55	3.70	8.01	0.84	10.48	10.0	11.32	11.0	4.03	4.0	
3564	0.78	1.04	0.38	0.79	0.48	3.47	3.70	7.48	0.65	10.20	10.0	10.85	11.0	4.01	4.0	
3326	0.58	0.54	0.28	0.59	0.51	2.5[illegible]	2.50	1.99	0.43	8.74	8.0	9.17	9.0	3.28	3.0	
3563	0.68	0.26	0.39	0.74	0.41	2.[illegible]8	2.50	5.20	1.12	7.75	8.0	8.87	9.0	3.3[illegible]	3.0	
3565	0.28	0.62	0.30	0.56	0.26	2.02	1.60	5.17	1.03	9.[illegible]4	9.0	10.27	10.0	2.37	2.0	
3271	1.86	1.08	1.76	1.30	0.70	6.70	6.50	4.24	0.96	7.30	7.0	8.26	8.0	4.44	4.0	Not registered in 1915.
3269	1.26	0.08	0.69	1.01	0.48	3.52	3.28	5.87	0.70	7.82	8.0	8.52	9.0	4.04	4.0	
3429	0.32	1.58	0.82	0.49	0.21	3.42	3.28	6.22	1.33	8.11	8.0	9.44	9.0	4.14	4.0	
3136	0.51	1.47	1.22	0.44	0.01	3.65	3.28	5.98	1.15	8.13	8.0	9.28	9.0	3.85	4.0	
3217	0.56	1.70	0.23	0.74	0.34	3.57	3.69	7.21	0.59	8.52	8.0	9.11	9.0	4.31	4.0	
3216	0.74	1.98	0.68	0.56	0.24	4.20	4.10	6.73	1.17	9.07	8.0	10.24	9.0	4.43	4.0	
3261	1.14	0.08	0.95	1.40	0.53	4.10	4.10	5.42	1.16	8.06	8.0	9.22	9.0	4.27	4.0	
3358	0.74	1.94	0.60	0.64	0.18	4.10	4.10	6.78	1.01	7.92	8.0	8.93	9.0	4.25	4.0	
3128	0.09	0.81	0.42	0.30	0.39	2.01	2.00	4.91	1.57	7.87	8.0	9.44	9.0	3.15	3.0	

*** In high grade organic ammoniates the figures in this column are considerably larger than those in the next column.**

Description of Samples—Continued.

Station number.	Maker and Brand.	Sample Obtained. From	Sample Obtained. Month.
3272	Essex Special Corn Fertilizer	E. T. Clifford, Winthrop	May
3268	Essex Special Potato Phosphate	E. T. Clifford, Winthrop	May
3135	Essex XXX Fish and Potash	Bangor Tallow Co., Bangor	April
3270	Essex XXX Fish and Potash	E. T. Clifford, Winthrop	May
	HUBBARD FERTILIZER CO., BALTIMORE, MD.		
3505	Fisher's Formula	F. A. Blaisdell, Monmouth	June
3198	4-8-4 Mixture in bulk	Hubbard Fertilizer Co., Searsport	April
3464	Hubbard's Blood, Bone & Potash	Haskell Implement & Seed Co., Lewiston	June
3463	Hubbard's Farmers' I. X. L.	Haskell Implement & Seed Co., Lewiston	June
3374	Hubbard's Maine Potato Grower	L. K. Porter, Hodgdon	May
3384	Hubbard's Maine Potato Grower	Thomas P. Howard, Caribou	May
3462	Hubbard's Maine Potato Grower	Haskell Implement & Seed Co., Lewiston	June
3497	Hubbard's Maine Potato Grower	F. J. Thompson, Sabattus	June
3461	Hubbard's Southern Guano	Haskell Implement & Seed Co., Lewiston	June
	INTERNATIONAL AGRICULTURAL CORPORATION, BUFFALO FERTILIZER WORKS, HOULTON, MAINE.		
3208	Buffalo Five-Eight-Four	Buffalo Fertilizer Co., Houlton	April
3252	Buffalo Five-Eight-Four	P. H. Reed, Ft. Fairfield	May
3266	Buffalo Five-Eight-Four	G. W. Parks, Ft. Fairfield	May
3442	Buffalo Five-Eight-Four	McIver & Watson, Van Buren	May
3465	Buffalo Five-Eight-Four	Thomas Lyons, Caribou	June
3650	Buffalo Five-Eight-Four	Robert McLaughlin, Hampden	August
3264	Buffalo Five-Eight-Seven	G. W. Parks, Ft. Fairfield	May
3265	Buffalo Five-Eight-Seven	G. W. Parks, Ft. Fairfield	May
3206	Buffalo Five-Ten-Four	Buffalo Fertilizer Co., Houlton	April

Guaranties and Results of Analysis of Fertilizer Samples, 1915—Continued.

Station number.	Nitrogen.							Phosphoric Acid.						Potash		Remarks.
			Organic.			Total.		Available.				Total.				
	% As nitrate.	% As ammonia.	% As water soluble.	% As active insoluble.	% As inactive insoluble.	% Found.	% Guaranteed.	% Soluble.	% Insoluble.	% Found.	% Guaranteed.	% Found.	% Guaranteed.	% Found.	% Guaranteed.	
				*												
3272	0.06	0.94	0.58	0.37	0.17	2.12	2.00	5.61	1.25	8.35	8.0	9.69	9.0	3.20	3.0	
3268	0.36	0.76	0.35	0.69	0.32	2.48	2.46	5.79	1.01	7.70	8.0	8.71	9.0	4.05	4.0	
3135	0.10	0.86	0.61	0.32	0.11	2.00	2.00	5.18	1.59	7.74	8.0	9.33	9.0	3.10	3.0	
3270	0.16	0.92	0.72	0.38	0.22	2.40	2.00	5.26	1.66	8.15	8.0	9.81	9.0	3.19	3.0	
3505	2.20	4.96	0.05	0.41	0.25	7.87	8.20	1.37	0.31	3.65	3.0	3.96	3.5	10.30	11.0	Probably 1914 goods. Not registered low in 1915.
3198	2.26	1.24	0.05	0.51	-	4.06	4.10	4.08	0.74	8.57	8.0	9.31	9.0	4.49	4.0	Sampled from bulk goods at barrelling point.
3464	1.38	0.76	0.21	0.38	0.15	2.88	3.28	0.96	0.91	7.54	8.0	8.45	9.0	3.00	3.0	Moisture 12.82 per cent.
3463	0.52	0.48	0.19	0.30	0.18	1.67	1.64	0.80	2.03	7.65	8.0	9.68	9.0	2.07	2.0	
3374	1.66	1.70	0.03	0.47	0.18	4.04	4.10	1.90	1.35	8.16	8.0	9.51	9.0	4.24	4.0	
3384	2.02	1.30	0.28	0.54	0.12	4.26	4.10	4.15	0.96	8.24	8.0	9.20	9.0	4.33	4.0	
3462	2.26	0.66	0.12	0.34	0.08	3.46	4.10	1.69	1.16	7.72	8.0	8.88	9.0	3.57	4.0	Moisture 14.45 per cent.
3497	1.90	1.26	0.43	0.42	0.08	4.09	4.10	2.03	1.15	8.21	8.0	9.36	9.0	4.28	4.0	
3461	1.06	0.84	0.32	0.42	0.28	2.92	2.87	5.26	1.21	9.60	10.0	10.81	11.0	2.08	2.0	
3208	1.10	0.86	0.69	1.00	0.55	4.20	4.10	6.00	0.73	8.52	8.0	9.25	9.0	4.41	4.0	
3252	1.16	0.76	0.45	1.01	0.69	4.07	4.10	5.74	0.94	7.90	8.0	8.84	9.0	4.22	4.0	
3266	1.82	0.06	0.59	1.07	0.58	4.12	4.10	5.07	0.68	8.12	8.0	8.80	9.0	4.07	4.0	
3442	0.92	0.98	0.71	0.90	0.60	4.11	4.10	6.16	0.97	8.03	8.0	9.00	9.0	4.38	4.0	
3465	1.20	0.76	0.36	0.97	0.56	3.85	4.10	5.55	0.56	7.89	8.0	8.45	9.0	4.09	4.0	Moisture 11.8 per cent.
3650	1.64	0.10	0.52	0.80	0.61	3.67	4.10	5.93	0.87	8.54	8.0	9.41	9.0	3.83	4.0	
3264	1.60	0.80	0.59	0.56	0.64	4.19	4.10	5.30	0.89	7.48	8.0	8.37	9.0	7.01	7.0	
3265	1.60	0.68	0.37	0.73	0.74	4.12	4.10	6.30	0.57	8.33	8.0	8.90	9.0	7.27	7.0	
3206	1.48	0.72	0.37	0.77	0.63	3.97	4.10	8.37	0.57	10.58	10.0	11.15	11.0	4.53	4.0	

* In high grade organic ammoniates the figures in this column are considerably larger than those in the next column.

Description of Samples—Continued.

Station number.	Maker and Brand.	Sample Obtained. From	Sample Obtained. Month.
3205	Buffalo Four-Eight-Four	Buffalo Fertilizer Co., Houlton	April
3509	Buffalo Four-Eight-Four	F. A. Blaisdell, Monmouth	June
3648	Buffalo Four-Six-Ten	Robert McLaughlin, Hampden	July
3204	Buffalo Four and Half-Ten-Four	Buffalo Fertilizer Co., Houlton	April
3382	Buffalo Four and Half-Ten-Four	N. McGinnis, Caribou	May
3504	Buffalo Four and Half-Ten-Four	F. A. Blaisdell, Monmouth	June
3211	Buffalo One-Eight-Two	Buffalo Fertilizer Co., Houlton	April
3209	Buffalo Seven-Six-Two	Buffalo Fertilizer Co., Houlton	April
3620	Buffalo Seven-Six-Two	A. B. Chase, Dover	June
3210	Buffalo Three-Eight-Three	Buffalo Fertilizer Co., Houlton	April
3621	Buffalo Three-Eight-Three	A. B. Chase, Dover	June
3506	Buffalo Two-Eight-Two	F. A. Blaisdell, Monmouth	June
3207	Buffalo Two-Nine-Two	Buffalo Fertilizer Co., Houlton	April
3503	Buffalo Two-Nine-Two	F. A. Blaisdell, Monmouth	June
3619	Buffalo Two-Nine-Two	A. B. Chase, Dover	June
	LISTERS AGRICULTURAL CHEMICAL CO., NEWARK, N. J.		
3417	Listers Bone Meal	Listers Agricultural Chemical Works, Portland	May
3259	Listers 5-9-4 Potato Fertilizer	Ames & Hacker, Ft. Fairfield	May
3589	Listers 5-9-4 Potato Fertilizer	H. McLaughlin, Bangor	June
3410	Listers Grain & Grass Fertilizer	Listers Agricultural Chemical Works, Portland	May
3578	Listers Grain & Grass Fertilizer	H. McLaughlin, Bangor	June
3518	Listers Plain Super-Phosphate	Galt Block Warehouse Co., Portland	June
3423	Listers Revised Corn & Potato Fertilizer	Listers Agricultural Chemical Works, Portland	May
3526	Listers Revised Corn & Potato Fertilizer	Listers Agricultural Chemical Works, Portland	June
3588	Listers Revised Corn & Potato Fertilizer	H. McLaughlin, Bangor	June

Guaranties and Results of Analysis of Fertilizer Samples, 1915—Continued.

	Nitrogen.							Phosphoric Acid.						Potash		
			Organic.			Total.				Available.		Total.				
Station number.	% As nitrate.	% As ammonia.	% As water soluble.	% As active insoluble.*	% As inactive insoluble.	% Found.	% Guaranteed.	% Soluble.	% Insoluble.	% Found.	% Guaranteed.	% Found.	% Guaranteed.	% Found.	% Guaranteed.	Remarks.
3205	0.90	0.66	0.26	0.81	0.64	3.27	3.30	6.25	0.57	8.58	8.0	9.15	9.0	4.31	4.0	
3509	1.04	0.50	0.46	0.73	0.51	3.24	3.30	6.00	0.76	8.20	8.0	8.96	9.0	4.36	4.0	
3648	1.70	0.12	0.76	0.68	0.45	3.71	3.29	1.07	1.61	5.25	6.0	6.86	7.0	10.13	10.0	1914 goods.
3204	1.16	0.66	0.55	0.76	0.67	3.80	3.70	8.26	0.59	10.51	10.0	11.10	11.0	4.67	4.0	
3382	1.52	0.12	0.85	0.81	0.62	3.91	3.70	6.95	1.28	9.09	10.0	10.37	11.0	4.15	4.0	
3504	1.28	0.70	0.24	0.74	0.61	3.57	3.70	7.85	0.73	10.42	10.0	11.15	11.0	4.10	4.0	
3211	0.06	0.02	0.17	0.52	0.29	1.04	0.80	4.94	0.71	8.33	8.0	9.04	9.0	2.19	2.0	
3209	2.32	0.80	0.46	1.22	0.70	5.50	5.80	5.02	0.51	7.03	6.0	7.54	7.0	2.53	2.0	
3620	2.50	0.72	0.28	0.93	0.63	5.06	5.80	4.88	0.56	6.59	6.0	7.15	7.0	2.81	2.0	
3210	0.54	0.06	0.24	0.72	0.72	2.28	2.50	5.42	0.70	8.42	8.0	9.12	9.0	3.21	3.0	
3621	0.76	0.04	0.10	0.81	0.59	2.30	2.50	5.34	0.98	8.06	8.0	9.04	9.0	3.25	3.0	
3506	1.10	0.08	0.18	0.61	0.30	2.27	1.64	3.03	1.57	7.68	8.0	9.25	9.0	3.00	2.0	
3207	0.14	-	0.42	0.74	0.44	1.74	1.60	5.17	1.12	8.90	9.0	10.02	10.0	2.04	2.0	
3503	0.10	-	0.37	0.68	0.70	1.85	1.60	6.27	0.83	9.23	9.0	10.06	10.0	1.94	2.0	
3619	-	0.08	0.58	0.67	0.57	1.90	1.60	5.31	1.43	9.37	9.0	10.80	10.0	2.30	2.0	
3417	-	-	-	-	-	3.54	2.67	-	-	-	-	24.48	22.9	-	-	
3259	1.22	1.34	0.83	0.74	0.12	4.25	4.11	5.38	1.35	9.56	9.0	10.91	10.0	3.93	4.0	
3589	0.18	2.94	0.51	0.63	0.38	4.64	4.11	7.86	1.56	9.60	9.0	11.16	10.0	4.13	4.0	
3410	-	-	-	-	-	-	-	6.79	1.21	10.59	10.0	11.80	11.0	2.00	2.0	
3578	-	0.02	-	-	-	0.19	-	6.86	0.83	10.24	10.0	11.07	11.0	2.16	2.0	
3518	-	-	-	-	-	-	-	8.31	1.48	14.28	14.0	15.76	15.0	-	-	
3423	0.04	0.62	0.80	0.32	0.20	1.98	1.65	6.48	1.56	8.26	8.0	9.82	9.0	2.00	2.0	
3526	-	0.66	0.52	0.28	0.21	1.67	1.65	6.28	1.89	8.16	8.0	10.05	9.0	2.21	2.0	
3588	0.24	0.60	0.40	0.28	0.20	1.72	1.65	5.68	1.67	6.67	8.0	8.34	9.0	2.11	2.0	

* In high grade organic ammoniates the figures in this column are considerably larger than those in the next column.

Description of Samples—Continued.

Station number.	Maker and Brand.	Sample Obtained. From	Sample Obtained. Month.
3412	Listers Revised High Grade Special for Spring Crops	Listers Agricultural Chemical Works, Portland	May
3577	Listers Revised High Grade Special for Spring Crops	H. McLaughlin, Bangor	June
3386	Listers Revised Potato Manure	J. C. Radcliffe, Limestone	May
3413	Listers Revised Potato Manure	Listers Agricultural Chemical Works, Portland	May
3582	Listers Revised Potato Manure	H. McLaughlin, Bangor	June
3415	Listers Standard Pure Superphosphate of Lime	Listers Agricultural Chemical Works, Portland	May
3575	Listers Standard Pure Superphosphate of Lime	H. McLaughlin, Bangor	June
3414	Listers Success Fertilizer	Listers Agricultural Chemical Works, Portland	May
3517	Nitrate of Soda	Galt Block Warehouse Co., Portland	June
	LOWELL FERTILIZER CO., BOSTON, MASS.		
3130	Lowell Animal Brand	Bangor Tallow Co., Bangor	April
3157	Lowell Animal Brand	Jackson & Hall, Belfast	April
3618	Lowell Animal Brand	A. J. McNaughton, Foxcroft	June
3627	Lowell Animal Brand	Eastern Grain Co., Corinna	June
3126	Lowell Bone Fertilizer	Bangor Tallow Co., Bangor	March
3567	Lowell Bone Fertilizer	Jackson & Hall, Belfast	June
3426	Lowell Empress Brand for Corn, Potatoes & Grain	R. P. Greely, Yarmouth	May
3569	Lowell Empress Brand for Corn, Potatoes & Grain	Bangor Tallow Co., Bangor	June
3628	Lowell Ground Tankage	Eastern Grain Co., Corinna	June
3154	Lowell Perfect Potato Brand	Jackson & Hall, Belfast	April
3219	Lowell Perfect Potato Brand	H. R. Burleigh, Houlton	April
3222	Lowell Perfect Potato Brand	H. R. Burleigh, Houlton	April
3129	Lowell Potato Grower	Bangor Tallow Co., Bangor	April
3155	Lowell Potato Grower	Jackson & Hall, Belfast	April
3134	Lowell Potato Phosphate	Bangor Tallow Co., Bangor	April

Guaranties and Results of Analysis of Fertilizer Samples, 1915—Continued.

Station number.	Nitrogen. Organic. % As nitrate.	% As ammonia.	% As water soluble.	% As active insoluble.*	% As inactive insoluble.	Total. % Found.	% Guaranteed.	Phosphoric Acid. % Soluble.	% Insoluble.	Available. % Found.	% Guaranteed.	Total. % Found.	% Guaranteed.	Potash % Found.	% Guaranteed.	Remarks.
3412	0.08	0.20	0.50	0.45	0.41	1.64	1.65	7.48	2.39	10.16	10.0	12.55	11.0	2.36	2.0	
3577	0.56	0.40	0.29	0.34	0.21	1.80	1.65	4.63	2.55	8.84	10.0	11.39	11.0	2.02	2.0	
3386	1.36	0.98	0.32	0.50	0.18	3.34	3.29	5.34	1.89	9.71	10.0	11.60	11.0	4.10	4.0	
3413	0.08	2.00	0.43	0.66	0.43	3.60	3.29	8.49	2.04	10.50	10.0	12.54	11.0	3.62	4.0	
3582	-	1.92	0.56	0.53	0.31	3.32	3.29	8.13	1.75	10.08	10.0	11.83	11.0	4.70	4.0	
3415	0.18	0.96	0.44	0.54	0.43	2.55	2.47	6.27	1.79	9.10	9.0	10.89	10.0	2.79	2.0	
3575	-	0.70	0.79	0.55	0.40	2.44	2.47	4.78	2.46	8.47	9.0	10.93	10.0	2.29	2.0	
3414	0.24	0.32	0.28	0.50	0.23	1.57	1.23	4.27	1.49	9.26	9.0	10.75	10.0	2.21	2.0	
3517	14.77	-	-	-	-	14.77	15.00	-	-	-	-	-	-	-	-	
31[illegible]0	0.40	0.68	0.61	0.39	0.33	2.41	2.46	6.16	1.15	8.15	8.0	9.30	9.0	3.01	3.0	
3157	0.43	0.71	0.55	0.44	0.18	2.33	2.46	6.64	1.21	8.42	8.0	9.63	9.0	3.09	3.0	
3618	0.38	0.76	0.70	0.49	0.17	2.50	2.46	6.41	1.63	8.40	8.0	10.03	9.0	3.13	3.0	
3627	0.32	0.90	0.79	0.47	0.19	2.67	2.46	6.75	1.28	8.72	8.0	10.00	9.0	3.20	3.0	
3126	0.10	0.88	0.37	0.30	0.14	1.79	1.64	6.00	1.08	8.27	8.0	9.35	9.0	3.33	3.0	
3567	-	0.74	0.60	-	-	1.72	1.64	5.93	1.30	7.89	8.0	9.19	9.0	3.00	3.0	
3426	0.46	-	0.34	-	-	1.20	0.82	4.47	1.00	6.18	7.0	7.18	8.0	2.02	2.0	
3569	0.40	0.04	0.43	0.28	0.15	1.30	0.82	4.63	0.83	6.63	7.0	7.46	8.0	2.26	2.0	
3628	-	0.04	2.14	2.41	0.40	4.99	4.92	0.67	11.99	8.20	-	20.19	14.0	-	-	
3154	0.77	1.93	0.50	0.49	0.25	3.94	4.10	6.70	1.20	8.82	8.0	10.02	9.0	4.31	4.0	
3219	0.60	1.66	0.49	0.41	0.30	3.46	4.10	6.09	1.10	8.23	8.0	9.33	9.0	4.03	4.0	
3222	0.34	1.92	1.24	0.64	0.30	4.44	4.10	5.34	1.12	7.29	7.0	8.41	8.0	8.27	8.0	1914 goods.
3129	0.58	1.30	0.78	0.49	0.09	3.24	3.28	6.06	1.35	8.28	8.0	9.63	9.0	4.20	4.0	
3155	0.48	1.28	0.82	0.46	0.24	3.28	3.28	6.54	1.02	8.47	8.0	9.49	9.0	4.35	4.0	
3134	0.46	0.72	0.36	0.68	0.26	2.48	2.46	6.00	1.20	7.92	8.0	9.12	9.0	4.07	4.0	

* In high grade organic ammoniates the figures in this column are considerably larger than those in the next column.

Description of Samples—Continued.

Station number.	Maker and Brand.	Sample Obtained.	
		From	Month.
3150	Lowell Potato Phosphate	Jackson & Hall, Belfast	April
3481	Lowell Potato Phosphate	E. S. Woodward, Ft. Fairfield	June
3617	Lowell Potato Phosphate	A. J. McNaughton, Foxcroft	June
3131	Lowell Superior Fertilizer	Bangor Tallow Co., Bangor	April
3156	Lowell Superior Fertilizer	Jackson & Hall, Belfast	April
3458	Lowell Superior Fertilizer	Tom Gilerson, Caswell Plantation	May
3625	Lowell Superior Fertilizer	Eastern Grain Co., Corinna	June
	MERROW BROTHERS & CO., AUBURN, ME.		
3632	Merrow's Bone Meal	Merrow Bros. & Co., Auburn	June
	MORISON BROTHERS, BANGOR, MAINE.		
3572	Acid Phosphate	Morison Bros., Bangor	June
3121	Morison Brothers' Corn & Grain Fertilizer	Morison Bros., Bangor	March
3120	Morison Brothers' Queen City Potato Fertilizer	Morison Bros., Bangor	March
3119	Morison Brothers' War Brand Potato Fertilizer	Morison Bros., Bangor	March
3122	Morison Brothers' War Brand Potato Fertilizer	Morison Bros., Bangor	March
3571	Nitrate of Soda	Morison Bros., Bangor	June
	NATIONAL FERTILIZER CO., NEW YORK & BOSTON.		
3367	Chittenden's Extra High Grade Manure	N. C. Kellogg, Sherman Mills	May
3299	National Ammoniated Bone Phosphate	Austin-Haines Co., Waterville	May
3242	National Aroostook Revised Special Fertilizer	B. D. Tingley, Houlton	May
3305	National Aroostook Revised Special Fertilizer	G. H. Everett, Ft. Fairfield	May
3555	National Excelsior Special Potato Fertilizer	W. R. Whitney & Son, Norridgewock	June
3246	National Extra Revised High Grade Manure	Benjamin Franklin, Presque Isle	May

Guaranties and Results of Analysis of Fertilizer Samples, 1915—Continued.

Station number.	Nitrogen. Organic. % As nitrate.	% As ammonia.	% As water soluble.	% As active insoluble.*	% As inactive insoluble.	Total. % Found.	% Guaranteed.	Phosphoric Acid. % Soluble.	% Insoluble.	Available. % Found.	% Guaranteed.	Total. % Found.	% Guaranteed.	Potash % Found.	% Guaranteed.	Remarks.
3150	0.94	0.76	0.04	0.68	0.28	2.70	2.46	6.22	0.64	8.21	8.0	8.85	9.0	3.92	4.0	
3481	0.78	0.08	0.56	0.91	0.36	2.69	2.46	6.25	0.83	7.70	8.0	8.53	9.0	4.16	4.0	
3617	0.36	0.76	0.58	0.45	0.19	2.34	2.46	6.67	1.08	8.41	8.0	9.49	9.0	3.72	4.0	
3131	0.48	1.74	0.43	0.73	0.33	3.71	3.69	6.68	0.74	8.08	8.0	8.82	9.0	4.22	4.0	
3156	0.44	1.76	0.48	0.66	0.33	3.67	3.69	6.75	0.74	8.19	8.0	8.93	9.0	4.34	4.0	
3458	0.06	1.76	0.95	0.75	0.38	3.90	3.69	5.65	1.20	7.40	7.0	8.60	8.0	9.87	10.0	1914 goods.
3625	0.54	1.66	0.72	0.60	0.27	3.79	3.69	5.84	1.44	7.57	8.0	9.01	9.0	3.90	4.0	
3632	-	-	-	-	-	1.59	1.25	-	-	-	-	30.00	28.0	-	-	
3572	-	-	-	-	-	-	-	15.86	0.32	17.74	16.0	18.06	-	-	-	
3121	1.47	0.13	0.14	0.47	0.25	2.46	2.47	4.71	1.72	10.11	10.0	11.83	-	2.36	2.0	
3120	1.54	1.06	0.55	0.78	0.31	4.24	4.12	4.47	1.15	8.26	8.0	9.41	-	7.41	7.0	
3119	2.18	-	0.23	0.62	0.25	3.28	3.29	5.82	0.94	10.29	10.0	11.23	10.0	4.28	4.0	
3122	2.00	0.02	0.40	0.61	0.29	3.32	3.29	6.12	1.28	10.16	10.0	11.44	10.0	4.12	4.0	
3571	15.02	-	-	-	-	15.02	15.00	-	-	-	-	-	-	-	-	
3367	0.94	1.40	0.26	1.11	0.42	4.13	4.11	3.96	1.07	7.22	7.0	8.29	8.0	10.09	10.0	1914 goods.
3299	0.62	0.46	0.24	0.41	0.19	1.92	1.65	4.53	0.82	8.75	8.0	9.57	9.0	2.09	2.0	
3242	1.22	1.52	0.30	0.80	0.36	4.18	4.11	4.42	0.70	9.11	9.0	9.81	10.0	4.19	4.0	
3305	1.46	1.30	0.23	0.76	0.35	4.10	4.11	5.30	1.66	8.67	9.0	10.33	10.0	4.01	4.0	
3555	1.22	1.22	0.22	0.55	0.20	3.41	3.29	5.53	1.33	9.80	10.0	11.13	11.0	4.13	4.0	
3246	1.54	1.14	0.37	0.72	0.33	4.10	4.11	5.73	0.84	10.80	10.0	11.64	11.0	3.72	4.0	Potash low.

* In high grade organic ammoniates the figures in this column are considerably larger than those in the next column.

Description of Samples—Continued.

Station number.	Maker and Brand.	Sample Obtained. From	Sample Obtained. Month.
3306	National Extra Revised High Grade Manure	G. H. Everett, Ft. Fairfield	May
3479	National Extra Revised High Grade Manure	Herbert Pryor, Bridgewater	June
3297	National Market Garden Revised Fertilizer	Austin-Haines Co., Waterville	May
3641	National Market Garden Revised Fertilizer	Austin-Haines Co., Waterville	June
3241	National Special Complete Root and Grain Fertilizer	B. D. Tingley, Houlton	May
3296	National Special Complete Root and Grain Fertilizer	Austin-Haines Co., Waterville	May
3341	National Special Complete Root & Grain Fertilizer	S. E. Griffin, Caribou	May
3466	National Special Complete Root & Grain Fertilizer	C. Haines, Washburn	June
3485	National Special Complete Root & Grain Fertilizer	O. J. Parsons, Patten	June
3298	National Special Eureka Potato Fertilizer	Austin-Haines Co., Waterville	May
3247	National Special Premier Potato Manure	Benjamin Franklin, Presque Isle	May
3472	National Special Premier Potato Manure	M. J. McCarty, Mars Hill	June
	NEW ENGLAND FERTILIZER CO., BOSTON, MASS.		
3133	New England Complete Manure	Bangor Tallow Co., Bangor	April
3151	New England Complete Manure	Jackson & Hall, Belfast	April
3483	New England Complete Manure	Bert Bermingham, Patten	June
3484	New England Complete Manure	Bert Birmingham, Patten	June
3282	New England Corn & Grain Fertilizer	Gray-Hildreth Co., Gardiner	May
3286	New England Corn & Grain Fertilizer	Gray-Hildreth Co., Gardiner	May
3613	New England Corn & Grain Fertilizer	P. R. Pushard, West Dresden	June
3152	New England High Grade Potato Fertilizer	Jackson & Hall, Belfast	April
3124	New England High Grade Special	Bangor Tallow Co., Bangor	March
3215	New England High Grade Special	H. R. Burleigh, Houlton	April
3470	New England High Grade Special	Joseph Brown, Washburn	June
3473	New England High Grade Special	M. J. McCarty, Mars Hill	June

Guaranties and Results of Analysis of Fertilizer Samples, 1915—Continued.

Station number.	% As nitrate.	% As ammonia.	% As water soluble.	% As active insoluble.*	% As inactive insoluble.	Nitrogen. Organic. % Found.	Nitrogen. Total. % Guaranteed.	Phosphoric Acid. % Soluble.	% Insoluble.	Available. % Found.	Available. % Guaranteed.	Total. % Found.	Total. % Guaranteed.	Potash % Found.	Potash % Guaranteed.	Remarks.
3306	1.42	1.66	0.33	0.40	0.19	4.00	4.11	7.58	1.22	10.71	10.0	11.93	11.0	3.63	4.0	Potash low.
3479	1.40	1.48	0.32	0.32	0.18	3.70	4.11	6.83	1.30	9.42	10.0	10.72	11.0	3.90	4.0	Moisture 14.58 per cent.
3297	0.90	0.88	0.21	0.49	0.21	2.69	2.47	4.55	1.14	8.29	8.0	9.43	9.0	3.36	3.0	
3641	1.06	0.78	0.08	0.44	0.28	2.64	2.47	4.48	1.15	8.13	8.0	9.28	9.0	2.88	3.0	
3241	1.04	0.98	0.46	0.60	0.32	3.40	3.29	4.31	1.24	8.27	8.0	[illegible]	9.0	4.40	4.0	
3296	0.92	1.30	0.14	0.56	0.25	3.17	3.29	4.85	[illegible]	8.22	8.0	9.47	9.0	4.26	4.0	
3341	1.22	0.88	0.36	0.53	0.33	3.32	3.29	4.12	1.76	[illegible]	8.0	[illegible]	9.0	4.27	4.0	
3466	1.14	1.16	0.13	0.54	0.28	3.25	3.29	3.91	1.48	7.93	8.0	9.41	9.0	3.92	4.0	Moisture 11 per cent.
3485	0.98	1.00	0.27	0.56	0.14	2.95	3.29	3.73	1.06	7.90	8.0	8.96	9.0	4.20	4.0	
3298	1.00	1.08	0.16	0.48	0.25	2.97	2.88	4.51	1.12	8.29	8.0	9.41	9.0	4.35	4.0	
3247	1.46	1.30	0.15	0.35	0.26	[illegible]	3.70	[illegible]	1.40	[illegible]	10.0	11.32	11.0	[illegible]	4.0	
3472	1.12	1.34	0.50	0.46	0.28	3.70	3.70	5.45	1.49	[illegible]	10.0	10.88	11.0	3.85	4.0	Moisture 12.55 per cent.
3133	0.63	1.21	0.78	0.59	0.07	3.28	3.28	6.35	1.15	7.86	8.0	9.01	9.0	4.11	4.0	
3151	0.09	1.29	1.46	0.44	0.20	3.48	3.28	6.64	0.92	[illegible]	8.0	9.44	9.0	4.01	4.0	
3483	0.88	0.62	0.84	0.56	0.25	3.15	3.28	5.77	0.79	6.82	8.0	7.61	9.0	4.00	4.0	
3484	0.78	0.90	0.65	0.56	0.27	3.16	3.28	5.98	0.84	7.45	8.0	8.29	9.0	4.00	4.0	
3282	0.10	0.40	0.31	0.30	0.13	1.24	1.23	5.39	0.96	6.90	7.0	7.86	8.0	2.24	2.0	
3286	-	0.40	0.53	0.31	0.10	1.34	1.23	5.09	0.97	7.04	7.0	8.01	8.0	2.35	2.0	
3613	-	0.32	0.50	0.27	0.16	1.25	1.23	4.53	1.11	6.59	7.0	7.70	8.0	2.02	2.0	
3152	0.36	0.74	0.37	0.64	0.25	2.36	2.48	6.32	0.80	8.08	8.0	8.88	9.0	4.01	4.0	
3124	0.46	1.74	0.44	0.83	0.33	3.60	3.65	6.95	0.69	8.43	8.0	9.12	9.0	4.31	4.0	
3215	0.44	1.78	0.43	0.81	0.36	3.82	3.69	6.86	0.55	8.35	8.0	8.90	9.0	4.31	4.0	
3470	1.00	0.78	0.67	0.91	0.39	3.75	3.69	6.06	0.89	7.39	8.0	8.28	9.0	4.04	4.0	
3473	0.52	1.62	0.41	0.66	0.26	3.47	3.69	6.48	1.02	7.98	8.0	9.00	9.0	4.10	4.0	

* In high grade organic ammoniates the figures in this column are considerably larger than those in the next column.

Description of Samples—Continued.

Station number.	Maker and Brand.	Sample Obtained. From	Sample Obtained. Month.
3340	New England Market Garden Manure	R. Dorsey, Ft. Fairfield	May
3284	New England Peerless Fertilizer	Gray-Hildreth Co., Gardiner	May
3281	New England Potato Fertilizer	Gray-Hildreth Co., Gardiner	May
3283	New England Potato Fertilizer	Gray-Hildreth Co., Gardiner	May
3125	New England Superphosphate	Bangor Tallow Co., Bangor	March
3153	New England Superphosphate	Jackson & Hall, Belfast	April
	NITRATE AGENCIES CO., NEW YORK CITY, N. Y.		
3629	High Grade Acid Phosphate 14%	Eastern Grain Co., Corinna	June
	PARMENTOR & POLSEY FERTILIZER CO., BOSTON, MASS.		
3308	P. & P. A. A. Brand	Thomas Leith, Ft. Fairfield	May
3653	P. & P. A. A. Brand	George F. Ashby, Ft. Fairfield	September
3123	P. & P. Aroostook Special	Bangor Tallow Co., Bangor	March
3218	P. & P. Aroostook Special	H. R. Burleigh, Houlton	April
3447	P. & P. Aroostook Special	L. Ouellette, Van Buren	May
3127	P. & P. Maine Potato Fertilizer	Bangor Tallow Co., Bangor	April
3448	P. & P. Maine Potato Fertilizer	B. Nadeau, Van Buren	May
	PLUMMER FERTILIZER CO., HOULTON, MAINE.		
3478	Plummers (4-8-4)	Guy Morse, Bridgewater	June
	PORTLAND RENDERING CO., PORTLAND, MAINE.		
3294	Portland Organic Fertilizer. Animal Brand	Augusta Tallow Co., Augusta	May
3391	Portland Organic Fertilizer. Animal Brand	Portland Rendering Co., Portland	May
3570	Portland Organic Fertilizer. Animal Brand	Bangor Tallow Co., Bangor	June
3295	Portland Organic Fertilizer. Cumberland Garden Manure	Augusta Tallow Co., Augusta	May
3390	Portland Organic Fertilizer. Cumberland Garden Manure	Portland Rendering Co., Portland	May
3460	Portland Organic Fertilizer. Cumberland Garden Manure	Johnson Seed Potato Co., Richmond	June

Guaranties and Results of Analysis of Fertilizer Samples, 1915—Continued.

	Nitrogen.							Phosphoric Acid.						Potash		
			Organic.			Total.				Available.		Total.				
Station number.	% As nitrate.	% As ammonia.	% As water soluble.	% As active insoluble.*	% As inactive insoluble.	% Found.	% Guaranteed.	% Soluble.	% Insoluble.	% Found.	% Guaranteed.	% Found.	% Guaranteed.	% Found.	% Guaranteed.	Remarks.
3340	1.06	1.04	0.83	1.04	0.54	4.51	4.10	6.12	0.94	7.86	8.0	8.80	9.0	4.11	4.0	
3284	-	0.06	0.48	-	-	0.80	0.82	4.61	0.85	6.55	7.0	7.40	8.0	1.01	1.0	
3281	-	0.46	0.69	0.51	0.12	1.78	1.64	4.80	1.11	7.71	7.0	8.82	8.0	3.93	4.0	
3283	-	0.84	0.47	-	-	1.65	1.64	5.06	0.75	6.71	7.0	7.46	8.0	3.78	4.0	
3125	0.22	0.74	0.88	0.40	0.22	2.46	2.46	6.51	1.33	8.02	8.0	9.35	9.0	2.93	3.0	
3153	0.40	0.78	0.69	0.42	0.19	2.48	2.46	6.43	1.20	8.29	8.0	9.49	9.0	3.07	3.0	
3629	-	-	-	-	-	0.13	-	15.25	0.31	17.19	14.0	17.50	15.0	-	-	
3308	1.16	0.08	1.25	1.33	0.61	4.45	4.10	5.98	1.40	8.09	8.0	9.49	9.0	4.18	4.0	
3653	1.11	0.07	1.33	1.26	0.63	4.40	4.10	6.01	1.20	8.24	8.0	9.44	9.0	4.02	4.0	
3123	0.53	1.73	0.38	0.75	0.24	3.63	3.69	6.54	0.71	7.98	8.0	8.69	9.0	4.28	4.0	
3218	0.44	1.72	0.78	0.58	0.24	3.76	3.69	6.54	0.92	8.43	8.0	9.35	9.0	4.28	4.0	
3447	0.46	1.76	0.55	0.75	0.22	3.74	3.69	6.54	0.70	7.94	8.0	8.64	9.0	4.35	4.0	
3127	0.46	1.22	0.73	0.47	0.26	3.14	3.28	6.46	1.19	8.78	8.0	9.97	9.0	4.00	4.0	
3448	0.44	1.28	0.58	0.63	0.21	3.14	3.28	5.77	1.28	7.33	8.0	8.61	9.0	3.85	4.0	
3478	0.40	1.24	0.35	0.65	0.46	3.10	3.29	5.49	2.35	7.44	8.0	9.79	9.0	4.14	4.0	Moisture 12.95 per cent.
3294	0.64	0.86	0.31	0.60	0.16	2.57	2.46	7.02	0.80	9.71	8.0	10.51	9.0	3.11	3.0	
3391	0.50	0.78	0.58	0.63	0.25	2.74	2.46	7.18	0.75	9.71	8.0	10.46	9.0	3.18	3.0	
3570	0.46	0.68	0.77	0.49	0.22	2.62	2.46	7.10	0.94	9.28	8.0	10.22	9.0	3.14	3.0	
3295	0.82	1.36	0.16	1.10	0.48	3.92	4.10	6.87	1.85	9.39	8.0	11.24	9.0	4.42	4.0	
3390	0.72	1.18	1.00	0.82	0.38	4.10	4.10	6.41	1.86	9.69	8.0	11.55	9.0	4.24	4.0	
3460	0.64	1.24	1.01	0.78	0.36	4.03	4.10	6.08	2.45	9.13	8.0	11.58	9.0	4.25	4.0	

* In high grade organic ammoniates the figures in this column are considerably larger than those in the next column.

Description of Samples—Continued.

Station number.	Maker and Brand.	Sample Obtained. From	Sample Obtained. Month.
3132	Portland Organic Fertilizer. Potato Grower	Bangor Tallow Co., Bangor	April
3293	Portland Organic Fertilizer. Potato Grower	Augusta Tallow Co., Augusta	May
3388	Portland Organic Fertilizer. Potato Grower	Portland Rendering Co., Portland	May
3615	Portland Organic Fertilizer. Potato Grower	L. W. Nash, Kennebunk	June
3638	Portland Organic Fertilizer. Potato Grower	E. S. Crosby, West Bethel	July
3389	Portland Organic Fertilizer. Sebago Brand	Portland Rendering Co., Portland	May
	PROVINCIAL CHEM. FERTILIZER CO., St. Steven, N. B.		
3444	Provincial No. 9. Registration No. 1106	C. L. Cyr, Van Buren	May
	ROGERS & HUBBARD CO., PORTLAND, CONN.		
3639	Hubbard's "Bone Base" Soluble Potato Manure	John A. Beals, Bowdoinham	July
	F. S. ROYSTER GUANO CO., BALTIMORE, MD.		
3523	Royster's Favorite Compound	Galt Block Warehouse Co., Portland	June
3438	Royster's Home Run Compound (Registered as "Royster's Parfait" Compound)	J. B. Williams, Ft. Fairfield	May
3520	Royster's Home Run Compound. (Registered as "Royster's Parfait" Compound)	Galt Block Warehouse Co., Portland	June
3522	Royster's Solace Compound	Galt Block Warehouse Co., Portland	June
3524	Royster's Truckers' Delight	Galt Block Warehouse Co., Portland	June
3521	Royster's Utopia Compound	Galt Block Warehouse Co., Portland	June
	SAGADAHOC FERTILIZER CO., BOWDOINHAM, MAINE.		
3541	Bone Meal	W. G. Sweetser, Yarmouth	June
3454	5-10-4	Sagadahoc Fertilizer Co., Bowdoinham	June
3451	4-8-4	Sagadahoc Fertilizer Co., Bowdoinham	June
3511	4-8-4	H. H. Witherell, Monmouth	June
3453	Sagadahoc Dirigo Fertilizer for Grass & Grain	Sagadahoc Fertilizer Co., Bowdoinham	June
3510	Sagadahoc Dirigo Fertilizer for Grass & Grain	H. H. Witherell, Monmouth	June

Guaranties and Results of Analysis of Fertilizer Samples, 1915—Continued.

	Nitrogen.							Phosphoric Acid.						Potash		
			Organic.			Total.				Available.		Total.				
Station number.	% As nitrate.	% As ammonia.	% As water soluble.*	% As active insoluble.	% As inactive insoluble.	% Found.	% Guaranteed.	% Soluble.	% Insoluble.	% Found.	% Guaranteed.	% Found.	% Guaranteed.	% Found.	% Guaranteed.	Remarks.
3132	0.70	1.06	0.39	1.03	0.27	3.45	3.28	7.15	1.43	10.18	8.0	11.61	9.0	4.31	4.0	
3293	–	1.12	0.92	0.77	0.35	3.16	3.28	6.71	1.14	9.71	8.0	10.85	9.0	4.28	4.0	
3388	0.58	1.02	0.66	0.67	0.34	3.27	3.28	7.37	0.89	9.05	8.0	9.94	9.0	4.33	4.0	
3615	0.66	0.94	1.43	0.64	0.36	4.03	3.28	5.90	1.28	9.09	8.0	10.37	9.0	4.00	4.0	Sample received from correspondent.
3638	0.28	0.98	1.21	0.52	0.29	3.28	3.28	7.53	0.61	9.42	8.0	10.03	9.0	4.33	4.0	
3389	0.84	1.14	0.66	0.68	0.38	3.70	3.69	6.44	1.42	9.39	8.0	10.81	9.0	4.34	4.0	
3444	1.22	1.50	0.27	0.62	0.21	3.82	4.10	4.51	1.96	7.23	8.0	9.19	9.0	4.05	4.0	Not registered in 1915. Not sold in Maine.
3639	2.46	0.16	0.62	0.97	0.47	4.68	5.00	0.69	3.73	7.07	7.0	10.80	10.0	2.55	2.0	
3523	–	1.00	0.58	–	–	1.83	1.65	6.51	1.54	10.36	10.0	11.90	10.5	2.05	2.0	
3438	0.08	2.20	0.65	0.87	0.45	4.25	4.11	5.15	2.07	7.79	8.0	9.86	8.5	4.15	4.0	
3520	0.12	1.94	0.52	0.68	0.34	3.60	4.11	4.64	2.23	7.90	8.0	10.13	8.5	3.82	4.0	
3522	0.26	2.00	0.36	0.73	0.35	3.70	3.70	5.12	2.27	8.94	9.0	11.21	9.5	3.21	3.0	
3524	0.10	1.82	0.43	0.62	0.39	3.36	3.29	4.63	2.83	7.70	8.0	10.53	8.5	4.52	4.0	
3521	0.14	1.38	0.33	0.44	0.19	2.48	2.47	4.34	2.03	7.91	8.0	9.94	8.5	3.01	3.0	
3541	–	0.12	0.83	2.41	1.14	4.50	4.11	0.57	12.50	8.94	–	21.44	18.0	–	–	
3454	2.18	0.20	0.48	–	–	2.96	4.12	4.39	1.11	10.49	10.0	11.60	11.0	4.23	4.0	Nitrogen very low.
3451	1.62	0.24	0.50	0.66	0.20	3.22	3.29	2.86	1.28	7.89	8.0	9.17	9.0	5.23	4.0	
3511	2.26	0.42	0.29	–	–	3.21	3.29	2.78	1.11	8.97	8.0	10.08	9.0	4.50	4.0	
3453	0.28	–	0.44	–	–	0.96	1.00	0.22	3.72	6.31	4.0	10.03	10.0	1.39	1.0	
3510	0.10	0.04	0.26	0.46	0.22	1.08	1.00	5.50	5.59	10.62	4.0	16.21	10.0	1.19	1.0	

* In high grade organic ammoniates the figures in this column are considerably larger than those in the next column.

Description of Samples—Continued.

Station number.	Maker and Brand.	Sample Obtained.	
		From	Month.
3540	Sagadahoc Dirigo Fertilizer for Grass & Grain	W. G. Sweetser, Yarmouth	June
3452	Sagadahoc High Grade Superphosphate	Sagadahoc Fertilizer Co., Bowdoinham	June
3450	Sagadahoc Special Corn	Sagadahoc Fertilizer Co., Bowdoinham	June
3455	Sagadahoc Special Orchard	Sagadahoc Fertilizer Co., Bowdoinham	June
3456	Sagadahoc Yankee	Sagadahoc Fertilizer Co., Bowdoinham	June
3449	2½-8-3	Sagadahoc Fertilizer Co., Bowdoinham	June
	J. W. SANBORN, GILMANTON, N. H.		
3670	Prof. Sanborn's Chemical Fertilizer for Potatoes & Corn	Fred L. Bailey, Springfield	October
	STANDARD GUANO CO., BALTIMORE, MD.		
3309	Farmers' Union of Maine 5-8-7	George H. Stone, Ft. Fairfield	May
3331	Farmers' Union of Maine 5-8-7	Rufus P. Ayer, Freedom	May
3332	Farmers' Union of Maine 5-8-7	Rufus P. Ayer, Freedom	May
3333	Farmers' Union of Maine 5-8-7	Nicholas Walton, Thorndike	May
3334	Farmers' Union of Maine 5-8-7	Nicholas Walton, Thorndike	May
3361	Farmers' Union of Maine 5-8-7	George H. Stone, Ft. Fairfield	May
3646	Farmers' Union of Maine 5-8-7	T. W. Skelton, Bowdoin	July
3647	Farmers' Union of Maine 5-8-7	T. W. Skelton, Bowdoin	July
3335	Farmers' Union of Maine 4-8-4	E. W. Downer, Freedom	May
3336	Farmers' Union of Maine 4-8-7	E. W. Downer, Freedom	May
3327	Farmers' Union of Maine 4-8-7	Skowhegan Farmers' Union, Skowhegan	May
3337	Farmers' Union of Maine 4-8-7	Robert W. Betts, Thorndike	May
	I. P. THOMAS & SON CO., PHILADELPHIA, PA.		
3643	High Grade Ammoniated Fertilizer	R. M. Stiles, Brooks	July
3622	Long Island Special 4-8-4	Central Maine Co-op. Association, Foxcroft	June
3642	Long Island Special 4-8-4	Brooks Farmers' Union, Brooks	July

Guaranties and Results of Analysis of Fertilizer Samples, 1915—Continued.

	Nitrogen.							Phosphoric Acid.						Potash		
			Organic.			Total.				Available.		Total.				
Station number.	% As nitrate.	% As ammonia.	% As water soluble.*	% As active insoluble.	% As inactive insoluble.	% Found.	% Guaranteed.	% Soluble.	% Insoluble.	% Found.	% Guaranteed.	% Found.	% Guaranteed.	% Found.	% Guaranteed.	Remarks.
3540	-	0.06	0.28	0.36	0.20	0.90	1.00	9.41	3.61	11.67	4.0	15.28	10.0	1.32	1.0	
3452	0.76	0.40	0.33	-	-	1.65	1.65	8.36	1.49	11.80	10.0	13.29	11.0	3.32	2.0	
3450	0.74	0.36	0.31	-	-	1.69	2.06	3.30	1.61	10.75	10.0	12.36	11.0	2.51	3.0	
3455	0.14	-	0.43	-	-	0.84	2.47	1.50	4.59	8.28	5.0	12.87	12.0	3.68	1.0	A bad mixup on nitrogen and potash.
3456	0.88	0.04	-	-	-	0.99	0.82	5.84	0.61	8.80	8.0	9.41	9.0	1.40	1.0	
3449	0.88	0.06	0.41	0.57	0.19	2.11	2.06	0.96	0.74	7.00	8.0	7.74	9.0	4.01	3.0	
3670	-	2.51	0.13	0.45	0.22	3.31	3.29	5.20	0.72	6.79	8.0	7.51	9.0	4.39	4.0	Sample received from correspondent.
3309	0.38	2.76	0.30	0.43	0.27	4.14	4.11	6.94	0.64	8.42	8.0	9.06	8.5	6.13	7.0	The 5-8-7 goods are low. They average 3.93 per cent. nitrogen and 6.22 per cent. potash.
3331	0.24	3.10	0.13	-	-	3.83	4.11	7.18	0.66	8.46	8.0	9.12	8.5	6.49	7.0	
3332	-	3.14	0.43	-	-	3.96	4.11	7.34	0.54	8.98	8.0	9.52	8.5	6.28	7.0	
3333	-	2.88	0.36	0.36	0.26	3.86	4.11	6.92	0.77	8.69	8.0	9.46	8.5	5.85	7.0	
3334	-	2.92	0.29	0.34	0.27	3.82	4.11	6.86	0.89	8.47	8.0	9.36	8.5	6.32	7.0	
3361	0.24	2.68	0.37	0.49	0.29	4.06	4.10	6.20	0.75	8.25	8.0	9.00	8.5	5.66	7.0	
3646	-	3.14	0.38	-	-	3.90	4.11	6.97	0.47	7.74	8.0	8.21	8.5	6.53	7.0	Moisture 11 per cent.
3647	-	3.10	0.39	-	-	3.87	4.11	6.92	0.48	7.80	8.0	8.28	8.5	6.52	7.0	
3335	-	2.04	0.68	0.38	0.10	3.20	3.29	6.54	0.66	8.21	8.0	8.87	8.5	4.00	4.0	
3336	-	2.00	0.74	0.35	0.11	3.20	3.28	7.35	0.82	8.72	8.0	9.54	8.5	7.44	7.0	
3327	0.18	2.78	0.03	-	-	3.37	3.28	5.74	0.83	8.15	8.0	8.98	8.5	6.73	7.0	
3337	-	2.66	0.08	-	-	3.11	3.28	6.57	0.74	8.75	8.0	9.49	8.5	6.40	7.0	Moisture 11.06 per cent.
3643	0.76	1.76	0.50	0.64	0.37	4.03	4.10	5.10	1.05	7.50	8.0	8.55	8.5	4.22	4.0	
3622	0.88	1.38	0.25	0.60	0.26	3.37	3.25	6.64	0.75	8.29	8.0	9.04	8.5	5.00	4.0	
3642	0.68	1.34	0.36	0.56	0.28	3.22	3.25	5.58	1.15	7.78	8.0	8.93	8.5	4.12	4.0	

* In high grade organic ammoniates the figures in this column are considerably larger than those in the next column.

Description of Samples—Continued.

Station number.	Maker and Brand.	Sample Obtained.	
		From	Month.
3645	War Time Fertilizer 4–8–7	F. H. Quimby, Brooks	July
	TUSCARORA FERTILIZER CO., BALTIMORE, MD.*		
3351	Complete Potato	Joseph Duffy, Benedicta	May
3310	Double Value	George H. Stone, Ft. Fairfield	May
3254	5–8–4	P. H. Reed, Ft. Fairfield	May
3474	5–8–4	Colbath & Anderson, Mars Hill	June
3253	5–10–4	P. H. Reed, Ft. Fairfield	May
3457	5–10–4	Tom Gilerson, Caswell Plantation	May
3214	4–8–4	H. R. Burleigh, Houlton	April
3475	4–8–4	Colbath & Anderson, Mars Hill	June
3508	4–8–4	F. A. Blaisdell, Monmouth	June
3493	Standard	Napoleon Beauregard & Co., Lewiston	June
3507	Standard	F. A. Blaisdell, Monmouth	June
3630	Standard	J. E. Gray, Corinna	June
3352	Trucker	E. W. Hughes, Sherman Mills	May
3354	Trucker	D. M. Caldwell, Sherman Mills	May
	UNION CHEMICAL WORKS, INC., NORTH WALES, PA.		
3459	Ideal Potato Manure	Johnson Seed Potato Co., Richmond	June
	VIRGINIA-CAROLINA CHEMICAL CO., NEW YORK CITY, N. Y.		
3302	V. C. C. Co.'s High Grade Corn & Vegetable Compound (With 4% Potash)	Fred A. Wing, Waterville	May
3534	V. C. C. Co.'s Special Corn & Grain Grower	Andrews & Horigan, Biddeford	June
3301	V. C. C. Co.'s Star Brand Potato & Vegetable Compound (With 4% Potash)	Fred A. Wing, Waterville	May

* For other samples of Tuscarora Fertilizer Co.'s goods see p. 274.

Guaranties and Results of Aanalysis of Fertilizer Samples, 1915—Continued.

Station number.	Nitrogen.							Phosphoric Acid.						Potash		Remarks.
	Organic.					Total.		Available.				Total.				
	% As nitrate.	% As ammonia.	% As water soluble.*	% As active insoluble.	% As inactive insoluble.	% Found.	% Guaranteed.	% Soluble.	% Insoluble.	% Found.	% Guaranteed.	% Found.	% Guaranteed.	% Found.	% Guaranteed.	
3645	0.46	1.52	0.56	0.55	0.15	3.24	3.25	5.38	1.37	8.15	8.0	9.52	8.5	6.50	7.0	Potash low.
3351	-	1.00	0.76	0.53	0.41	2.70	3.28	5.59	0.62	6.38	6.0	6.99	8.0	9.49	10.0	1914 goods.
3310	0.86	1.58	0.43	0.68	0.40	3.95	4.11	6.64	0.51	7.83	8.0	8.34	9.0	9.79	10.0	1914 goods. Moisture 10.37 per cent.
3254	1.54	0.10	0.57	1.35	0.63	4.19	4.11	6.49	0.79	8.21	8.0	9.00	8.5	4.11	4.0	
3474	1.50	0.10	0.66	1.25	0.55	4.06	4.11	6.54	1.10	7.64	8.0	8.74	8.5	4.07	4.0	
3253	1.72	0.04	0.52	1.36	0.50	4.14	4.11	8.29	1.00	9.89	10.0	10.89	11.0	4.05	4.0	
3457	0.80	1.58	0.50	0.61	0.39	3.88	4.11	8.13	1.00	9.70	10.0	10.70	11.0	4.17	4.0	
3214	0.48	1.06	0.77	0.65	0.44	3.40	3.29	6.78	0.27	8.34	8.0	8.61	9.0	4.24	4.0	
3475	1.40	1.24	0.58	0.67	0.50	3.39	3.29	5.39	2.18	7.26	8.0	9.44	9.0	4.02	4.0	
3508	0.44	0.44	0.90	0.84	0.66	3.28	3.29	5.10	1.57	7.74	8.0	9.31	8.5	4.04	4.0	
3493	-	0.46	0.46	0.48	0.33	1.73	1.65	4.59	1.11	7.63	8.0	8.74	8.5	2.11	2.0	
3507	-	0.34	0.58	0.50	0.46	1.88	1.65	4.66	1.45	7.43	8.0	8.88	8.5	2.16	2.0	
3630	-	0.50	0.51	0.49	0.34	1.84	1.65	4.98	1.02	7.98	8.0	9.00	8.5	2.10	2.0	
3352	0.84	1.42	0.32	0.67	0.41	3.66	4.11	6.25	0.45	7.88	8.0	8.33	9.0	7.02	7.0	1914 goods. Moisture 12.08 per cent.
3354	0.54	1.92	0.28	0.54	0.53	3.81	4.11	6.79	0.84	8.20	8.0	9.04	9.0	6.92	7.0	1914 goods.
3459	-	2.34	0.74	0.44	0.22	3.74	4.10	9.20	0.97	10.56	10.0	11.53	10.0	3.04	3.0	
3302	-	1.90	0.20	0.34	0.16	2.60	2.47	5.20	1.00	8.52	8.0	9.52	9.0	3.83	4.0	
3534	0.66	0.36	0.34	0.32	0.16	1.84	1.65	7.18	1.21	10.26	10.0	11.47	11.0	3.39	3.0	
3301	-	2.54	0.14	0.49	0.16	3.33	3.29	4.45	0.34	6.07	6.0	6.41	7.0	4.29	4.0	

*** In high grade organic ammoniates the figures in this column are considerably larger than those in the next column.**

Description of Samples—Concluded.

Station number.	Maker and Brand.	Sample Obtained. From	Sample Obtained. Month.
3328	V. C. C. Co.'s Star Brand Potato & Vegetable Compound (With 4% Potash)	Holt & Hight, Skowhegan	May
3436	V. C. C. Co.'s Star Brand Potato & Vegetable Compound (With 4% Potash)	Sam H. Fitts, Freeport	May
3626	V. C. C. Co.'s Star Brand Potato & Vegetable Compound (With 4% Potash)	Eastern Grain Co., Corinna	June
3226	V. C. C. Co.'s 20th Century Potato Manure (With 4% Potash)	George H. Benn, Houlton	April
3300	V. C. C. Co.'s 20th Century Potato Manure (With 4% Potash)	Fred A. Wing, Waterville	May
3433	V. C. C. Co.'s 20th Century Potato Manure (With 4% Potash)	Sam H. Fitts, Freeport	May
3434	V. C. C. Co.'s 20th Century Potato Manure	Sam H. Fitts, Freeport	May
	WHITMAN & PRATT RENDERING CO., LOWELL, MASS.		
3496	Whitman & Pratt's Vegetable Grower	F. J. Thompson, Sabattus	June
	TUSCARORA FERTILIZER CO.,* BALTIMORE, MD.		
3368	Aroostook Special	Joseph Duffy, Benedicta	May
3360	Double Value	Geo. H. Stone, Ft. Fairfield	May
3353	4-8-4	E. W. Hughes, Sherman Mills	May

* For other samples of Tuscarora Fertilizer Co's foods see p. 268.

Guaranties and Results of Aanalysis of Fertilizer Samples, 1915—Concluded.

Station number.	Nitrogen. % As nitrate.	Nitrogen. % As ammonia.	Nitrogen. Organic. % As water soluble.*	Nitrogen. Organic. % As active insoluble.	Nitrogen. Organic. % As inactive insoluble.	Nitrogen. Total. % Found.	Nitrogen. Total. % Guaranteed.	Phosphoric Acid. % Soluble.	Phosphoric Acid. % Insoluble.	Phosphoric Acid. Available. % Found.	Phosphoric Acid. Available. % Guaranteed.	Phosphoric Acid. Total. % Found.	Phosphoric Acid. Total. % Guaranteed.	Potash % Found.	Potash % Guaranteed.	Remarks.
3328	0.18	2.98	0.03	-	-	3.43	3.29	3.86	0.70	5.82	6.0	6.52	7.0	4.72	4.0	
3436	0.13	2.21	0.82	0.35	0.29	3.80	3.29	3.29	1.15	6.39	6.0	7.54	7.0	4.38	4.0	
3626	-	1.96	1.00	0.42	0.26	3.64	3.29	2.79	1.42	5.53	6.0	6.95	7.0	4.53	4.0	
3226	0.04	2.96	0.07	0.86	0.41	4.34	4.12	6.84	0.97	8.85	8.0	9.82	9.0	4.25	4.0	
3300	0.26	3.14	0.24	0.37	0.19	4.20	4.12	7.35	0.64	8.53	8.0	9.17	9.0	4.15	4.0	
3433	-	3.10	0.49	0.36	0.19	4.14	4.12	4.71	1.08	8.49	8.0	9.57	9.0	4.56	4.0	
3434	0.08	2.76	0.14	0.46	0.52	3.96	4.12	6.49	1.81	8.27	8.0	10.08	9.0	8.10	8.0	1914 goods.
3496	0.50	1.32	0.77	0.47	0.26	3.32	3.29	5.50	1.11	7.77	8.0	8.88	10.0	4.08	4.0	
3368	-	1.30	0.04	0.52	0.39	2.25	2.47	6.16	0.63	7.52	7.0	8.11	7.5	8.04	8.0	1914 goods.
3360	0.80	1.64	0.10	0.73	0.30	3.57	4.11	6.12	0.47	7.57	8.0	8.04	9.0	9.62	10.0	1914 goods.
3353	0.50	1.10	0.48	0.61	0.44	3.13	3.29	6.70	0.41	7.77	8.0	8.18	9.0	4.19	4.0	

* In high grade organic ammoniates the figures in this column are considerably larger than those in the next column.

Discussion of Results of Analyses of Fertilizers.

The errors due to the sampling and laboratory examination effect, of course, the results of the analyses as reported. With the best of care, different samples taken from the same goods at the same time and examined by the same analyst will show slightly discordant results. These may be slightly too high or slightly too low. A variation of two-tenths of a per cent in the actual content may occur. That is, the examination of a sample of goods that actually carried 4 per cent nitrogen might show a result as low as 3.8 per cent or as high as 4.2 per cent. Hence when only a single sample is examined variations to these limits would always be passed. If several samples of the same goods are found to be all or nearly all only slightly low a case could probably be maintained under the fertilizer law, provided the other constituents were not present in sufficient excess to indicate the sample taken did not fairly represent the output.

Nitrogen and potash are the most costly constituents of fertilizers, and in examining the tables special attention should be given to these constituents. When there is a marked deficiency in the goods, the fact is noted in the tables. When there is a shortage of more than .2 per cent in one constituent and a corresponding overrun in others, no comment is made in the tables.

On the whole the fertilizers of 1915 are fairly well up to the guaranty. It is to be remembered, however, that these guarantees are minimum and not average guarantees, and that companies whose goods on the whole run close to their guaranteed analyses may be manufacturing too close to their minimum guarantees for safety to themselves or their customers.

Formerly the lower figure in a guaranty was usually maintained with a good margin for safety. There seems to be a growing tendency on the part of certain companies to manufacture too close to the minimum guaranty. Of course in theory a fertilizer should never fall below the guaranty for that is supposed to be its minimum.

In quite a number of instances 1914 goods were sampled and the analyses are reported herewith. Wherever it is known to the Station that these were 1914 goods the fact is indicated in the tables.

Fertilizers for House Plants.

The inspectors collected samples of four different fertilizers on sale in the State in small packages for household plants.

Bowker's Ammoniated Food for Flowers, Bowker Fertilizer Co., Boston, (No. 3635), carried 1.90 per cent of nitrogen, with a guaranty of 2.47 per cent; 7.30 per cent of available phosphoric acid with a guaranty of 6 per cent; and 3.38 per cent of potash with a guaranty of 2 per cent.

Mak-Gro Concentrated Odorless Plant Food, The Consumers' Fertilizer Company of New York, (No. 3634), carried 2.45 per cent of nitrogen with a guaranty of 2.46 per cent; 9.24 per cent available phosphoric acid with a guaranty of 8 per cent; 8.12 per cent potash with 8 per cent guaranteed. These goods were not registered.

Sterlingworth Plant Tablets, Sterling Chemical Co., Cambridge, Mass., No. 3637, was without guaranty and was unregistered. It carried 8.85 per cent of nitrogen, 13.02 per cent of available phosphoric acid and 8.65 per cent of potash.

Verdantine Plant Food, made by the Union Chemical Co., Lewiston, Maine, (sample No. 3636), carried 7.29 per cent of nitrogen with a guaranty of 5.20 per cent; 7.04 per cent available phosphoric acid with a guaranty of 5.5 per cent; and 8.91 per cent potash with a guaranty of 15.5 per cent.

New Mineral Plant Food.

Two samples of the material put out by the New Mineral Fertilizer Company were examined. These goods contained practically no water-soluble plant food. When treated with strong acid about two-tenths of a per cent of phosphoric acid goes into solution. One of the two samples was in very poor mechanical condition. It contained pieces of unground rock as large as the end of one's finger.

These goods were not registered in Maine in 1915.

Lime.

The Pownal Lime Company of Boston, Mass., registered ground limestone that was guaranteed to carry not less than 50 per cent lime. The sample received (3519) carried 46.44 per cent calcium oxide (lime) and a trace of phosphoric acid.

The Rockland & Rockport Lime Company of Rockland, Maine, registered R. R. Land Lime with a minimum guaranty of 60 per cent total lime (calcium oxide). Two samples (3530 and 3539) were found to carry 58.40 and 60.00 per cent lime, with traces of phosphoric acid.

The United States Gypsum Company of Chicago, Illinois, registered Land Plaster with a guaranty of 92 per cent calcium sulphate. The sample (3525) examined carried 85.9 per cent calcium sulphate.

Delay in the Publication of the Analyses.

Under the law it is the duty of the Commissioner of Agriculture to collect the samples of fertilizers, and it is the duty of the Director of the Station to make the analyses. The collection of samples usually begins by March 10 and ends by May 25. This year (1915) the first samples were received April 5, and the last sample September 17. It was not possible to complete the analyses until the end of September. The reports of the analyses were sent to the Commissioner of Agriculture from time to time during the summer as they were completed.

The samples as received at the Station were identified by number, but without information as to the brand, the guaranty, and the maker. This information for most of the samples was received at the Station October 13 but the data for the last of the samples were not received until November 19.

As the results could not be put in tabular form for printing until after all the data were at hand, the copy for the tables could not be sent to the printer until late in November. The law requires the Director of the Station to "publish the official bulletin giving the results of analyses that are deemed of public importance annually in the month of October." It was impossible to comply with the law the present year for the reasons stated above. As it takes from 8 to 10 weeks from the time the copy is sent to the printer before the completed pamphlet is received from the binder, the fertilizer analyses for 1915 will be distributed about 3 months late.

Analysis of Samples Submitted by Correspondents.

All analyses of commodities coming under the laws of which the Commissioner of Agriculture is the executive are made by the Director of the Station at the request of the Commissioner. There is a special law (Chapter 130, Public Laws of 1911) which provides for the analysis of samples of fertilizers taken by any citizen. It requires the sample to be taken in the presence of a witness from not less than 5 packages in a manner prescribed by the Commissioner of Agriculture. The sample shall be accompanied by an analysis fee of $10. If not more than one sample of the same brand has been analyzed, or if the analysis differs materially from the guaranty, the analysis fee is returned to the sender.

The description of the goods may or may not be sent to the Commissioner as the sender chooses. It is not necessary, as so many seem to think, that the name of the brand and its analysis be sent with the sample. But this information must be given either when the sample is sent or after the analysis is reported to the sender if he wishes the refund.

No samples should be taken without first getting complete directions for sampling. These may be had from the Commissioner of Agriculture, Augusta, or from the Station.

Fertilizers for 1916.

For more than a generation New England agriculture has been dependent upon the purchase of plant food in the form of commercial fertilizers. It has been a matter of great concern to those officially interested in New England agriculture that it has not been self-sustaining and that it has been necessary to look outside of its borders for the needed extra plant food. A most cursory examination of statistics indicates that with the introduction of commercial plant food, New England agriculture has steadily advanced, not only in the total yield but in the net profit per acre. The commercial fertilizers used before the early seventies carried little or no potash. In 1916 because of its shortage and prohibitive price, fertilizers will again carry little or no potash. Many experiments have been made and many treatises have been written showing the value of potash in agriculture. The experimental data showing how crops can be grown without potash are few.

Recognizing the dearth of information and the prime importance of the subject, the directors of the New England, New Jersey and New York Experiment Stations held a special meeting recently to discuss this subject and arrive at definite recommendations for the crops for 1916. Based upon this discussion and the conclusions there reached, supplemented by a few special studies made by this Station, chiefly at its Aroostook Farm, the writer prepared an address for the Maine Seed Improvement Association.* The following is taken from that address:

POTASH.

Feldspar carries considerable potash, but experiments have not shown it to be of any direct value as applied to land. There are patented processes for extracting potash from feldspar which would doubtless come into practice were it not for the fact that as soon as the war is over potash will probably go back to its normal price. While it is hoped that supplies of potash may be found that will make this country independent of foreign sources, not enough will be produced before planting time to at all relieve the present shortage.

Outside of a limited amount of ashes, available potash is practically unobtainable for most crops. Commercial fertilizers for 1916 will, for the most part, be made to carry no potash or at the most only one per cent. This one per cent will add five dollars to the cost of fertilizer per ton.

POTASH LIBERATORS.

There are no such things as potash substitutes in agriculture, but some materials, such as the sodium and calcium salts, will under certain conditions more or less replace the potash in the soil and render it available for the growing of plants.

Among the soda salts are nitrate of soda, soda ash and common salt. Gypsum (calcium sulphate) is the most important calcium salt. Alkaline sources of lime and soda such as calcium carbonate and lime and of soda ash, do not seem to be so effective in releasing the potash of soils as are the chlorides and nitrates.

Field experiments conducted for 20 years at the Rhode Island Experiment Station seem to indicate that soda has con-

*This is printed in pamphlet form under the title of "Growing Crops Without Potash in 1916," and can be had on application to the Station.

siderable value in releasing potash for certain crops. There was very little gained from the use of common salt with the potato crop. This experiment indicated during its whole course that the application of soda to the granitic soils helped to insure the production of normal crops, even without the addition of potash. At the Experiment Station at Rothamsted, England, nitrate of soda has been found to be of marked value in the growing of crops, irrespective of the nitrogen which it carries. Dr. Hall concludes from these experiments that "in practice the dressing of nitrate of soda on any but the lightest soil will dispense with the necessity of a specific potash manuring even for potash loving crops."

Lime (calcium oxide), hydrated lime (calcium hydrate) air-slaked lime (calcium carbonate), or ground limestone (calcium carbonate), is helpful in liberating potash from the organic matter of the soil. The effect of lime upon the mineral potash of a soil is not so well determined, and there is a difference of opinion. The best New England authorities think that it has little or no effect in freeing mineral potash.

Gypsum (calcium sulphate) has been found to have some effect in replacing potash in the soil. Its price, however, is probably too high for general application the present year. Acid phosphate, however, of necessity, always carries gypsum. Hence all mixed fertilizers containing available phosphoric acid also carry gypsum. In general multiplying the available phosphoric acid in a fertilizer by two and a half will give the approximate pounds of gypsum in fertilizers. That is, an acid phosphate carrying 16 per cent of available phosphoric acid will carry about 40 per cent of gypsum. A ton of fertilizer with ten per cent available phosphoric acid would carry about 500 pounds of gypsum.

Growing Potatoes Without Potash.

Potatoes are the chief cash crop grown in Maine. It is of first importance for the grower to have what facts are available relative to the likelihood of obtaining a crop in 1916 without the application of potash. Foreseeing the possibility that the fertilizers in 1916 would contain very little, if any, potash, the Maine Agricultural Experiment Station began in 1915 at Aroostook Farm, a series of experiments to determine the effect of different amounts of potash. Four different mixtures were used. In each case the fertilizer contained 4 per cent of nitrogen (five per cent of ammonia), of which one-third was in the form of nitrate of soda, and 8 per cent of available phosphoric acid. The potash varied as follows: On one plot there was none, on another 2 per cent, on another 5 per cent, and on another 8 per cent. The plots were one-half acre each and they were planted in duplicate. The land had been in grass for two years, one year in oats and the year before that had been in potatoes. No fertilizer had been used since the potato crop of 1911. In each case the fertilizer was applied at the time of planting at the rate of 1500 pounds per acre. Other than the amount of potash used, all the plots were treated exactly alike.

Throughout the growing season the vines on both the no potash plots were a distinctly brighter green and had a thriftier look than on the adjoining plots. The difference was so marked that it attracted much attention from visitors at the farm. Although some slight irregularities occurred in the yield from the different plots, the average figures show fairly consistent increases with the increase in potash. The plots without potash yielded 110 barrels or 302 bushels of merchantable potatoes. The plots with 2 and 5 per cent potash gave practically the same yields of 116 barrels of 320 bushels per acre. The 8 per cent potash plots averaged to yield 120 barrels or 331 bushels per acre. This is an increase of 10 barrels from the 8 per cent plots over the no potash plots. This amount is undoubtedly large enough to be significant and to indicate that the potash increases the yield of potatoes in Aroostook county.

On the other hand, 110 barrels (302 bushels) per acre is a good yield—considerably above the average in the county in 1915. So far as the results of this one year are concerned, they indicate that a profitable yield of potatoes can be obtained on Aroostook soils without the addition of potash for at least one year. In a few farmers' trials made by the various fertilizer companies, in which no exact records were made, satisfactory results were obtained without the use of potash by all the growers from whom the Station has heard.

CONDENSED DIRECTIONS FOR 1916.

Crops can be successfully grown without potash under certain conditions. It is not believed, however, that New England agriculture can be successfully maintained at its present high rate without the purchase of plant food, including potash. However, for the year 1916 under the emergency, it is believed that agriculture may be successfully prosecuted without potash, if the following conditions are observed:

Select for the money crop only soils that are known to be in good tilth and in good heart. Avoid, so far as possible, the light sandy soils of the State.

Pay special attention to plowing, harrowing and cultivating so as to "fine" the soil as much as possible. Tillage renders the plant food of the soil much more available.

Properly conserve all of the possible available plant food from waste. This can be utilized by composting or by applying directly to the soil. Composting makes unavailable sources more available.

Spread the farm manure over a greater area than ordinary and supplement by the purchase of commercial fertilizers without potash.

The following specific recommendations are given not that they are the best or that they may give high financial returns but with the belief that despite the lack of experimental data, following these recommendations will lead to satisfactory results. Be sure to insist that at least one-third of the nitrogen in mixed goods be in the form of nitrate of soda.

TOP DRESSING GRASS LAND, WINTER RYE, ETC.

Ammoniates. Nitrate of soda is without doubt the best ammoniate for top dressing mowing lands. The high cost the present season may make it desirable to use some other form. Sulphate of ammonia is a good top dressing. Probably cyanamide used by itself would make a good top dressing. Equal weights of cyanamide and nitrate of soda would be useful for this purpose. Cyanamide cannot, of course, be used with sulphate of ammonia. Any of these materials can be used at the rate of 100 to 300 pounds per acre.

Phosphoric Acid. Because of the high price of available phosphoric acid the present year, its use may not be found profitable.

Wood ashes and stable manure are useful for top dressing.

POTATOES, ROOT CROPS AND MORE COMMON VEGETABLES.

If possible, use 8 to 10 tons of stable manure per acre with about 500 pounds of 3-10-0 goods. If farm manure cannot be obtained use 1000 to 2000 pounds of 5-8-0 or 4-10-0 goods.

CORN.

In general it is not wise to grow sweet corn without farm manure. Use, if possible, 20 to 25 tons of manure per acre. In addition to the farm manure use 300 to 500 pounds of a 3-10-0 fertilizer. If farm manure cannot be had, a satisfactory crop may probably be had by growing upon freshly turned sod land with 1000 to 1500 pounds of 4-10-0 goods. An additional dressing of a ton of unleached hard wood ashes would supply potash enough for the crop.

OATS AND OTHER SMALL GRAINS.

Spring seeding down with oats or other grains or grass should follow about the usual places in the rotation. In case the land was heavily fertilized in 1915 it may not be necessary to fertilize in 1916. If fertilizer is used 300 to 500 pounds of a 5-8-0, 5-10-0 or 6-8-0 fertilizer is the best that can be had under the conditions.

ORCHARDS AND FRUIT.

The present year clean tillage seems to be the thing that is indicated for apple and similar orchards rather than to use any fertilizer. Raspberries and the other small fruits would have to be handled practically as recommended above for the root crops and more common vegetables.

(505-2-15)

MAINE
AGRICULTURAL EXPERIMENT STATION
ORONO, MAINE.
CHAS. D. WOODS, Director.

SPECIAL REPORT

OF THE

Maine Agricultural Experiment Station

FOR THE

COMMISSIONER OF AGRICULTURE

For the Year 1914

Reprint from the Report of the Commissioner of Agriculture for 1914.

CONTENTS.

THE WORK OF THE MAINE AGRICULTURAL EXPERIMENT STATION IN 1914.

DIRECTOR CHAS. D. WOODS.

The year 1914 was the thirtieth year of the Maine Agricultural Experiment Station. It began its work April 1, 1885. The office, laboratories, and poultry plant of the Station are on the campus of the University of Maine, Orono. Its field work is carried out on the two experimental farms, Aroostook Farm situated in Presque Isle, Aroostook County, and Highmoor Farm in Monmouth, Kennebec County. The work on Aroostook Farm is largely with potatoes and small grains. The work on Highmoor Farm is chiefly with apples, oats, beans and sheep. The results of the investigations are published in the bulletins of the Station, in the Journal of Agricultural Research published by the U. S. Department of Agriculture and in different scientific journals in America and abroad. The bulletins of the year contain summaries of the more technical work and a full statement of the more practical studies. These are sent free to all residents of Maine on request and at a nominal price to non-residents so far as the editions will permit.

In the space allotted for this report it would not be possible to more than list the investigations undertaken during the year. Instead of attempting to make a review of the work of the year, a summary is given of the results of some of the matters that are of immediate practical agricultural significance. The practical results of the field trials at Aroostook Farm and Highmoor Farm obtained in 1914 are given in Bulletin 236 of this Station, entitled Field Experiments in 1914.

MILK PRODUCTION AND AGE.

One of the first problems which it was necessary to work out in connection with the studies of the inheritance of milk production, in progress at the Station, was that of the proper correction to apply to milk production records for the changing age of a cow. It is a fact well known to all dairymen that as a cow grows older, up to full maturity, her milk yield increases at each lactation, under normal circumstances. Furthermore, it is well known that after a cow passes a certain age her milk flow begins to fall off with further increase in age. Before any critical study can be made of the inheritance of milk production, upon which any scheme of breeding for improved milk production must be based, it is necessary to have accurate corrections for the effect of age upon milk flow so that cows of different ages may be compared with each other. The work on this problem, which has been very laborious, is now being brought to a close and tables are being prepared by which it will be possible, knowing a heifer's milk record, to read off her probable production as a mature cow. These tables in due time will be published in bulletin form for the different dairy breeds. The work on Holstein-Friesian and Jersey cattle is now practically completed.

An interesting point about this change of milk flow with age is that the increase as the cow grows older after her first lactation is not regular. Instead it follows what is known in mathematics as a logarithmic curve. In other words, the amount of milk produced by a cow in a given unit of time is a logarithmic function of the age of the cow. This law may be stated verbally in the following way: Milk flow increases with increasing age but at a constantly diminishing rate (the increase at any given time being inversely proportional to the total amount of flow already attained) until a maximum flow is reached. After the age of maximum flow is passed the flow diminishes with advancing age at an increasing rate. The rate of decrease after the maximum is, on the whole, much slower than the rate of increase preceding the maximum. In general this law applies to the absolute amount of fat produced in a unit of time as well as to the milk.

In connection with the establishment of this law of relation of milk flow to age it has been necessary to work out in the laboratory a new method of dealing with such figures and a paper is now in press having the title "The Fitting of Logarithmic Curves by the Method of Moments."

This work furnishes a good example of the fact that a scientific study of agricultural problems may wander into fields quite far removed from what is ordinarily thought of as agricultural science. At first thought one would hardly suppose that the application of pure mathematics would be necessary to make a reasonable prediction of the probability that a cow which gave a certain amount of milk at her first lactation as a heifer would be a profitable or an unprofitable cow to keep to maturity. Yet, as a matter of fact, the only scientific way by which to solve this important problem is by the application of pure mathematics, and it is this which has been done in the department of biology at this Experiment Station. When the tables spoken of above are completed and published in bulletin form it will be possible for any farmer who keeps a record of the milk production of his heifers at their first lactation to predict, with an average error of rather less than 2 per cent, what the production of the same cow will be when she is seven years old. Furthermore it will be possible for a dairyman to give each one of his cows an absolute rating in comparison with advanced registry animals of the same breed at any given age. If he will keep a milk record, he can with the help of these tables say whether or not a particular cow is better or worse, and by what proportion, than the average of advanced registry cows of the same age.

Double-Yolked Eggs.

Since everyone has seen quite a number of double-yolked eggs it is quite naturally and rightly concluded that they are not unusual. However, we do not usually consider how many single yolked eggs we see to every one that is double-yolked. The Station flock produces 531 single yolked eggs to every double-yolked egg. That is, only two-tenths of one per cent of the eggs are double-yolked. The ratio of double to single yolked eggs is less than twice as high as the ratio of twin to single births in the human family.

Recent study at this Station shows that all birds are not equally likely to lay double-yolked eggs. In fact the great majority of birds never lay anything but single yolked eggs. There are, however, birds which possess a tendency to lay double-yolked eggs. Such an individual may produce several such eggs. It has been further found that a bird which possesses the tendency to lay double-yolked eggs is not equally likely to produce them at any age. She is most likely to produce them when she is young. Eighty per cent of all the double-yolked eggs produced by the Station flock are produced by birds less than eight months old. We have only a very few records of birds which have laid double-yolked eggs after their first adult molt.

It has been usually supposed that double-yolked eggs are caused by the simultaneous entrance of two yolks into the egg tube and the consequent common passage of the two yolks through the duct. A careful study of the structure of all the double-yolked eggs produced by the Station flock shows that in only a small per cent (16) of the cases have the two yolks passed the entire length of the duct together. In such cases the two yolks are enclosed in a common thin layer of white membrane, the chalazal membrane, and have only one pair of chalazae. They also have common albumen envelopes as well as a common egg membrane and shell.

Since the formation of each egg part (chalazal membrane and chalazae, thick albumen, egg membrane, and shell) is confined to a particular part of the oviduct, a study of the number of the secondary parts which are common to the two yolks of a double-yolked egg shows the level of the duct where the two yolks came together. Such a study carried out on all double-yolked eggs produced by the large flock of birds owned by this Station shows that the two yolks unite at every level of the duct from the mouth of the funnel to the very end of the albumen secreting portion. It shows further that the number of eggs of any given structure observed is exactly equal to the number expected on the assumption that the union of the two yolks occurs indiscriminately at every level of the duct from the mouth of the funnel to the beginning of the isthmus or egg membrane secreting portion. When two eggs unite after the first egg has received its membrane the result is two eggs at the same time.

The structure of the egg has shown us that in a majority of cases the two yolks of a double-yolked egg have not passed the entire length of the duct together. On a moment's reflection we see that there was never any *a priori* reason for the assumption that the cause for the production of a double-yolked egg was necessarily the simultaneous discharge of two yolks from the ovary into the oviduct or egg tube. The only condition necessary for two yolks to be enclosed in the same egg membrane is that they entered the membrane secreting portion of the oviduct together. There are at least three possibilities beside simultaneous ovulation which may bring two yolks together before they reach this portion of the oviduct. First, the first yolk may be delayed at any level of the duct forward to the point where the egg membrane begins to be secreted; second, the first yolk may be returned up the oviduct and then come back in company with the second yolk; and, third, a yolk may be ovulated into the body cavity and picked up by the oviduct shortly before or after the ovulation of another yolk. It is, therefore, unnecessary to assume that the production of a double-yolked egg represents simultaneous or even an abnormally rapid succession of ovulations, since any of these delays may have been as long as the normal period between ovulations.

A study of the structure of the eggs and the egg records of the birds leads to the conclusion that double-yolked eggs do not necessarily represent two simultaneous or even nearly simultaneous ovulations; but in about one-third of the cases of double-yolked eggs produced at this Station the time between the two ovulations must have been unusually short, since the birds which laid these double-yolked eggs each laid a normal egg on the preceding day. A study of the egg structure of these double-yolked eggs where the time between the ovulations is known to have been abnormally short shows that the ovulations have been simultaneous in only a small per cent of the cases. In fact the two yolks have come together at every level of the duct in front of the beginning of the isthmus.

A study of the ovaries of birds which had recently produced double-yolked eggs showed that each of the two yolks was discharged from a normal separate follicle exactly as are the yolks of successive single yolked eggs.

From these recent studies of double-yolked egg production it is certain that some individual hens have an inherent tendency to lay double-yolked eggs while a great majority of hens never lay anything but normal single-yolked eggs. A bird with the tendency to double-yolked egg production is more likely to produce double-yolked eggs when she is quite young than later in life.

The two yolks of a double-yolked egg may enter the oviduct simultaneously and pass the entire length of the duct together receiving from the duct an entire common set of egg envelopes, or they may come together at any level of the oviduct from the funnel mouth to the beginning of the isthmus. It is highly probable that the two ovulations may be either simultaneous or that they may be separated by any period up to the normal period between ovulations.

The production of a double-yolked egg is evidently seldom caused by the simultaneous discharge of two normal separate follicles into the oviduct. Usually it is caused by the successive discharge of separate follicles at times varying from simultaneity to the normal period, and by the subsequent union of the eggs in the duct due to a difference in the rate of passage of the successive eggs.

Practical Hints on Breeding for Egg Production.

For many years there has been in progress at the Station an investigation of the laws of inheritance of egg producing ability in poultry. The following suggestions, compiled from Bulletin 231 of this Station, are offered as a basis for the improvement of poultry in egg production by breeding.

1. Selection of all breeding birds *first* on the basis of *constitutional vigor and vitality* making the judgment of this so far objective as possible. In particular the scales should be called on to furnish evidence. (a) Do not use as a breeder a cockerel which (in the case of Plymouth Rocks or Rhode Island Reds or Wyandottes) has not attained a weight of at least eight pounds at ten months of age, and better, nine pounds. Use no pullet as a breeder which does not weigh at least five and one-half pounds at the same age. (b) Let all deaths in shell, and chick mortality, be charged against the dam, and only those females used as breeders a second time which show a high record of performance in respect to the vitality of their chicks, whether in the egg or out of it. This constitutes one of the most valuable measures of constitutional vigor and vitality which we have. If for no other reason than to measure this breeding performance, a portion of the breeding females each year should be pullets. In this way one can in time build up an elite stock with reference to hatching quality of eggs and vitality of chicks. (c) Let no bird be used as a

breeder which is known ever to have been ill, to however slight a degree. In order to know something about this, put an extra leg-band on every bird, chick, or adult, when it shows the first sign of indisposition. This then becomes a permanent brand, which marks this individual as one which *failed* to a greater or less degree, to stand up under its environmental measures of constitutional vigor.

2. The use as breeders of such *females* only as have shown themselves by trap-nest records to be high producers, since it is only from such females that there can be any hope of getting males capable of transmitting high laying qualities.

3. The use as breeders of such *males* only as are known to be the sons of high producing dams, since only from such males can we expect to get high producing daughters.

4. The use of a pedigree system, whereby it will be possible at least to tell what individual male bird was the sire of any particular female. This amounts, in ordinary parlance, to a *pen* pedigree system. Such a system is not difficult to operate. Indeed, many poultrymen, especially fanciers, now make use of pen pedigree records. It can be operated by the use of a toe-punch. All the chickens hatched from a particular pen may be given a distinctive mark by punching the web between the toes in a definite way.

5. The making at first of as many different matings as possible. This means the use of as many different male birds as possible, which will further imply small matings with only comparatively few females to a single male.

6. Continued, though not too narrow, *inbreeding* (or line breeding) of those lines in which the trap-nest records show a preponderant number of daughters to be high producers. One should not discard all but the single best line, but should keep a half dozen at least of the lines which throw the highest proportions of high layers, breeding each line within itself.

Items 4, 5 and 6 imply the carrying over of a considerable number of cockerels until some judgment has been formed of the worth of their lines, through the performance at the trap-nest of their sisters.

Item 6 assumes, as an absolutely necessary prerequisite that item 1 will be faithfully and unfailingly observed.

The plan of breeding for egg production above set forth, which involves nothing in principle or practice which any poultryman cannot put into operation will not fail, if consistently and intelligently followed for a period of years, to bring about a material increase in the productiveness of the flock. The evidence which leads to this conviction is the best of all evidence; the plan has been tried and it works.

The Color of the Hen's Legs a Help in Picking Out the Layers.

For some time past there has been in progress at the Station an investigation of the cause of the different shank colors observed in different breeds and different individuals of the domestic fowl. The results of this investigation are now in hand, and a bulletin on the subject will shortly be issued. As this bulletin will be of a rather technical character it is thought desirable to call attention at this time to some of the more important, non-technical and practical features growing out of this work

It is a well known fact to every poultryman and every visitor to a poultry show that different breeds of fowls have characteristically different colors of the skin. In the United States generally yellow skinned birds are preferred over white skinned ones for market purposes. As consequence of this preference nearly all of the so-called American breeds such as, for example, Plymouth Rocks, Wyandottes, Rhode Island Reds, etc., have a distinct yellow color of the skin. Correlated with this general yellow skin color these same breeds of poultry have characteristic yellow shanks. This color of the shank is one to which a good deal of attention is given, both by the judges in the show room and by the expert poultryman in picking out stock for his pens. A clear, bright yellow leg is always preferred in these breeds by the show room judge.

In the matter of this preference for yellow skin color in its poultry the United States stands practically alone. Nearly all of the European countries prefer a white skinned bird for table purposes. In consequence the birds for table use on the continent of Europe and in England belong to breeds characterized by white skin color, and usually by white shank color, such as, for example, is seen in the White Orpingtons.

The cause of the skin color of birds is really a layer of colored fat which lies in and below the skin. This fat in the

American breeds is colored by a particular kind of yellow fatty pigment known as a lipochrome pigment. While the matter has not yet been completely investigated it is very probable that the yellow color of chicken fat which gives the color to the skin is due to the same pigment which gives the yellow color to the milk of the Jersey or the Guernsey cow. Recent experiments on the color of milk in cattle have demonstrated that there this pigment is chemically precisely the same as that which gives the yellow color to the common carrot. This coloring matter is known by the name carotin. In the white skinned breeds of poultry this yellow pigment is very nearly, or completely, absent, with the result that while the skin fat is there just as in the yellow skinned breeds it is not colored. Also probably this same coloring matter gives the yellow color to the yolk of the egg.

This last consideration is one which calls attention to the practical bearing of these results on shank color. It is a well established fact, both in cattle and in poultry, that when the food does not supply a sufficient amount of this yellow coloring matter carotin for the product, whether milk or eggs, the animal then draws on its own body fat for the further supply of this coloring matter. This results in a bleaching of the body fat of its yellow color while keeping up the color of the milk or the eggs. From this fact it results that the general skin color, and particularly the shank color, of a hen having naturally yellow shanks is much bleached out after the hen has been laying heavily, and furthermore, the heavier the laying has been the greater will be the amount of bleaching observed. In consequence of this it is possible to go through a flock at the end of a laying year and pick out at once by the color of the shanks those birds which have been extremely heavy layers from those which have been drones. The drones will be the birds which at the end of the season have bright yellow legs, such as one is accustomed to see in pullets which have not yet begun to lay. On the other hand, birds which have done a hard year's work and produced many eggs will have shanks completely white or nearly so. Examination at this Station of many hundreds of birds, whose trap nest records are known, makes it possible to say positively that no bird which has been a high producer will have bright yellow legs at the end of the laying season. "Two hundred egg" hens always have white legs at the end of their pullet year. This point is one which may be of great value to the poultryman when he is culling his flock in the fall and deciding which of his pullets he will keep over to use as breeders the next year. If he has no trap nest records the color of the shanks furnish him one of the best indications he can have as to the way in which these pullets have laid during their first year of life. His first selection should always, of course, be on the strength and constitutional vigor, but after having picked out the good strong healthy birds he should then choose from among those the ones which show the whitest legs. Poultrymen often make a mistake on this point. One frequently hears of a poultryman practicing just the opposite—that is, when he culls his pullets in the fall for the breeders of the next year, he will pick out carefully those which have yellow legs. By doing this he is systematically picking out the poorest layers in his flock to use as breeders, whereas, if he takes those with the white legs he is systematically picking out his best layers for breeding purposes.

Maine Station Methods Win in Feeding Hens for Egg Production.

In connection with the Second National Egg Laying Contest carried out by Director T. E. Quisenberry at the Missouri Poultry Experiment Station a 12 months test was made, during the past year, of different methods of feeding for egg production. In the fall of 1912 ten pens of pullets were selected for this test. The birds in these pens were as uniform a lot as it is possible to select. The methods of housing were the same in all cases. The only variable factor was the different methods of feed used in the different cases. Five of the pens were Single Comb White Leghorns and five were Buff Orpingtons. The ten different methods of feeding used and the results obtained are shown in the following table.

Pen.	Ration Fed.	Eggs.
62	Fed according to New York method............	1,522
63	Fed according to Maine method................	1,598
67	Fed with Norwich feeders.....................	1,510
70	Fed and confined to house continuously..........	1,495

64	Fed according to Canadian method	1,480
68	Feed kept before them at all times	1,403
69	Fed simple farmer's ration	1,402
65	Fed according to Saylor method	1,399
66	Fed according to any egg farm method	1,318
61	Fed according to Connecticut method	1,232

It will be seen from these figures that the method designated as the "Maine method" won over all the others, the birds in this pen laying 76 more eggs in the year, or more than a half dozen eggs per bird on the average than for any of the other feeding methods. The "Maine method" here referred to is the method of feeding which was first worked out by the Maine Agricultural Experiment Station and described in its bulletins. This method has been used for a number of years with excellent results on the Station's own flock of Barred Plymouth Rocks, and it has been very widely used by poultrymen, not only in this country, but all over the world, with satisfactory results. It is a matter of gratification, however, that this method should take a leading position when subjected to exact comparative test, as in this laying contest.

A brief description of the way this winning pen of birds in the Second National Egg Laying Contest was fed is given below.

The feed of all adult birds, whether pullets or not, consists of three essential parts: (a) the whole or cracked grains scattered in the litter, (b) the mixture of dry ground grains which has come to be generally known as a dry mash, and (c) green food. The component parts of the ration and the methods of feeding them will be considered separately. In addition to the grains and dry mash, oyster shell, dry cracked bone, grit, and charcoal, are kept in slatted troughs, and are accessible at all times. Plenty of clean water is furnished. About five pounds of clover hay cut into one-half inch lengths is fed daily to each 100 birds in the breeding pens during the breeding season. When the wheat, oats and cracked corn are given, the birds are always ready and anxious for them, and they scratch in the litter for the very last kernel before going to the trough where an abundance of feed is in store.

Taking first the dry grains, the following may be said in regard to the method in which they are fed: Early in the morning for each 100 hens, four quarts of whole or cracked corn is scattered on the litter, which is six to eight inches deep on the floor. This is not mixed into the litter, for the straw is dry and light and enough of the grain is hidden so the birds commence scratching for it almost immediately. At 11 o'clock they are fed in the same way two quarts of wheat and two quarts of oats. This is all of the regular feeding that is done.

COMPOSITION OF DRY MASH FED TO LAYING PULLETS.

First month in laying house.

Bran	300 lbs.
Corn meal	100 lbs.
Daisy flour (or other low-grade flour)	100 lbs.
Meat scrap	100 lbs.

Second month in laying house.

Bran	200 lbs.
Corn meal	100 lbs.
Daisy flour (or other low-grade flour)	100 lbs.
Gluten meal	100 lbs.
Meat scrap	100 lbs.

Third month in the laying house.

The mash has the same composition as that of the second month given above *with the addition of 50 pounds of linseed meal.*

Fourth month in the laying house.

The mash has the same composition as that of the second month given above.

Fifth month in the laying house.

The mash has the same composition as that of the third month given above.

From this time on 50 pounds of linseed meal are put into the mash as given for the second month above every alternate month. That is to say, one month linseed meal is fed and the next month it is not.

This dry mash made as described above is kept before the birds all the time in open hoppers.

BEANS.

Several years ago the Experiment Station undertook some breeding work with beans. The immediate problem for which the work was undertaken was to procure true-breeding strains of Old Fashioned Yellow Eye beans. A great deal of difficulty has been experienced by bean growers in securing strains which would come even reasonably true to seed. In spite of careful seed selection for many years strains of these beans often continue to throw small numbers of black, solid yellow, mottled or white beans every year. Many of the large growers complain that in order to secure a good price for their crop it is necessary to hand-pick their beans every year.

At the time our work was started it was believed that it would be a relatively simple matter to secure pure-breeding strains but our experience has shown that this is not the case. It was generally believed that the bean flower was normally self-fertilized: that is, the pistil or female portion of the flower was fertilized by pollen from the same flower. It was believed that this fertilization took place before the blossom opened. Three years ago we found that this is not always the case but that cross-pollination could be brought about by bumble-bees.

For this reason it has been necessary to carry on the bean breeding under other conditions. In 1913 there was built at Highmoor a bean cage 25 x 50 feet which was enclosed on both roof and sides with screen wire. This effectually excludes all insects which might cross-pollinate the bean flowers.

Last year (1913) a number of strains of Old Fashioned Yellow Eye beans were grown under this cage. A few of these appeared to be breeding true. These strains have been tested further this year. Those which have proved to be true to type will be multiplied in isolated plots next year so that there will be no danger of crossing. In order to maintain such a strain pure it will be necessary for the grower to plant only one kind of beans or at least to have the different kinds so separated that there will be no danger of crossing by the bumble-bees.

The Station has also been working upon a set of standards for yellow eyed beans. There is a great difference of opinion among the growers of the state as to what is the best type for the Old Fashioned and the Improved Yellow Eye beans. While every grower is entitled to his own opinion as to the best type, yet it is true that certain types bring a much better price on the market. During the past several years both the growers and the dealers have been consulted regarding this question and it is hoped that the data so obtained will aid in establishing better standards for these varieties of beans. The results of these investigations will be published by the Station during the coming year.

In addition to the work outlined above the Station is also attempting to produce new and desirable types of beans by means of controlled hybridization. This work naturally proceeds slowly and it will be several years before any of these new varieties will have been sufficiently tested to be placed before the public.

OATS.

The work with oats at Highmoor has been continued along the same lines as in the past several years. Twenty-two commercial varieties of oats were tested in 1914. In addition 31 new varieties originated in the breeding work of the Station were also tested under field conditions. The season of 1914 was very favorable for oats at Highmoor. The yields were much higher than in any of the preceding years. Individual varieties averaged to yield from 120 to 60 bushels per acre. Seven of the varieties originated by the Station yielded above 100 bushels per acre.

The work of developing new varieties by hybridization was continued. About 8000 second generation hybrid plants were grown this year. The most desirable of these have been selected for further tests and purification next year.

SELECTION EXPERIMENTS.

Another line of investigation has dealt with the question whether it is possible to improve pure lines of oats by continued selection. It has been found that one of the most important means of securing new and improved varieties of oats has been the selection of new strains out of the existing varieties. In doing this work it has been found that the only successful way is to select individual plants and then to multiply the seed of each plant separately. By this means there is obtained what is known as a "pure line." Each pure line is the descendant of a single individual plant. Since the oat flower is always fertilized by its own pollen it follows that each plant in any single pure line has exactly the same hereditary constitution as every other plant.

By the selection and isolation of such pure lines out of standard commercial varieties we have been able to secure new varieties or strains which are far superior to any of the commercial varieties so far tested. The question now arises, can any improvement be made in these pure lines by further selection.

The points in question can perhaps be made clearer by considering what constitutes a commercial variety. To the casual observer a variety may appear to be breeding perfectly true and all the plants may appear to be alike. However, if the plants are examined carefully many differences will be found. Further, if individual plants are selected and the seed of each grown in separate rows it will be found that many of these rows differ greatly in their yield, time of maturity, strength of straw, etc. These differences are transmitted from one generation to the next. Each plant which breeds differently from the others belongs to a different pure line. A commercial variety then consists of a mixture of a large number of pure lines which we may designate by the letters,

A, B, C, D, E, F, . . . etc.

If we select a single plant it will belong to one of these pure lines, for example, C. If we multiply the seed of this plant we may have finally a whole field, all the plants of which belong to this pure line C. If we again select single plants from such a field we still have only the same pure line. If we grow the seed of such selected plants in separate rows there is little or no difference between the rows. The question is, can we improve this pure line C, by selecting year after year the best yielding plants?

Experiments to test this question have been in progress for the past four years. Twenty-eight pure lines coming from 13 different commercial varieties have been used in this work. The method has been to grow short rows of each pure line in the oat garden at Highmoor Farm. All of the rows were grown under as nearly uniform conditions as possible. Each plant was then threshed separately and various data including the height, number of culms, weight of plant, weight of straw and weight of grain were recorded. For planting the next year, individual plants showing the highest and lowest degrees of a given character were chosen. The seed from each of these plants was again sown in short rows and the process repeated the next year. Over 12,000 plants have been grown in this way in the four years.

A careful analysis of this large amount of data has shown that in these experiments *selection within a pure line has not permanently changed any of the characters studied.* Thus plants which have been subjected to three successive selections in the plus direction do not on the average yield better than plants which have been selected in the minus direction for three successive years.

The results of this work are of much importance to the practical oat breeder. It follows that in order to secure improved strains it is only necessary to select individual plants from the commercial fields and then to multiply the seed of each plant separately. Then each of these pure lines must be tested and only the best retained. After a desirable pure line has been isolated it is only necessary to keep it pure and unmixed with other seed. Such a pure line will not deteriorate nor can it be improved by further selection. This greatly simplifies the methods of practical oat breeding. It is now shown that it is useless to continue the expensive methods of selecting year after year within a pure line. In order to get still better yielding strains it is necessary to go back to a commercial field and make new selections with the hope of isolating still better pure lines. Once a pure line is isolated it cannot be improved by further selection.

The Blueberry Maggot the Same as Apple Maggot.

In the spring of 1913 the attention of the Maine Agricultural Experiment Station was called to a certain maggot infesting blueberries in Washington County. Although it was the opinion of the growers that the berries affected were winnowed out in the process of sorting the berries, still their presence caused considerable concern, and in some localities it had become the practice to discontinue canning the fruit late in the season after the maggot became abundant.

Altogether it was a situation that warranted study both in the economic interest of the blueberry industry and from the entomological standpoint, for when the complaints first came in, no one knew anything concerning the identity or habits of the pest.

Accordingly the barrens were visited and about the first of August, flies with banded wings were found to be common about the blueberry bushes. Much to the surprise of the entomologists at the Station these flies proved to be the same species as our common apple pest *Rhagoletis pomonella,* the larva of which is popularly known as the "railroad worm" on account of the trails it makes under the skins of light colored apples. After the middle of August it was not a difficult matter to find infested berries on the plains. When the maggots are small, the fruit attacked cannot be distinguished from a sound one, but usually when they have attained a fair size the fruit becomes very much shrivelled. An infested berry can easily be told by touch, for it feels soft and mushy, and this is the surest external indication that it has been attacked.

When the maggot becomes full fed it leaves the berry by an irregularly shaped hole through the skin and pupates in the ground just as the insect does after leaving an apple.

Maggoty berries were brought to the Experiment Station and cared for in order that the adult insects might be reared. They formed pupae late in the summer which normally would have remained in the ground in that stage until another summer. By keeping them under warmer conditions, however, their development was forced and in early spring adult flies began to emerge from the pupa case which proved to be the same species as those taken on the barrens the summer of 1913, thus establishing beyond a doubt the fact that in Maine the maggot which breeds in blueberries is the common apple maggot, *Rhagoletis pomonella.*

This fly is smaller when developing in blueberries than when it grows in the apple, but otherwise there is no difference. This fact is not surprising as it is common with insects which feed inside vegetable matter to have their size dependent upon the amount of the food supply. The apple maggot has been reported from the huckleberry in New Jersey and Connecticut but this record from Maine is the first account of its accepting the blueberry as a habitation.

It is too soon to predict what can be done by way of control. While the maggots were common on the plains, it should be stated that the blueberries grow so profusely that only a small percentage of the fruit was infested. There seems to be no doubt that much of the defective fruit is winnowed out in the process of cleaning as the infested berries become shrunken and drier than the normal ones.

The common practice of burning over the barrens every third year undoubtedly is a very potent cause of the blueberry being so comparatively free from pests, as many insects must be kept within bounds by this treatment. It may be that advantage can be taken of this method of dealing with the blueberry maggot by burning wider areas if it is found advisable for berry growers to enter into a siege against this insect in the barrens.

It is hoped that when its habits on the barrens have been more thoroughly studied some means of practical treatment may be suggested to help out the situation so that it will not be necessary to shorten the canning season on account of the presence of this insect.

At any rate, the discovery that the apple maggot is also a blueberry pest has widened our knowledge of this insect and may have an indirect bearing on certain infested orchards in the vicinity of scattered blueberry bushes. It throws a decidedly new light on some phases of the apple maggot problem for Maine.

Currant and Gooseberry Aphids.

Every year appeals are sent in to the Maine Agricultural Experiment Station concerning deformed leaves on currant and gooseberry bushes soon after growth starts in the spring. The fresh tender leaves are wrinkled, curled and otherwise stunted and distorted by plantlice that have overwintered on the bushes in the egg stage, thus being ready to attack the new growth as soon as they hatch in the first warm days. As their life histories had not been worked out, during the season of 1913 the Department of Entomology of this Station paid considerable attention to the group of plantlice or aphids that attack the currant and gooseberry. They were found to be particularly difficult to study from the fact that a single collection frequently contained as many as four species with their innumerable progeny harmoniously feeding in mixed colonies on the same stem and leaves. Thus it was no easy matter to isolate the different species for the purpose of rearing the successive generations.

In all, eight species were found to be present in Maine. The worst of these, a grayish species, we have called the "white cornicled currant aphid," on account of the milk white color of the so-called "honey tubes." As these insects reproduce rapidly the colony soon gets too numerous to be sheltered by a single leaf so it scatters to infest the growing shoot and under side of fresh leaves. A thriving colony will distort the stem seriously and cause the misshapen foliage to cluster in a dense protecting mass. It occurs on both currant and gooseberry.

Associated with the species just mentioned is the "green aphid of the gooseberry," a pale aphid taken on wild gooseberry.

A third species common in Maine upon currant in spring is probably the same species as one found on sow thistle and lettuce during the summer. Like many other of the aphids, this insect is migratory and moves to a different sort of vegetation for the summer generations, returning in the fall to the currant to provide for the deposition of the winter eggs.

It is interesting to notice that another currant and gooseberry species is indistinguishable from a lettuce aphid and is probably also a summer migrant to that plant. It is thus apparent that it is advisable to clear out lettuce in the vicinity of this fruit before late summer, care being taken to leave no neglected lettuce stalks about for the development of aphids. This is as much for the sake of the lettuce as the currants for although these green plantlice are not poisonous, most of us prefer our salad served without them.

It is no uncommon thing to find currant leaves puffy with reddish or yellowish blister-like deformations. These are the home of *Myzus ribis,* a delicate little aphid of world wide distribution. Though not so serious a pest as some of the other species, still it is troublesome enough to interfere with the proper functioning of the leaves and, as one currant grower in the state complained, "the plants are hurt and look very annoying." A closely related species which belongs to the same genus and was found present with it on the leaves is an aphid which has not been previously described for the currant.

One of the most interesting of the migratory aphids attacking currant is a species that is found curling the leaves of the English elm in the spring from whence it migrates to currant and gooseberry roots for the summer. As yet this species has not been collected from the bushes in Maine, but as it is present on English elms in this state it doubtless occurs also on currants here as it does in Europe.

These insects, three of which are "new species," are described and figured and pictures of their work are given in Bulletin 225 of the Maine Agricultural Experiment Station.

As most of these aphids are present on the bushes at the time the leaves start in the spring, the logical treatment is to spray thoroughly with tobacco decoction, either home made or some reliable commercial brand, before the leaves become so much distorted that a spray is not practicable. If neglected until the leaves become massed the shoots with the worst infestations may as well be clipped off and burned, and the others thoroughly sprayed.

Poisoned Sweetened Baits and Other Methods of Control of the Currant Fly.

For several years, people in many parts of the state have been digging out their currant and gooseberry bushes because the fruit was so badly infested with maggots that it could not be used. These maggots are the larval stage of a banded winged fruit fly which pupates in the ground over winter and emerges in the spring in time to develop eggs to be deposited in the berries when they are of the right size.

In view of the fact that poisoned sweetened baits have been reported as a successful method of combating certain other closely related fruit flies, the Maine Agricultural Experiment Station secured the services of Doctor H. Severin, a specialist of long experience in this particular line of work, in order to attack the problem of the control of the currant or gooseberry fruit fly with the use of poisoned sweetened baits.

The fact that the egg is deposited within the berry and the maggot does all of its work in the fruit and that the pupal stage is passed under the ground makes it a difficult pest to deal with in these stages. Such remedies have been suggested as picking the entire crop of berries and destroying them before they begin to ripen and before any begin to drop. By thus sacrificing one crop the entire brood of flies would be unable to deposit their eggs and the patch freed from them until they were introduced again from some other source. This method when consistently carried out over a large area for one season ought to reduce the pest to a minimum for years to come. Concerted action of this sort, however, is not an easy matter to bring about and if a direct remedy can be recommended to those who are interested enough in their fruit to take care of it, the present distressing situation will be relieved.

Another treatment which has been suggested is the laborious one of removing about three inches of soil from beneath bushes which had been infested, replacing this with fresh soil, and then treating the infested soil containing the puparia, in such a way that when the flies mature they cannot emerge, or by burying the infested soil deep enough so that the flies cannot emerge, or by depositing the infested soil in a road where the pupæ would be destroyed. The destruction of the pupæ in the infested soil by the different methods suggested were put to an experimental test. About a dozen different methods of treating the infested soil without removing it from beneath the bushes were included in the tests made on a farm near Orono.

It has been found that certain other fruit flies, after issuing from the pupæ, require two weeks or more before the egg-laying period begins. This period is a feeding period and during this time the insect flies about seeking food, such as the waxy coating of fruit, juices or injured fruit or infested fallen fruit on the ground, nectar of flowers, moisture on the leaves, etc. The greediness of the flies for sweets is a weak point in the life history of these pests and one can readily understand that if this sweet is poisoned and is within easy reach of the flies with their first appearance on the wing, no doubt large numbers would be killed in the two weeks or more before the egg-laying period commences. The problem to be worked out, then, is to ascertain what sweet, cheap enough to be economically available, will attract the currant or gooseberry fruit fly sufficiently to feed upon the poisoned bait.

Comparatively little work with poisoned bait for controlling fruit flies has been done in the United States but in some other parts of the world this method has been in use for several years. In South Africa a decisive demonstration of the success of poisoned diluted molasses to combat the Mediterranean fruit fly was made in the season of 1908-9. "A severe outbreak of this fruit fly in a commercial peach orchard was brought to a sudden and practically complete halt, and the fruit maturing later was marketed under the guarantee of freedom from maggots, while the infestation of the fruit on the control trees increased until practically every fruit was involved."

In controlling the Mexican or Morelos orange worm a common poisonous Mexican herb has been discovered and very satisfactory results from the use of this preparation have been obtained in combating the Mexican fruit fly.

In 1908 the loss to the olive crop of Italy amounted to five million dollars, due to the olive fruit fly. For a period of ten years Italian entomologists have been experimenting with various formulas of poisoned bait to control this pest and at present a cheap and practical remedy has been discovered to combat this fruit fly.

In 1912 similar control measures were adopted against the cherry fruit flies in New York. The fruit of the unsprayed trees showed an infestation of fully one-third of the crop, while only two-tenths per cent was wormy on the treated trees. The sprayed fruit showed also a noticeable lack of curculio injury.

During the past season experiments with poisoned bait were carried on to control the imported onion fly under Wisconsin conditions. The results obtained against the second brood of the pest were most encouraging in a somewhat isolated onion field.

Altogether the evidence in favor of sweetened poisoned baits as a control for fruit flies seemed strong enough to warrant investigations under Maine conditions with this serious pest of the currant and gooseberry.

Sawflies.

Currant "worms" and rose and pear "slugs" are familiar pests wherever these plants are grown. In Maine where conifers abound "worms" with round heads and bodies that jerk into a curl at any disturbance are such frequent devastators of larch, spruce and pine that summer residents as well as owners of forest lands become interested and concerned at their appearance. Related to these commonly known larvæ are many less familiar pests of varying degrees of economic importance, significant enough to deserve serious attention from entomologists.

Realizing that we had very slight acquaintance with the early stages of this family of insects, called sawflies, the Maine Agricultural Experiment Station invited Dr. Alex. D. MacGillivray to spend the summer of 1913 in this state collecting, rearing and studying the larvæ of Maine sawflies. This was in accordance with our present entomological policy of having, when possible, certain groups of economic insects worked up by scientists who have made a specialty along that particular line, the printed results of such study to appear among the papers published by this Station.

Our first contribution on larvæ of sawflies, too technical to be published as a bulletin for general distribution, appeared in the Forty-Fourth Annual Report of the Entomological Society of Ontario, the substance of the paper having been delivered before that society by Doctor MacGillivray after his summer's work in Maine. The following paragraphs are for the most part adapted from his contribution.

A sawfly belongs to the same order of insects as the bees and wasps but instead of having a sting for an ovipositor, its egg laying apparatus is equipped with a small saw with which it cuts a slit in the tissue of the plant and deposits an egg in the opening. The adult or winged sawfly does practically no harm, but the young which hatch from her eggs are as greedy as caterpillars and as completely demolish the foliage they feed upon. These larvæ resemble hairless caterpillars somewhat in their appearance as well as in their feeding habits and are frequently mistaken for them.

The eggs are always laid by the female within the tissue of the food plant. Where the larvæ are borers, they are laid in holes pierced in the stems of bushy plants or in the limbs or trunks of living or recently dead trees. Where the larvæ are leaf-feeders, the eggs are placed in slits sawed by the female from the under surface and located between the two layers of parenchyma. A few species insert their eggs in the petiole of the leaf, some of the gall-making species in the leaf-buds, and one in the blossoms of cherry on the sepals or the upper part of the calyx cup. The eggs are oval in outline, flattened, usually white in color, though sometimes bluish or greenish, and very difficult to locate when first laid. They swell after a short time to twice their original size and push out the surface of the leaf so that it appears to be covered with little mounds.

The manner of feeding is strikingly varied. With many species, the young larvæ as soon as they emerge from the egg, eat holes through the leaf and continue feeding around the circumference of the hole, clinging to the leaf with their thoracic legs and holding the body S-shaped in the hole. Some species are leaf-skeletonizers for the first two or more stages and then either feed from the edge or eat holes in the leaf. The great majority of species are edge feeders.

The larvæ of certain genera and subfamilies of the sawflies are entirely different in appearance during their last larval period; white larvæ may become spotted, the spotted change to white or green and the spiny lose their spines. Thus the same specimen may be powdery white one afternoon and the next morning yellow with black spots. These changes which take place at time of molting increase the difficulties of studying a species.

The members of one subfamily feed on various species of conifers; they clasp the needles between the thoracic legs and feed until only short stubs are left. Some species will feed on the needles of the year old growth, others are indiscriminate, feeding either on the new or the old growth. The pines, spruces, and larches especially suffer from the attack of sawfly larvæ in Maine and on this group of larvæ Doctor MacGillivray has in preparation a bulletin to be published by this Station.

Powdery Scab of Potatoes.

For many years the plant pathologist of the Maine Agricultural Experiment Station has been studying the common scab of the potato, and in this connection has asked for specimens of scab to be forwarded in different years from various parts of the country. About two years ago two specimens were received—one from Massachusetts and the other from Nebraska—which were infected with powdery scab. So far as is known, this was the first intimation of any powdery scab produced on potatoes grown within the United States.

Some six months before the first specimens of powdery scab were discovered in Maine, and over a year before it was known that the disease occurred in the state except on one or two farms, this Station issued a warning as to the dangerous nature of the disease, described its appearance, pointed out the strong possibility of its being introduced into the state on account of its presence in Canada, and requested potato growers and others to coöperate, as it has done at various times in the past, by sending in suspected specimens in order that the presence and distribution of this and other dangerous plant diseases might be known as soon as possible.

Powdery scab differs from the ordinary scab, which is well-known practically everywhere that potatoes are grown, in quite a number of ways. The common scab is caused by a minute fungus; the powdery scab by an organism of larger size and belonging to a different order of plants called slime moulds. Common scab produces relatively large, more or less irregular brownish spots, usually with a decidedly uneven surface. Powdery scab forms only small spots which are at first in the form of pustules containing a brownish or olive colored powder. Later the tops of these pustules become rubbed off, leaving small, scab-like spots. These may run together into larger patches but even then the original limits of the spots or pustules can usually be made out.

A very important difference between common and powdery scab is that the former produces only one type of injury to the potato tuber. In addition to the ordinary type, powdery scab in severe cases may produce true cankered areas where the tissues are eaten into and hollowed out. Also in severe cases of the ordinary, pustular or scabby stage of the disease, potatoes attacked by powdery scab exhibit a strong tendency to wither and dry out and show an apparent dry rot.

Methods of Control.

When it became evident that powdery scab was prevalent in at least limited sections of the state, the Station pathologists were at once delegated to assist the state and national authorities in making a preliminary survey to determine the limits of the infected areas. One of the pathologists also spent some time in assisting in training the inspectors when the state inaugurated its inspection service. A bulletin has been published which summarized the information regarding the disease to date, and studies are now being carried on with reference to control measures and life-history studies. The following are some of the control measures advocated in order to prevent the spread and distribution not only of powdery scab, but of several other important tuber-borne diseases as well:

Use for seed only stock that is known to be free from contamination with powdery scab. Remove all tubers which are bruised, cracked or show evidence of decay or disease of any kind. Soak this sorted and selected seed for two hours in a solution of one pint of 40 per cent formaldehyde in 30 gallons of water, or one and one-half hours in a solution consisting of four ounces of corrosive sublimate in 30 gallons of water. Have two or three knives for each cutter and when not in use immerse the blades in a strong solution of formaldehyde. When cutting seed reject every tuber which shows any discoloration of the interior. At once drop the knife used in cutting the discolored tuber into the strong formaldehyde and use one of the other knives until another suspicious potato is cut. Use care that the disinfected seed does not come in contact with barrels, baskets, planters, etc., which have been used for diseased seed.

It is recommended that seed tubers be thoroughly dusted with sulphur as soon as they are cut, or before the surfaces have become dry.

No exact data are available as to how long the germs of powdery scab remain in the soil after once introduced, but the Station has secured information that indicates that this is a matter of several years, at least. Hence, land known to be infected should be kept in other crops as long as possible. If the infected area is large it would be best to test a small patch in the worst infected section by first planting it with clean, disinfected seed a year in advance before risking the chance of loss of seed and crop on the whole field.

Methods of Disinfection.

Many inquiries have been addressed to the Station asking for information as to the best methods for disinfecting potato storage houses, implements or containers which may have become contaminated with the germs of powdery scab. The notion that the disease may be spread by means of articles which have come in contact with affected potatoes appears to be well founded. No doubt, if it could be traced, it would be found that some of the powdery scab in Maine came from the purchase of second-hand sacks previously used for imported potatoes. Likewise it is evident that only a relatively few barrels of affected tubers in a storage bin might so infect the bin and other parts of the house as to result in spreading the disease in a manner far out of proportion to their number.

Assuming that only healthy, disinfected seed is used and planted on clean soil, how may it and the resulting crop be protected from infected barrels, sacks, planters, potato houses, etc.? From an experimental standpoint very little has been done as yet to answer this question and some phases of it have not been touched at all. However, there is available a large amount of data regarding the effect of certain fungicides and germicides upon the organisms causing common scab, blackleg, the Rhizoctonia disease, etc.

Planters and other tools which have in any way come in contact with the germs of powdery scab should be washed clean, then thoroughly washed or sprayed with a strong solution of formaldehyde, one pint to five gallons, and allowed to stand a few days before using. Barrels or other containers may be handled in the same way. Sacks may be disinfected by soaking two hours in formaldehyde the same strength as used for treating seed potatoes, one pint to 30 gallons of water, and then drying. Doubtless a less expensive method for disinfecting sacks would be steam sterilization at some central station.

Corrosive sublimate and copper sulphate solutions have both been recommended for disinfecting tools and implements. These are undoubtedly as efficient for the purpose as formaldehyde and are all right from the standpoint of the scientist, but the practical farmer may experience difficulties with them, especially with corrosive sublimate, which will not make him kindly disposed toward them. Corrosive sublimate produces a very active, corrosive action upon metals, especially upon iron—it being necessary to always use wooden tubs or vessels for containers in disinfecting seed tubers. Therefore, it is not adapted for and never should be used upon the metal parts of good tools or valuable farm machinery. While copper sulphate solution acts upon iron this action is much less severe than is the case with corrosive sublimate. Hence there is much less objection to the use of copper sulphate solution. Formaldehyde solution, on the other hand, when used as recommended, produces no more injury to the tools than so much water.

Special attention should be given to empty storage houses. All loose dirt and rubbish, including decayed potatoes or other culls, should be removed from the interior and from around the outside of the house. As much of this material as possible should be burned. What remains unburned should be soaked with a strong solution of copper sulphate. After all rubbish has been removed the interior walls and floors of the empty potato house should be thoroughly sprayed with a solution of copper sulphate, 5 pounds and water 50 gallons. The addition of a small amount of lime will aid in marking the portions covered by the spray. A hand barrel-pump with 25 to 50 feet of hose with an extension rod such as is used in orchard spraying is very satisfactory for this purpose.

More complete disinfection of empty houses may be secured by the use of formaldehyde gas *following* spraying with copper sulphate. To accomplish this, make all outside doors and windows as tight as possible. For every 1000 cubic feet of contents of the house or room use 23 ounces of potassium permanganate and three pints of 40 per cent formaldehyde. Spread the permanganate evenly over the bottom of one or more large vessels like a wash tub or half of a kerosene barrel, these latter arranged in the central parts of the floors of the house or rooms. Pour the formaldehyde quickly over the permanganate, being sure that it is well mixed with the latter. Leave and tightly close the house at once. Allow to remain closed 24 hours or longer. Barrels and tools if clean, can be disinfected at the same time, although probably not so thoroughly and efficiently as by washing with formaldehyde solution. Do not attempt to use the gas in the house till after all potatoes and rubbish have been removed and the house cleaned up as described above.

Sulphur and Common Potato Scab.

The pathologists of the Station have recently been giving considerable attention to the subject of soil disinfectants, particularly sulphur, for use upon land infected with common scab, powdery scab, and the Rhizoctonia disease of potatoes. While little hope was entertained that a satisfactory material could be found which would be sufficiently cheap in price to allow its use in the necessary quantities to ensure success, the question is of so much importance to the potato growers that any possibility of success, no matter how remote, should not be overlooked.

The fungicidal properties of sulphur are well known. Moreover, the chemical compounds which would be formed as the result of the addition of sulphur would tend to develop acidity in the soil which of itself is unfavorable to the common potato scab organism. Experiments conducted in New Jersey some years ago indicated that it was of value, at least under some conditions, as a soil disinfectant for common scab. It can be purchased in ton or carload lots at a considerable less price than the same amount of fertilizer. Therefore it seemed to be a favorable material with which to experiment.

The present discussion is limited to the use of sulphur on soil contaminated with the germs of the common scab and is not concerned with the use of sulphur for other soil-inhabiting potato diseases. Certain greenhouse experiments, although necessarily conducted on a small scale, gave some rather interesting results. Sulphur was added to 10-inch pots of greenhouse soil, well contaminated with scab germs, at the rate of 300 pounds per surface acre. This was mixed only with the soil immediately surrounding the seed tuber, simulating as far as possible the application in the hill by means of a planter. Some of the pots of soil were sterilized to make them comparable to clean land. Scabby seed tubers were planted in this, with and without sulphur. At the same time disinfected and undisinfected scabby seed tubers were planted in other pots of unsterilized soil, with and without sulphur.

When the seed was scabby, the soil not sterilized, and no sulphur was used, 100 per cent of the crop was scabby. The addition of sulphur in the manner described reduced the amount of scab but slightly. Sterilized soil and scabby seed gave 30 per cent of scab on the crop, while perfectly clean potatoes were secured with the same sterilized soil and scabby seed where sulphur at the rate of 300 pounds per acre was mixed with the soil immediately surrounding the seed-piece. Apparently this amount of sulphur was sufficient, when applied in this manner, to prevent the disease from spreading from the infected seed-piece to the crop, but not enough to materially reduce it where the soil itself was badly contaminated with the germs of the disease.

Some pots of fresh greenhouse soil were planted with scabby seed tubers, disinfected with formaldehyde, with and without the addition of sulphur to the pots. In this case there was an average of more scab where the sulphur was used than without.

A reasonable explanation of the failure of sulphur to produce results in this instance, and also in the unsterilized pots of soil mentioned above, comes from the fact that the scabby tubers were found in those parts of the pots outside of the area of soil into which the sulphur was introduced.

The chief value of these greenhouse experiments lies in the fact that they were carried out under control conditions—they are far too limited to admit of any definite conclusions. They do, however, suggest certain things of practical interest, the most important one of which comes from the results obtained where sulphur was used with scabby seed on clean or sterilized soil. This is, that the practice recently adopted by some of our potato growers of dusting cut seed with, or rolling it in, sulphur, is a good one and should be encouraged. If the seed tubers are first carefully sorted, then disinfected with corrosive sublimate or formaldehyde, cut and dusted with or rolled in sulphur, it would seem as if the danger from the introduction of common scab into clean land by means of seed tubers would be practically eliminated.

A close analysis of the results of these greenhouse experiments does not tend to encourage the view that sulphur can be used economically to rid badly infested soils of the germs of common potato scab. However, in this and in most other experiments no account of the later effects of sulphur in the soil are taken into consideration and it hardly seems possible that the entire effects are obtained the first year. Hence the case may not be entirely hopeless.

Field experiments designed to test matters of this kind are not easy to perform, as it is next to impossible to get any large body of land equally infected and alike in all other particulars. An attempt was made to carry on such an experiment in coöperation with an Aroostook county potato grower last season. Seven half-acre plots were laid off on one side of a large field where the land was said to be fairly uniformly infected with common potato scab. A plot of Green Mountains and one of Irish Cobblers were treated at the rate of 1000 pounds of sulphur per acre, harrowed in before planting. These were followed by an untreated check plot of equal size and this by plots of Cobblers, side by side with untreated checks, where 500 and 300 pounds of sulphur were added respectively.

Several factors intervened which influenced the accuracy of the results, but so far as could be judged, the application of 300 pounds of sulphur to this land produced no appreciable effects in reducing common scab the present season. The potatoes from this plot were equally badly incrusted with scab spots as those produced upon the adjoining checks—practically all of them being unsalable except for starch making. Where 500 pounds of sulphur was used there were fewer tubers thoroughly covered with scabs and a small per cent of the crop here was merchantable. Where 1000 pounds of sulphur was applied per acre, fully 75 per cent of the crop was suitable for table purposes and it was estimated that at least one-third of these were free from scab.

Based upon the figures alone, it would seem that the larger amount of sulphur materially reduced the amount of scab on the crop for the current year. There is always the possibility that on large plots of land like these the soil is unequally infected or some outside factor interferes. However, the check alongside of these plots which received the heaviest application of sulphur produced fully as much scab on the crop as on any other part of the field. Before the plots were planted a record was made of the fact that the owner of the land stated that according to his best recollection the soil where the heavier amounts of sulphur were applied was, if anything, the most seriously infected of any on the field. He was not so positive of this fact after the results were obtained at digging time, thus leaving this question somewhat in doubt.

The following paragraph quoted from a recent publication of the Cornell Experiment Station is a brief summary of some quite extended experiments made at that institution along the lines under consideration.

"From our work on sulfur treatment of soil against potato scab it is evident that by application of sulfur in sufficient quantity—450 to 900 pounds per acre—if the application is made broadcast and the sulfur is thoroughly mixed with about two inches of the surface soil just before the potatoes are planted, the amount of scab can be considerably reduced, especially by the heavier application of sulfur. * * * In no case, however, even by the heaviest of the tested applications of sulfur, was the scab entirely eliminated."

Apple Spraying Experiments at Highmoor Farm.

The season of 1914 marked the completion of the fifth year of a series of apple spraying experiments carried on by the Station at Highmoor Farm, the object in view being to improve methods and mixtures in order to secure more efficient control of apple scab and other orchard diseases without adding to the expense involved. Some very important and suggestive practical results have already been obtained, particularly during the past three years.

One of the most striking results and to a certain extent an unexpected result of the two previous seasons was the discovery of the relatively high efficiency of arsenate of lead as a fungicide when applied slightly in excess of the amount commonly used as an insecticide. As yet an opportunity has not presented itself where it has been possible to test the effect of arsenate of lead alone under exceptionally severe conditions. Hence, a plot sprayed with this without the addition of any other fungicide was included last season and will be repeated each year till a season occurs where the weather conditions are exceptionally favorable to scab development.

Arsenate of lead is well and favorably known and widely used for spraying apple trees as an insecticide in combating codling and brown-tail moths and kindred pests of the orchard. In recent years it has been known to have some fungicidal value, but apparently no one has considered this to be of much importance for when used in connection with bordeaux mixture, lime-sulphur, or other recognized fungicides in spraying experiments, it has been customary to assign to the latter all beneficial results secured in the control of parasitic fungi. Hence, the observations made at Highmoor Farm with regard to the fungicidal value of arsenate of lead may be looked upon as discoveries of considerable practical value.

In 1912, a plot of trees sprayed only with arsenate of lead at the rate of four pounds of the paste form to 50 gallons of water showed better scab control than where standard dilution lime-sulphur and two pounds of arsenate of lead paste has been applied and even better than where bordeaux mixture and the smaller amount of the insecticide was used. No unsprayed check plot was available that year.

In 1913, an unsprayed check plot was added and powdered, dry arsenate of lead substituted for the paste. Two plots were sprayed with arsenate of lead alone, one with two and another with one pound of the powder to 50 gallons of water or equivalent to about four and two pounds of the paste form, respectively. Nearly 39 per cent of the apples on the unsprayed plot were scabby. Almost perfect scab control was secured with bordeaux mixture, lime-sulphur and the larger amount of arsenate of lead used alone—the efficiency being in the order named. Attention should be called to the fact that one pound of dry arsenate of lead was added to each 50 gallons of the bordeaux mixture and lime-sulphur, also that where this smaller amount of arsenate of lead was used alone the amount of scab was reduced from nearly 39 per cent to less than 16 per cent. Hence, it is more than a possibility that when the insecticide is added to bordeaux mixture or lime-sulphur, it may contribute materially to the fungicidal effect of the combined spray.

In 1913 there was considerable russeting of the fruit. Much of this, as indicated by the condition of the apples on the unsprayed check plot, was due to natural conditions, but this russeting was largely increased by the action of some of the sprays. This increase of russeting on the lime-sulphur and bordeaux plots was about 11 and 40 per cent, respectively, while, where the two pounds of dry arsenate of lead was used alone in 50 gallons of water, it was actually less than on the check plot.

The results secured in 1912 and 1913 were sufficiently encouraging to warrant a repetition of this part of the experiment, but omitting the smaller amount of arsenate of lead used alone. Also the results of the previous season suggested the alluring possibility that, except for the "pink spray," arsenate of lead used somewhat in excess of the usual amounts might be depended upon to prevent apple scab as well as control certain of the more important insect enemies of the orchard, thus eliminating a considerable part of the labor and expense of orchard spraying.

Accordingly, in 1914, in addition to spraying a plot with arsenate of lead alone, used at the rate of two pounds of the dry powder to 50 gallons of water, one plot was sprayed the first time with a 3-3-50 bordeaux mixture, plus one pound of the dry lead arsenate and later with two pounds of the arsenate alone in 50 gallons of water. On another plot lime-sulphur, 20 per cent stronger than standard dilution, was used in place of bordeaux mixture at the first application. These and all other plots in the same experiments were all sprayed on the same days, first on May 23 when the flower buds were showing pink, second June 6, just after the petals fell, and again on June 22. Those mentioned above were compared with adjoining plots sprayed with bordeaux mixture, standard strength lime-sulphur and lime-sulphur 20 per cent stronger than standard, to which, in each case, one pound of dry arsenate of lead had been added to every 50 gallons of spray. An unsprayed check plot was also saved.

The season of 1914 was somewhat peculiar with reference to scab development and control. The disease was not particularly severe at Highmoor Farm, even on unsprayed trees, and the results secured from treatment with standard sprays were rather erratic. However, nothing occurred to materially change the tentative conclusions derived from the work of the two previous years regarding the fungicidal value of arsenate of lead, although its relative efficiency in 1914 was considerably less than before. When lime-sulphur 20 per cent stronger than standard dilution plus one pound of dry arsenate of lead was used for the first spraying and two pounds of the arsenical was used alone for the later applications, 96 per cent of perfect apples were obtained as compared with less than 94 per cent where standard dilution of lime-sulphur was used in combination with the smaller amount of the insecticide for all three applications. Scab control was slightly better on the last mentioned plot, but there was decidedly more russeting of the fruit, thus decreasing the percentage of perfect apples.

A rather surprising result was obtained where bordeaux mixture was used for the first spray, even though it was applied before the blossoms opened. Over 15 per cent of the fruit was russeted as compared with less than two-tenths of one per cent on the unsprayed check plot. This could not be attributed to the later applications of arsenate of lead for, on this plot where all three applications consisted of the stronger amount of this material alone, only a little over one per cent of the fruit was russeted.

SUBSTITUTES FOR LIME-SULPHUR SPRAYS.

A spray combination known as "copper-lime-sulphur" has been tried and recommended by the Virginia Experiment Station as efficient in controlling rust on apples. A plot of trees sprayed with this material was included in the 1914 experiments to see if it would prove equally satisfactory for preventing apple scab in Maine. The results obtained on Ben Davis trees were very disappointing. The trees suffered severely from foliage injury. Over 57 per cent of the fruit was russeted and less than 41 per cent of perfect apples were obtained, while adjoining plots sprayed with other fungicides produced from 96 to 98 per cent of fruit without spot or blemish.

On account of real or supposed difficulties attendant upon the manufacture of concentrated lime-sulphur solution at home it has come to be the common practice in Maine to purchase the material already prepared. Except for the added cost there is no particular objection to this for, unlike the numerous forms of ready-made bordeaux mixture which have appeared from time to time, the various brands of concentrated lime-sulphur put out by reliable concerns appear to be equal to the best of the home-made goods. However, every time an orchardist purchases rather than makes his lime-sulphur concentrate he pays freight from Boston, New York, Baltimore or some other more distant point upon from one-fortieth to one-tenth of all the water used in his spray. In the case of a large orchard this is an item of expense of considerable importance.

From the above it is apparent that any concern which can place on the market a lime-sulphur concentrate with all the water removed, or can furnish some other form of dry powder or paste which is equally as satisfactory as a fungicide, will thereby secure a distinct advantage over its competitors. The first proposition so far has not proved practicable but there are powder and paste substitutes on the market. It is not the practice of nor within the province of the Station to conduct tests of proprietary articles of this nature, but on account of the distinct advantages which these concentrated spray materials appeared to offer, provided they could substantiate the claims which their manufacturers made for them, it seemed advisable to include some of them in the spraying experiments conducted at Highmoor Farm in 1913 and 1914.

In 1913 two different brands were used. One of these was in the form of a moist paste and apparently had a large amount of very finely divided sulphur, but gave off a distinct odor of hydrogen sulphide, resembling the smell of stale eggs. The other consisted of a dry, yellowish powder which appears to be largely sodium sulphide. While the manufacturers made no statements in the literature which they sent out, claiming that such was the case, many of the purchasers of this latter compound in Maine in 1913 supposed that it was identical with lime-sulphur solution with the water removed.

The paste was used at the rate of seven pounds to 50 gallons of water and the powder at the rate of two pounds to 50 gallons. One pound of dry arsenate of lead was also added to control insect pests. Three applications were made—one just as the blossoms were showing pink, one after the petals fell, and another about three weeks later.

The plot sprayed with the fine sulphur paste showed no foliage injury and scab was well controlled on the leaves throughout the season. On the other hand, while the powdered material was efficient in controlling scab it produced, when used as above described in combination with the arsenate of lead, very decided injury to the foliage. This began to appear shortly after June 3 when the second application of the spray was made, and consisted of a spotting and more or less browning of the margins of the leaves. After the third application this injury developed quite rapidly and by July 7 from 75 to 90 per cent of the leaves were affected. This was followed by much yellowing and leaf fall, resulting in quite marked defoliation of the trees.

The results obtained at harvest time when the percentages of scabby and perfect apples produced on the different plots were determined confirmed the observations made in the summer with reference to the control of the disease on the leaves. Both of the proprietary compounds produced as high or nearly as high percentages of apples free from scab as was obtained where standard dilution lime-sulphur was used.

In 1914 these experiments were repeated and another possible substitute for lime-sulphur was added to the list. This latter was simply a very finely divided sulphur, much finer than the ordinary flour sulphur of commerce. The chief difficulty encountered in attempting to use pure sulphur in a spray is that it cannot be wet readily and consequently refuses to stay in suspension. This was overcome with the fine sulphur by first wetting it with a small amount of dilute glue solution. It would then stay in suspension long enough to be applied to the trees.

Again, extremely satisfactory results with reference to scab control on both foliage and fruit was obtained with the paste and powder used the season before, but the latter in combination with the usual amount of arsenate of lead, although reduced three-fourths pound to 50 gallons of water on the recommendation of the New England selling agents of the compound, caused fully as much defoliation as the previous season. This year leaf injury was noted even before June 6, the date of the second application of the spray. Defoliation began soon after this and in ten days, from one-third to one-half of the surface of the ground under the trees was covered with fallen leaves. By the last of June fully one-third of the leaves had fallen from the trees sprayed with this material.

No spray injury was observed throughout the season, but some scab developed on the leaves of the trees which were sprayed with the extra fine sulphur. It did not control scab so well on the fruit as did standard dilution lime-sulphur or the two compounds already mentioned, but showed enough fungicidal value to warrant a repetition of the experiment.

(515-1-16)

University of Maine.

MAINE

AGRICULTURAL EXPERIMENT STATION,

ORONO, MAINE.

CHAS. D. WOODS, Director.

METHODS OF POULTRY MANAGEMENT AT THE MAINE AGRICULTURAL EXPERIMENT STATION.

(Revised to January, 1916.)

RAYMOND PEARL.

ORONO, MAINE.

JANUARY, 1916.

CONTENTS.

METHODS OF POULTRY MANAGEMENT AT THE MAINE AGRICULTURAL EXPERIMENT STATION.

INTRODUCTION.

Many years' practical experience in raising and keeping poultry and investigations in poultry breeding at the Maine Experiment Station have resulted in the accumulation of a considerable fund of information on poultry management. It is the purpose of the following pages to outline this experience for the benefit of poultry keepers and thereby to help them to discriminate between some of the wrong theories which have underlain much of the common practice of the past and the better theories which underlie other and newer methods that are now yielding more satisfactory results. It may be that these methods are no better than those practiced by others, but the attempt is made to state concisely the methods which have been or are now being successfully employed at the Station.

POULTRY HYGIENE AND SANITATION.

Second in importance only to high constitutional vigor and health in the stock is attention to the basic rules of hygiene and sanitation in the management of poultry. This section gives an account of the general principles involved in the methods of dealing with these matters practised at the Maine Agricultural Experiment Station. Attention to the rules and principles here set forth will go a great ways towards preventing the occurrence of disease. This does not mean that if these rules are *not* followed disease and destruction will forthwith result. Everyone knows of plenty of instances of more or less successful poultry keeping under the most unsanitary and unhygienic of conditions. So similarly human beings are able when forced to do so to live under unhygienic conditions. But every civilized country in the world believes that the most economical insurance against the steady loss of national wealth which the prevalence of disease involves is the enforcement of sanitary regulations throughout its domain. In poultry keeping many may be successful for a time in managing their birds in defiance of the laws of sanitation and hygiene; a *very few* may be successful in this practice for a long time, but in the long run the vast majority will find that thorough, careful, and intelligent attention to these laws will be one of the best guarantees of *permanent* success that they can find.

Poultry hygiene and sanitation will be considered here under seven main heads, as follows: 1. Housing. 2. Feeding. 3. The Land. 4. Exercise. 5. External Parasites. 6. Disposal of the Dead. 7. Isolation of Sickness. What is said under all of these heads is intended to apply (unless a specific statement to the contrary is made) both to adult birds and to chicks. No discussion of the hygiene of incubation, or of the relative merits of artificially and naturally hatched chickens will be undertaken here, because there are special subjects falling outside the field of general poultry hygiene.

I. POULTRY HOUSE HYGIENE AND SANITATION.

A. Cleanliness.—The thing of paramount importance in the hygienic housing of poultry is *cleanliness.* By this is meant not merely plain, ordinary cleaning up, in the housewife sense, but also bacteriological cleaning up; that is, *disinfection.* All buildings or structures of whatever kind in which poultry are housed during any part of their lives should be subjected to a most thorough and searching cleaning and disinfection once every year. This cleaning up should naturally come for each different structure (i. e., laying, colony or brooder house, individual brooder, incubator, etc.) at a time which just precedes the putting of new stock into this structure.

A very thorough method of cleaning a poultry house: Not every poultryman knows how to clean a poultry house thoroughly. The first thing to do is to remove all the litter and loose dirt which can be shovelled out. Then give the house—floor, walls and ceiling—a thorough sweeping and shovel out the accumulated debris. Then play a garden hose, with the maximum water pressure which can be obtained, upon floor, roosting boards, walls and ceiling, until all the dirt which washes down easily is disposed of. Then take a heavy hoe or roost board scraper and proceed to scrape the floor and roosting boards *clean* of the trampled and caked manure and dirt, Then shovel out what has been accumulated and get the hose into action once more and wash the whole place down again thoroughly and follow this with another scraping. With a stiff bristled broom thoroughly scrub walls, floors, nest boxes, roost boards, etc. Then after another rinsing down and cleaning out of accumulated dirt, let the house dry out for a day or two. Then make a searching inspection to see if any dirt can be discovered. If so apply the appropriate treatment as outlined above. If. however, everything *appears* to be clean, the time has come to make it *really* clean by *disinfection*. To do this it is necessary to spray, or thoroughly wash with a scrub brush wet in the solution used, all parts of the house with a good disinfectant *at least twice,* allowing time between for drying. For this purpose 3 per cent cresol solution or 5 per cent formalin is recommended. The chief thing is to use an effective disinfectant and plenty of it, and apply it at least twice. A discussion of disinfectants immediately follows. To complete the cleaning of the house, after the second spraying of disinfectant is dry it is the practise at this Station to apply a liquid lice killer (made by putting 1 part crude carbolic acid or cresol with 3 parts kerosene) liberally to nests and roosts and nearby walls. After all this is done the house will be *clean*. In houses cleaned annually in this way the first step is taken towards hygienic poultry keeping.

The same principles which have been here brought out should be applied in cleaning brooders, brooder houses, and other things on the plant with which the birds come in contact.

What has been said has reference primarily to the annual or semi-annual cleaning. It should not be understood by this that no cleaning is to be done at any other time. On the contrary the rule should be to keep the poultry house *clean* at all times, never allowing filth of any kind to accumulate and using plenty of disinfectant.

Disinfection.—In the matter of disinfection there are several options open to the poultryman. He may make his own disinfectant, or he may purchase proprietary compounds, or he may buy a plain disinfectant like formaldehyde, or carbolic acid.

The Maine Agricultural Experiment Station has tried various disinfectants with a view to finding the most useful, when the factors of efficiency, ease of application and low cost, are considered. There is probably no more effective disinfectant than formaldehyde. The only objection to its use is that a man may find it difficult to withstand the fumes long enough to spray and scrub out thoroughly a pen. Formaldehyde is very good where it can be used, and there is no cheaper disinfectant, efficiency considered. The formaldehyde gas method for disinfecting poultry houses has recently been advocated, using the permanganate method of generating. This, however, is indicated only for rooms which can easily be closed up air tight. It costs too much in time and trouble to make any form of "fresh air" poultry house even moderately air tight. The formaldehyde gas method is well adapted to disinfecting and fumigating feed rooms, incubator cellars, brooder houses and all houses which can be readily made air tight. For the benefit of those who wish to use the method for such purposes the following directions are given. This will give a very strong fumigation and disinfection, but such is indicated about poultry establishments.

Formaldehyde Gas Disinfection: First make the room as tight as possible by stopping cracks, key-holes, etc., with pieces of cloth or similar substance. Use a metal or earthern dish for a generator, of sufficient size so that the liquid will not spatter or boil over on the floor, since the permanganate will stain. The temperature of the room should not be below 50° F. and more effective disinfection will be obtained if the temperature is 80° F. or above at the beginning. Sprinkle boiling water on the floor or place a kettle of boiling water in the room to create a moist atmosphere. Spread the permanganate evenly over the bottom of the dish and quickly pour in the formaldehyde (40 per cent strength as purchased). Leave and tightly close the room at once and allow to remain closed for 4-6 hours or longer, then air thoroughly." *Use 23 ounces of per-*

manganate and 3 pints of formaldehyde to each 1000 cubic feet of space.

For general disinfecting purposes about a poultry plant the Station has found one of the cheapest and most effective disinfectants to be compound cresol solution. This is used here for spraying and disinfecting the houses after they are cleaned, disinfecting brooders, brooder houses, incubators, nests and everything else about the plant which can be disinfected with a liquid substance. Any person can easily make this disinfectant. The following revised directions for its manufacture are quoted from Bulletin 179 of the Maine Agricultural Experiment Station.

Cresol Disinfectant.—The active base of cresol soap disinfecting solution is commercial cresol. This is a thick, sirupy fluid varying in color in different lots from a nearly colorless fluid to a dark brown. It does not mix readily with water, and, therefore, in order to make a satisfactory dilute solution, it is necessary first to incorporate the cresol with some substance like soap which will mix with water and will carry the cresol over into the mixture. The commercial cresol as it is obtained, is a corrosive substance, being in this respect not unlike carbolic acid. It should, of course, be handled with great care and the pure cresol should not be allowed to come in contact with the skin. If it does so accidentally the spot should be immediately washed off with plenty of clean water. The price of commercial cresol varies with the drug market.

Measure out 3 1-5 quarts of raw linseed oil in a 4 or 5 gallon stone crock; then weigh out in a dish 1 lb. 6 oz. of commercial lye or "Babbit's potash." Dissolve this lye in as little water as will completely dissolve it. Start with 1-2 pint of water, and if this will not dissolve all the lye, add more water slowly. Let this stand for at least 3 hours until the lye is completely dissolved and the solution is cold; then add the *cold* lye solution very slowly to the linseed oil, stirring constantly. Not less than 5 minutes should be taken for the adding of this solution of lye to the oil. After the lye is added continue the stirring until the mixture is in the condition and has the texture of a smooth homogeneous liquid soap. This ought not to take more than a half hour. Then while the soap is in this liquid state, and before it has a chance to harden add, with constant stirring, 8 1-2 quarts of commercial cresol. The cresol will blend perfectly with the soap solution and make a clear, dark brown fluid. The resulting solution will mix in any proportion with water and yield a clear solution.

Cresol soap is an extremely powerful disinfectant. In the Station poultry plant for general purposes of disinfecting the houses, brooder houses, incubators, nests, and other wood work, it should be used in a 3 per cent solution with water. Two or 3 tablespoons full of the cresol soap to each gallon of water will make a satisfactory solution. This solution may be applied through any kind of spray pump or with a brush. Being a clear watery fluid it can be used in any spray pump without difficulty. For disinfecting brooders or incubators which there is reason to believe have been particularly liable to infection with the germs of white diarrhea or other diseases the cresol may be used in double the strength given above and applied with a scrub brush in addition to the spray.

B. Fresh Air and Light.—Too great stress cannot be laid on the importance of plenty of fresh air in the poultry house if the birds are to keep in good condition. And it must be remembered in this connection that "fresh" air, and cold stagnant air are two very different things. Too many of the types of curtain front and so-called "fresh air" houses now in use are without any provision other than an obliging southerly wind, to insure the circulation or changing of air within the house. Even with an open front house it is wise to provide for a *circulation* of air in such way that direct drafts cannot strike the birds. This applies not only to the housing of adult birds in laying houses, but also to the case of young stock in colony houses on the range. Further a circulation of fresh air under the hover in artificial rearing is greatly to be desired and will have a marked effect on the health and vigor of the chicks.

Not only should the poultry house be such as to furnish plenty of fresh air, but it should also be *light*. The prime importance of sunlight in sanitation is universally recognized by medical authorities. Disease germs cannot stand prolonged exposure to the direct rays of the sun. Sunlight is Nature's great disinfectant. Its importance is no less in poultry than in human sanitation. The following statement made some years ago (1904) by a writer signing himself "M" in Farm Poultry

(Vol. 15) brings home in a few words the importance of having plenty of light in the poultry house.

"Light in the poultry house has been found by the writer a *great help in keeping the house clean and keeping the fowls healthy.* Probably there is no greater assistance to the diseases of poultry than dark and damp houses, and dark houses are frequently damp. In recent years I have had both kinds of experience, those with the hens confined in a large, dry and light house, and with hens confined in a dark house in which a single window looking towards the setting sun furnished the only light. Being forced to use the latter building for an entire winter I found it impossible to get it thoroughly dried out after a rain had rendered the walls damp. By spring some of the fowls that had been confined there began to die of a mysterious disease and a post-mortem examination showed it to be liver disease. Later the roup broke out in the same house and this dread disease continued with the flock for months exacting a heavy toll in laying hens."

C. Avoid Dampness. Of all unfavorable environmental conditions into which poultry may, by bad management, be brought, a damp house is probably the worst. Nothing will diminish the productivity of a flock so quickly and surely as will dampness in the house, and nothing is so certain and speedy an excitant to roup and kindred ills. *The place where poultry are housed must be kept dry if the flock is to be productive and free from disease.*

D. Provide Clean and Dry Litter. Experience has demonstrated that the best way in which to give fowls exercise during the winter months in which, in northern climates at least, they must be housed the greater part if not all of the time, is by providing a deep litter in which the birds scratch for their dry grain ration. For this litter the Experiment Station uses pine planer shavings with a layer of oat straw on top. Whatever the litter it should be changed as often as it gets damp or dirty.

II. HYGIENIC FEEDING.

Along with housing as a prime factor in poultry sanitation goes feeding. This is not the place to enter upon a detailed discussion of the compounding of rations and such topics.

These matters are considered farther on in this circular (see pages 39-64). There are, however, certain basic principles of hygienic feeding which must always be looked after if one is to avoid diseases. These are:

A. Purity. It should be a rule of every poultryman never to feed any material which it not clean and wholesome. Musty and mouldy grain, tainted meat scraps or cut bone, table scraps which have spoiled, and decayed fruits or vegetables should never be fed. If this consideration were always kept in mind many cases of undiagnosed sickness and deaths, and low condition in the stock would be avoided. Keep all utensils in which food is placed *clean.*

B. Avoid Overfeeding. Intensive poultry keeping involves of necessity heavy feeding, but one should constantly be on the lookout to guard against overfeeding, which puts the bird into a state of lowered vitality in which its natural powers of resistance to all forms of infectious and other diseases are reduced. The feeding of high protein concentrates like linseed or cotton seed meal needs to be particularly carefully watched in this respect.

C. Provide Plenty of Green Food. Under natural conditions poultry are free eaters of green grass and other plants. Such green food supplies a definite need in metabolism, the place of which can be taken by no other sort of food material. It is not enough merely to supply *succulence* in the ration. Fowls need a certain amount of succulent food, but they also need *fresh green food.* It is desirable to provide for a succession of green food throughout the year. The succession followed at the Maine Agricultural Experiment Station is as follows:

Beginning in the early fall when the pullets are put in the laying house they are given green corn fodder cut fine in a fodder cutter. Stalks, leaves and ears are cut together in pieces averaging about 1-2 inch in length. The birds eat this chopped corn fodder greedily. It is one of the best green foods for poultry that we have as yet been able to find. Its usefulness is limited only by the season within which it is possible to get it. The feeding of corn fodder is continued until the frost kills the plants.

When the corn can no longer be used cabbage is fed. The supply of this usually lasts through December. In the event of the supply of cabbage failing before it is desirable to start the oat sprouter (see p. 59) the interval is filled out by the use of mangolds. From about January 15 to May 15 green sprouted oats grown as described below (pp. 59-64) form the source of green food. From about May 15 until the corn has grown enough to cut, fresh clover from the range is used. During the summer the growing chicks on the range are given rape (Dwarf Essex) and green corn fodder cut, as described above to supplement the grass of the range, which rather rapidly dries out and becomes worthless as a source of green food under our conditions. The very young chicks in the brooders are given the tops only of green sprouted oats chopped up fine.

D. Provide Fresh and Clean Drinking Water. The most sure and rapid method by which infectious diseases of all kinds are transmitted through a flock of birds is by means of the water pail from which they all drink in common. Furthermore the water itself may come from a contaminated source and be the origin of infection to the flock. Finally it is difficult to devise any satisfactory drinking fountain in which the water is not liable to contamination from litter, manure, etc. All these considerations indicate the advisability of adding to all drinking water which is given to poultry some substance which shall act as a harmless antiseptic. The best of all such substances yet discovered for use with poultry is potassium permanganate. This is a dark reddish-purple crystalline substance which can be bought of any druggist. It ought never to cost more than 20c-30c per pound and a pound will last for a long time. It should be used in the following way: In the bottom of a large mouthed jar, bottle or can, put a layer of potassium permanganate crystals an inch thick. Fill up the receptacle with water. This water will dissolve all of the crystals that it is able to. This will make a stock saturated solution. As this solution is used add more water and more crystals as needed, always aiming to keep a layer of undissolved crystals at the bottom. Keep a dish of stock solution like this alongside the faucet or pump where the water is drawn for the poultry. *Whenever any water is drawn for either chicks or adult fowls at the Maine Agricultural Experiment Station enough of the stock solution is* *added to give the water a rather deep wine color.* This means for some 4 years past no bird has ever had a drink of water from the time it was hatched which did not contain potassium permanganate, except such water as it got from mud puddles and the like.

III. THE LAND.

One of the most important considerations in poultry sanitation is to keep the ground on which the birds are to live, both as chicks and as adults, from becoming foul and contaminated. This is not a very difficult thing to do if one has enough land and practices a definite and systematic crop rotation in which poultry form one element. On the open range where chicks are raised a four year rotation is operated at the Maine Agricultural Experiment Station and serves its purpose well. This system of cropping is as follows: First year, chickens; second year, a hoed crop, such as beets, cabbage, mangolds or corn; third year, seed down to timothy and clover, using oats or barley as a nurse crop; fourth year, chickens again. Other cropping systems to serve the same purpose can easily be devised.
1 to 2 teaspoons of the stock solution to 10 quarts of water. At the same time one should clean and disinfect the drinking pails and fountains regularly, just as he would if he were not using potassium permanganate. At the Maine Station plant
To maintain the runs connected with a permanent poultry house, where adult birds are kept, in a sweet and clean condition is a more difficult problem. About the best that one can do here is to arrange alternate sets of runs so that one set may be used one year and the other set the next, purifying the soil so far as may be by annually plowing and harrowing thoroughly and planting exhaustive crops. Failing the possibility of alternating in this way, disinfection and frequent plowing are the only resources left.

The following excellent advice on this subject is given by the English poultry expert Mr. E. T. Brown (Farm Poultry, Vol. 18, p. 294): "Tainted ground is responsible for many of the diseases from which fowls suffer, and yet it is a question that rarely receives the attention it deserves. The chief danger of tainted soil arises when fowls are kept in confinement, but still we often find that even with those at liberty the land over which they are running is far from pure. So long as the grass can be kept growing strongly and vigorously there is small fear of foul ground, as the growth absorbs the manure; it is when the grass becomes worn away that the chief danger arises. The manure constantly falling upon the same small area, and there being nothing to use it up, the land is bound in a short space of time to become so permeated as to be thoroughly unfit for fowls. The question is very often asked in connection with this subject as to how many fowls a certain sized piece of land will accommodate the whole year through. Occasionally one may see in some of the agricultural or poultry journals this question answered, but as a matter of fact to give any stated number is most misleading. It depends very largely upon the class of soil, as some can carry twice as many birds as others; it depends upon the breed of poultry, some being much more active than others, and thus requiring more space; it depends, too, upon the time of year, because during the spring and summer, when there is an abundance of vegetable growth in the soil, a considerably larger number of birds can be maintained than during the autumn or winter. The number must be varied according to these circumstances, and no hard and fast rule is applicable."

"The results of tainted ground are generally quickly noticeable, as the fowls have a sickly apearance, the feathers lose their brilliant lustre, and the wings begin to droop. Roup, gapes, and other ailments speedily show themselves, causing, if not death itself, considerable loss and unpleasantness. One of the greatest advantages to be derived from portable houses is that they so greatly reduce the risk of tainted ground, as they are being constantly moved from one place to another, thus evenly distributing the manure. When it is remembered that each adult fowl drops nearly a hundred weight of manure in the course of a year, the importance of this question will be immediately realized. It is quite possible, however, provided that suitable precautions are taken, to keep a comparatively small run pure for a long time. If the grass is short it should be occasionally swept, in this manner removing a good deal of the manure. Another important point is to always have around the house a space of gravel, upon which the birds should be fed, and if swept once or twice a week this will have a wonderful effect in preserving the purity of the grass portion. Anyone who has observed poultry will know how fond they are of constantly being near the house, and thus the greater portion of their droppings falls within its immediate vicinity. The shape of the run also has a great bearing upon the length of time it will remain untainted, a long narrow run being much superior to a square one. I have proved by my own experience how true this is, and probably a long and narrow run, containing the same amount of space will remain pure twice as long. It is unnecessary here to go into a full explanation of why this is so, but I may state the fact, which I am confident is quite correct. If the space at one's disposal is very limited it is a good plan to divide it into two equal parts, placing the house in the middle. During one year one-half would be available for the fowls, the other being planted with some quickly growing vegetables, the order being reversed the year following. The vegetable growth has the effect of quickly using up the manure, and in this manner quite a small plot of land can be heavily stocked with poultry for an unlimited number of years."

IV. EXERCISE.

If poultry are to be in good condition, and maintain their normal resistance to disease *they must exercise.* As chicks they will do this on the range. As adults (in climates like that of Maine) the most feasible way to bring this about is to provide litter and make the birds scratch for their feed.

V. EXTERNAL PARASITES.

In hygienic poultry keeping the birds must be kept reasonably free at all times of lice, mites, and all other forms of external parasites. The methods of dealing with this matter in use at this Station are given in detail farther on. It is desired here merely to call attention to the matter as one of the general principles of hygienic poultry management.

VI. DISPOSAL OF DEAD BIRDS.

On every poultry plant and around every farm there are bound to occur from time to time a greater or less number of deaths of chickens and adult fowls from disease or other natural causes. The disposal of these dead bodies offers a problem to the poultryman, the correct solution of which may in many cases become a very important matter. This is especially true in the case of death from contagious diseases, which include a considerable proportion of the deaths of poultry generally. The method usually practiced by the farmer and poultryman for the disposition of dead carcasses is unsanitary in the extreme. To throw the dead bodies on the manure pile is to invite the spread of disease on the plant. Burying is far from being a satisfactory way of dealing with the matter for two reasons. Unless the grave is dug deep, which costs a good deal of time and labor, there is considerable likelihood that dogs or other marauding animals will dig out the carcasses, and, after feeding on them, scatter the remains around on the top of the ground. Furthermore, burying cannot be resorted to at all during the winter months when the ground is frozen.

The only really sanitary method of dealing with dead bodies is to incinerate them. The difficulty of following this plan in practice is that the farmer or poultryman usually does not have any suitable source of heat ready at hand at all times. To be sure, during certain seasons of the year, those poultrymen who employ large brooder houses with a hot water heating system have a furnace in operation, and the dead chicks can be burned up in the furance. This, however, covers only a part of the year. At other times resort must be had to burying or some other means of disposal, as the poultryman is not likely to fire up a large furnace for the sake of burning a few dead birds.

At the Station plant it was felt to be desirable to have a small crematory conveniently located, and so easy and economical of operation that dead birds could be disposed of immeditely, with a minimum amount of trouble and labor. To meet this requirement there was devised the small crematory here described. The construction was carried out with the idea of keeping the first cost as low as possible, in order that there should be nothing about it which any poultryman or farmer could not easily afford to duplicate. As a matter of fact, the cost of materials for the crematory here described was less than ten dollars. The labor was done by the poultryman and his assistant at odd times, when an hour or two could be spared for this work. The result is therefore, not beyond the reach of any poultryman or farmer. At the same time the crematory is so satisfactory in operation that anyone who builds one will wonder, after he has completed and used it for a time, why he did not long before have so simple and sanitary an adjunct to his plant.

The crematory shown in Figure 1 is very simple in construction. It consists essentially of a cement base or fire box, bearing on its top a series of grate bars which are in turn covered by a cremating box or oven in which the material to be incinerted is placed.

The crematory here described is sufficiently large to take care of all the needs of a plant carrying 1000 head of adult stock, raising 3000 to 4000 chickens annually, and in which a good deal of anatomical and physiological research is going on, necessitating a much larger amount of waste animal material than the ordinary commercial poultryman would have. Therefore, it is doubtful if it would be necessary in any but the very largest commercial plants to build a larger crematory than the one here described.

In building this an excavation was first made for the base, in which a lot of loose stones and gravel were placed, in order to secure adequate drainage below the cement. On top of this the cement base and fire box were made.

This base consists essentially of a rectangular box made of cement open at the top, and with a small opening in front through which the fire is fed and which serves as a draught. The walls are about 6 inches thick. The outside dimensions of the fire box base are 3 feet, 4 inches by 2 feet, 6 inches. The inside dimensions of the fire box are 2 feet, 3 inches by 1 foot, 9 1-2 inches by 1 foot, 4 inches. Across the top of the fire box there were laid, while the cement was still soft, some old grate bars from a small steam boiler, which had been discarded and thrown on the dump heap. These were set close together and held firmly in place when the cement hardened. They form the grate on which the material to be incinerated is thrown. These old boiler grate bars, besides costing nothing, had another advantage; namely that of their thickness and weight. When they become thoroughly heated from the fire below they will hold the heat for a considerable time charring and burning the animal material above.

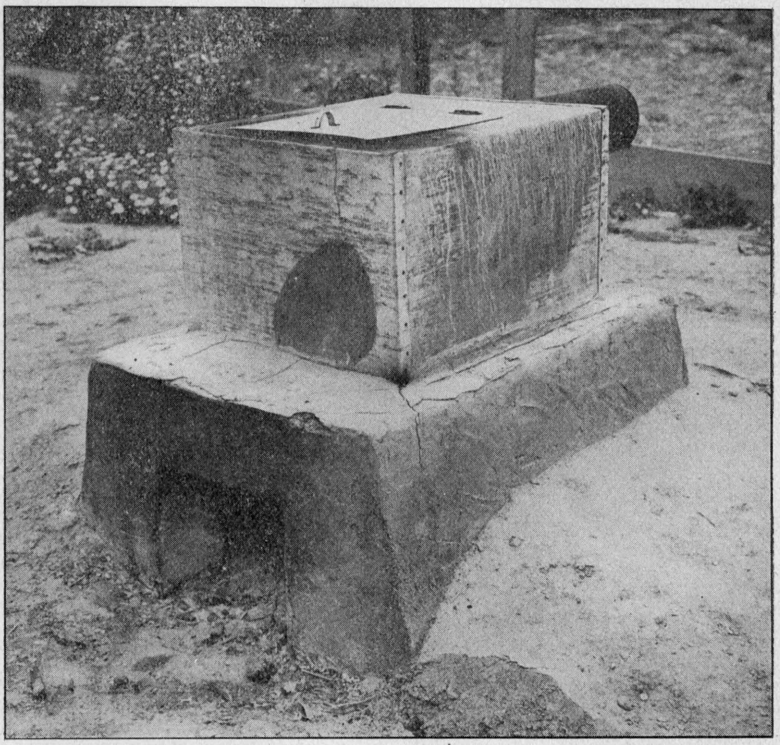

Fig. 1. Photograph of crematory described in text. Note cement base, with opening in front into fire box; galvanized iron cremating box on top; cover of cremating box.

The incinerating chamber proper was made from galvanized iron by a local tinsmith. This consists of a rectangular box having the following dimensions: Length 2 feet, 2 inches; width 1 foot, 10 inches; height 1 foot, 6 inches. In the top of this is cut a round hole, 12 inches in diameter which is protected by a hinged cover 15 inches by 14 1-2 inches. This galvanized box has no bottom. It is placed on top of the grate bars, and held firmly in place by cement worked up around its lower edges. At the back end of this iron cremating box is an opening for a stove pipe, which is necessary in order to give the proper draught. It is found in practice that only a short piece of stove pipe is necessary to get sufficient draught to make a very hot fire, which entirely consumes the birds in a few hours.

2

The funnel may best be left removable so that when the crematory is not in use it can be taken off and stored inside the wooden box (which then sets over the galvanized iron portion to protect it from the weather.

It is important in locating a crematory of this kind to plan matters so that there will be good drainage from around it. In particular pains should be taken to insure that water does not run into the firebox and freeze during the winter.

In operation the apparatus works as follows: Dead birds are thrown into the incinerating chamber through the opening in the top and the lid closed while a wood fire is burning in the fire box below. The aim should be to use dry wood and get a quick and very hot fire. This first roasts the material and then chars it, and finally reduces it to fine ashes.

VII. ISOLATION OF SICKNESS.

Whether one expects to treat the bird or to kill it, *every individual that shows signs of sickness should be removed from the general flock*. When the bird has been isolated a decision as to what will be done about the case can be reached at leisure, and in the meantime the flock is not subjected to the danger of infection. This is an important matter with young chickens as well as with adult stock.

The general subject of the diagnosis, etiology and treatment of poultry diseases is not discussed in the present work. Those desiring information regarding these matters should consult the book on this subject prepared by the present writer and his associates.*

THE ESSENTIALS OF POULTRY HYGIENE.

To summarize this discussion of poultry hygiene and sanitation it may be said that the essentials in the hygienic and sanitary management of poultry are

1. CLEAN HOUSES.
2. CLEAN AIR.

Pearl, Surface, and Curtis. The Diseases of Poultry. New York, (published by the Macmillan Co.) 1915.

3. Clean Food.
4. Clean Water.
5. Clean Yards and Clean Range.
6. Clean Incubators and Brooders.
7. Clean Birds, Outside and Inside.

The Selection of Breeding Stock.

At the Maine Agricultural Experiment Station the poultry plant is conducted for purely experimental purposes in connection with the study of the principles of breeding. On that account the considerations which determine the choice of birds to go into the breeding pens are somewhat different to what they would be in a purely commercial plant. It will therefore be advisable to discuss here only those general guiding principles in regard to the selection of breeding stock, which the experience of this Station has demonstrated to be of fundamental importance in building up an economically productive strain of poultry.

Whatever the object of the breeder, whether egg production, table fowl production, or the fancy, the first selection of breeding stock should be for constitutional vigor and vitality. No bird which shows the slightest sign of weakness or lack of vigor should be used as a breeder. The selection for constitutional vigor should begin at a very early age and be continued until the pens are mated. It is a great mistake to leave the whole of the process of selection until just prior to the breeding season. As the chicks are growing on the range the most vigorous ones, those which impress themselves in the eye of the breeder as surpassing their associates in vitality, rate of growth, vigor, etc., should be marked and watched. With later development some of these early selected birds will fail to fulfill the promise of their youth and will then be discarded. Others which were not conspicuously excellent at an early age will develop into unusually good specimens later. They may then be taken into the selected group. Finally as the mating season approaches the breeder should go carefully over this group of birds which have been selected from the beginning of their lives, and pick out the most vigorous of the lot which also carry the other qualities for which he is breeding. The point is to make the selection of breeders a process of continuous picking out the good and culling the poor throughout the entire growth of the birds.

Another point of importance is in relation to the size of the breeding stock. It is a nearly universal experience, if line breeding be practised for any particular character, as for example egg production or feather marking, that unless special attention is paid to this point there will tend to be a progressive deterioration in the average size of the birds. This is particularly liable to happen when one is breeding for egg production. To counteract this tendency special attention must be paid to the size of the breeding stock, making it a rule never to use as a breeder any bird, whatever the other excellencies may be, which does not attain a certain weight standard set by the breeder.

What has been said regarding size is only a special case of the general rule of breeding that always the effort in selecting breeders should be towards all-round excellence. Selection for any one character alone—as for example egg production—with an entire disregard of all other characters of the birds will, in comparatively few generations, defeat its own end. It will be found that the stock has deteriorated quite as much in regard to some important qualities as it may have gained in respect to the character for which selection was made.

While it is not possible here to enter upon an exhaustive discussion of the subject of breeding for egg production a word may be said regarding the results of the Maine Agricultural Experiment Station along this line. From long continued experiments it appears to be conclusively demonstrated that the male bird has a hitherto unsuspected importance in the transmission of high-laying qualities to the progeny. Egg production, in the Barred Plymouth Rock fowl at least, appears to depend upon two separately inherited physiological factors. Either of these factors when present alone in a bird makes it a poor or mediocre layer. If both factors are present together the bird is a high producer. The novel feature of the case lies in the point that the factor upon which high production depends (i. e., which must be present if the bird is to be a high producer) is never transmitted in inheritance from a mother to her daughters, but only to her sons. It behaves, in other words as a sex-linked character. The male bird which possesses this hereditary factor for high production may however transmit it both to his sons and his daughters. It thus appears that the high egg productiveness exhibited by some pullets or hens is always directly inherited from the sire, and not at all *directly* from the dam, though the sire himself may very likely have inherited the quality from his dam. Indeed the male which is hereditarily pure (homozygous) with respect to this high producing factor must receive one half of his endowment from his dam. The practical significance of this matter is that more attention will have to be paid to the male birds in breeding for egg-production than has hitherto been the case. Only males from high-laying dams should be used as breeders and of those only a portion will transmit high producing qualities to any large proportion of the daughters. An important practical step is to toe-mark, or otherwise identify, all pullets so that their *sire* may be known. From their performance the breeder will be able to judge of the ability of the sons of this sire (the brothers of the pullets) to transmit high-producing qualities.*

Raising Chickens by Natural Processes.

While even the small grower of chickens in many cases uses an incubator for hatching, circumstances make it necessary at times to hatch and raise chickens by aid of the mother hen. To persons so situated an outline of the method practiced at the Station before incubators had reached their present development may be helpful. An unused tie-up in a barn was taken for the incubating room and a platform was made along the inner side. The platform was 3 feet above the floor and was 2 1-2 feet wide and 50 feet long. It was divided into fifty little stalls or nests, each 1 foot wide, 2 feet long, and 1 foot high. This left a 6-inch walk along the front of the nests for the hens to light on when flying up from the floor. Each nest had a door made of laths at the front, so as to give ventilation. The door was hinged at the bottom and turned outward. Across the center of each nest a low partition was placed, so that the nesting material would be kept in the back end—the

*A detailed report of the experiments on the basis of which the above statements are made is published as Bulletin 205 of the Maine Agricultural Experiment Station.

nest proper. For early spring work paper was put in the bottom of the nest, then an inch or two of dry earth, and on that the nest, made of soft hay.

Whenever half a dozen hens became broody they were taken in from the henhouse and put on the nests, each nest having a dummy egg in it; the covers were then shut up, and nearly every hen seemed contented. In a day or two 13 eggs were placed under each hen. Every morning the hens were liberated as soon as it was light, when they would come down of their own accord and burrow in the dry dust on the floor, eat, drink, and exercise, and in twelve or fifteen minutes they would nearly all go back to the nests voluntarily. In the afternoons one would occasionally be found off the eggs looking out through the slatted door. If she persisted in coming off she was exchanged for a better sitter. The double nest is necessary, otherwise the discontented hen would have no room to stand up, except on her nest full of eggs, and she would very likely ruin them. There was no danger of this with the double nest, as she would step off the nest, go to the door and try to get out.

The advantages of a closed room in which to confine the sitters are many, as the hens are easily controlled and do not need watching as they do when selecting nests for themselves, or when sitting in the same room with laying hens. A room 12 feet square could be arranged so as easily to accommodate 50 sitters.

The most satisfactory arrangement used at the Maine Station for the accommodation of the hen with her brood of young chicks consisted of a closed coop about 30 inches square, with a hinged roof and a movable floor in two parts, which would be lifted out each day for cleaning. This little coop had a wire-covered yard attached to it on the south side. The yard was 4 by 5 feet in size and 1 1-2 feet high. Its frame was of 1-inch by 3-inch strips and was fastened securely to the coop.

The wire on the sides was of 1-inch mesh, but on top 2-inch mesh was sufficient. Such a coop is easily kept clean, and the coop and yard can be set over upon clean grass by one person.

The small run will be sufficient for the first few weeks, but soon the chicks need greater range, and then the fence at the farther end of the run can be lifted up 3 or 4 inches and they can pass in and out at will, while the mother will be secure at home and they will know where to find her when they get cold or damp or need brooding. Such a coop accommodates 15 to 20 chicks until they no longer require brooding, after which several flocks should be combined in one and put in a portable house on a grassy range.

Whenever the hen is allowed to hatch or to mother chicks, much care must be exercised to prevent lice from getting a foothold and ruining the birds. The free and frequent use of the lice powder described farther on (p.), working it through the feathers to the skin, is one of the best methods for destroying the pests. Grease or oil is effective when applied to the heads and under the wings of young chicks, but care must be taken not to get too much on them, especially during damp weather. The feeding of chicks raised in coops with their mothers does not vary much from the feeding of those raised in brooders as described below.

Raising Chickens by Artificial Processes.

Incubators have been much improved and there are several kinds on the market that will hatch about as many chicks from a given lot of eggs as can be done by selected broody hens. Furthermore, in the experience of this Station, with proper management during and subsequent to incubation the chicks so produced are *fully* the equal in constitutional vigor, average duration of life, and productivity, of hen-hatched chicks. The best present day incubators require little care, maintain an even temperature arising from the development of the embryoes going on in the eggs. In some machines the moisture supply is automatic and adapted to the requirements; in others it has to be supplied, and skill is necessary in determining the quantity needed. The economy of the incubator is very great. A 360-egg machine will do the work of nearly 30 broody hens, and can be kept at work continually if desired. For more than 10 years past all chicks in the Maine Experiment Station's poultry plant have been hatched in incubators. There has yet to appear any reason for going back to the old system of hatching with hens.

THE INCUBATOR.

There are many makes of incubators on the market, some of which will give satisfactory results. The Maine Station has not tested many makes of incubators, and very likely some of the makes not tested would prove as satisfactory as those used.*

Whatever make of incubator is used, pains should be taken to become thoroughly acquainted with the machine before the eggs are put into it. It is advisable for a person not familiar with the use of an incubator to run the machine empty for several days before filling it. After the eggs are put in, changes and adjustments should be made with the greatest care for fear of extreme results. By the use of an incubator it is possible to determine exactly the time when the chickens shall be hatched. With the strain of Barred Plymouth Rocks bred by the Maine station it was formerly necessary to hatch the chickens in March in order to have them ready for November laying. By better methods of feeding, breeding, and treatment, it is now possible to delay the hatching until April and the first of May and have the pullets in good laying condition the last of October and early in November. Chickens hatched in March under the present method of breeding and feeding would in many cases begin laying in August.

THE INCUBATOR ROOM.

It is important that the incubator room be so situated that it can be kept at a fairly constant temperature. On this account an underground room is usually selected. For many years the well-lighted cellar under the wing of the farmhouse was used by the Maine Station. A cold or badly ventilated cellar would, however, be poorly adapted for incubators. Ventilation is very important, and where several incubators are in use artificial ventilation must be provided, in order that the machines may be furnished with clean, fresh air at all times.

In 1905 the Maine Station erected an incubator house which practically consists of a well-made, light, airy cellar with a house for the poultry man above it. The incubator room, which occupies the entire cellar, is 30 feet square. The room is 7 feet

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*A discussion of the different types of incubators and the methods of managing them to get the best results is given in Farmers' Bulletin 236, "Incubation and Incubators," which may be obtained free on application to the Secretary of Agriculture, Washington, D. C. The directions furnished by the manufacturers of the different incubators should be strictly adhered to by the beginner.

high in the clear, 5 feet of which is below the level of the outside ground. It is lighted by six 3-light windows, carrying glass 10 inches by 16 inches. The cement walls are finished smooth and the cement floor is slightly inclined toward the southeast corner where the intake of the drain is located. This enables the free use of water from hose in cleaning the room preparatory to starting the incubators. Two chimneys extend to the basement floor and contain ventilating flues that have no opening into the rooms above. Entrance to the room is through a covered outside cellar stairway leading into a shed at the rear of the building. The room now contains thirteen 360-egg machines.

In the directions which accompany certain of the incubators which have been used at the Station it is stated that an artificial source of moisture is not needed in operating these incubators except in very arid parts of the country. It is said that in other places the normal moisture of the atmosphere is sufficient to insure the necessary moisture in the incubator. The experience of the Station indicates that except possibly in a rather wet season this is not the case. It has been found here that in an ordinary season if no artificial moisture is supplied to the incubators there is too great an evaporation from the eggs. It is demonstrable that many eggs fail to hatch because of this dryness of the air in the incubator. It is not desirable here to enter into a detailed discussion regarding experiments on this point. It suffices to state the fact that in the Station's experience better hatches have been obtained when moisture beyond that normal in the atmosphere is supplied during incubation. The most satisfactory way to supply this extra moisture in machines where sand trays are not an integral part, has been found to be by sprinkling the eggs with warm water twice a day. The water is warmed to a temperature of from 104°-108° Fahr. The sprinkling may be done either with a small hand sprayer or by simply shaking the water on with the hand or a whisk broom. This is done in connection with the regular manipulation of the eggs (cooling and turning) during incubation. The application of moisture is begun as soon as the eggs go into the machine and is continued until the 18th day. Since adopting this procedure a very considerable reduction in the mortality of chicks in the shell has been effected.

BROODER HOUSES.

Some years ago there was erected at this Station a long continuous brooder house, containing 10 brooders and with capacity for 600 to 1000 chicks. This house burned during the first season of its use, and has never been replaced.

A permanent brooder house would be indispensable for the raising of winter chickens, and a house piped for hot water has some advantages. The advantages are especially great when raising chickens if April or May proves to be cold or wet, for then the small houses are apt to be cold outside of the brooders. In ordinary seasons, even in Maine, little or no difficulty is experienced in raising chicks hatched in April and May in the small houses. The expenditure would be greater for the piped house, for the reason that colony houses still must be provided in which the chicks may be sheltered after they leave the brooder house.

Since the burning of the house just described, the Maine Station has used small portable brooder houses (see fig. 1). The small brooder houses built on runners are readily moved about, and for the work with spring-hatched chickens are preferred to the large permanent brooder house. Several styles and sizes have been used, but the following meets the needs of the Station better than any other that has been tried. The houses are built on two 16-foot pieces of 4 by 6 inch timbers, which serve as runners. The ends of the timbers, which project beyond the house, are chamfered on the underside to facilitate moving. The houses are 12 feet long; some of them are 6 feet and others 7 feet wide; 7 feet is the better width. They are 6 feet high in front and 4 feet high at the back. The frame is of 2 by 3 inch lumber; the floor is double boarded, and the building is boarded and covered with a good quality of heavy roofing paper. Formerly shingles were used for the outside covering, but paper is preferred and is now used exclusively. This kind of covering for the wall is not so likely to be injured in moving as shingles. A door 2 feet wide is in the center of the front and a 6-light window, hinged at the top, is on each side of it. Two brooders are placed in each of these houses and 50 to 60 chicks are put with each brooder. A low partition separates the flocks while they are young. The houses are large

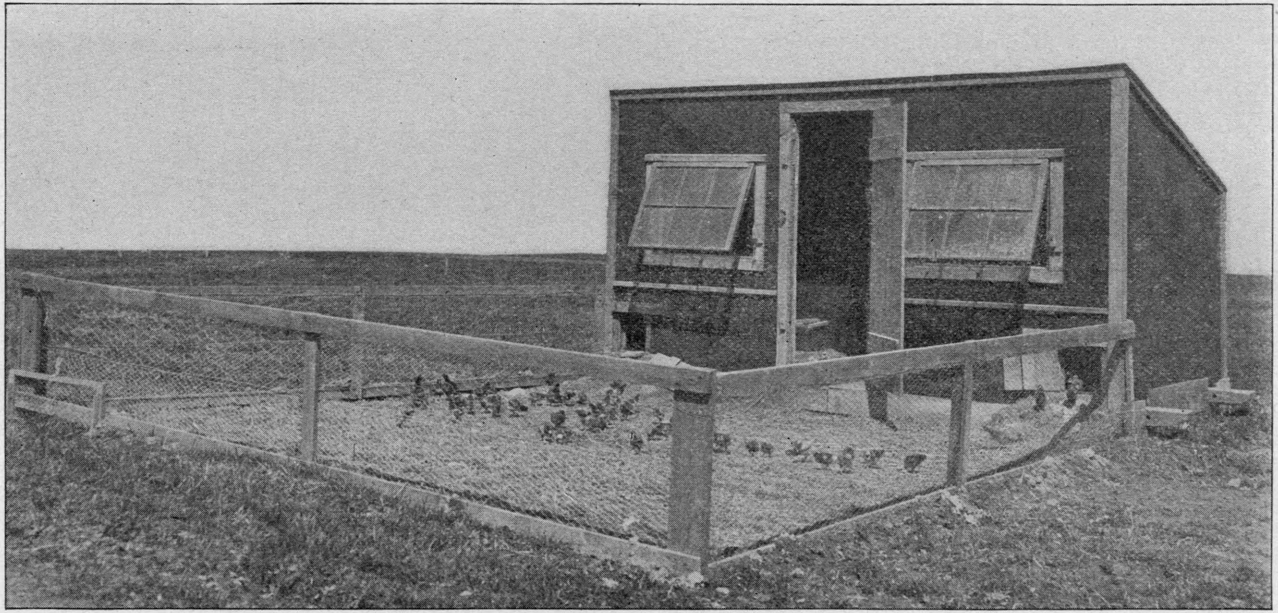


FIG. 2.—Portable brooder house and temporary yard.

enough so that a person can go in and do the work comfortably, and each one accommodates 100 chicks until the cockerels are large enough to be removed. One of these houses is shown in figure 2.

An improvement has recently been made in these brooder houses by providing for better ventilation. When the weather is very hot there is no movement of air within one of these houses, even though the door and windows are open. The air within the house is practically stagnant and, on account of its relatively small volume, becomes intensely hot and stifling when the temperature outside gets high. The effect on the chicks under such circumstances is bad. They retreat to the houses to get shade, but only to be injured if not killed by the hot, stifling air of the house. To remedy this difficulty a slot 2 feet long and 1 foot wide has been cut in the back of each house high up under the eaves. This slot is closed with a wooden slide running in grooves which are put on the outside of the house. The opening is covered on the inside with 2-inch mesh chicken wire. On very hot days the slide is pulled out completely so as to expose the whole opening of the slot. At night or during a period of wet, cold weather the size of the opening is regulated to suit the conditions. It enables one to keep a current of fresh air through the house in the warmest weather. The effect on the well-being of the chicks during a period of hot weather is most marked and satisfactory.

A FRESH AIR BROODER.

For a number of years prior to 1910 the Maine Station used in rearing chickens a commercial, hot air, brooder. These brooders never gave entire satisfaction. During the period in which they were used the mortality during the first three weeks in the brooder was too large, and remained so even after all factors other than the brooder had so far as possible been corrected.

After careful consideration of the matter it appeared that there were three fundamental defects in brooders of the type used. These are: (1) In order to get a sufficiently high temterature underneath the hover in the sort of weather which prevails in this locality during the latter part of March and first part of April it is necessary to turn the lamp so high that the floor of the brooder gets much too hot. In other words, if brooders of this type are forced at all there is too much "bottom heat." (2) Brooders of this kind have no provision for taking the lamp fumes and vitiated air out of the building in

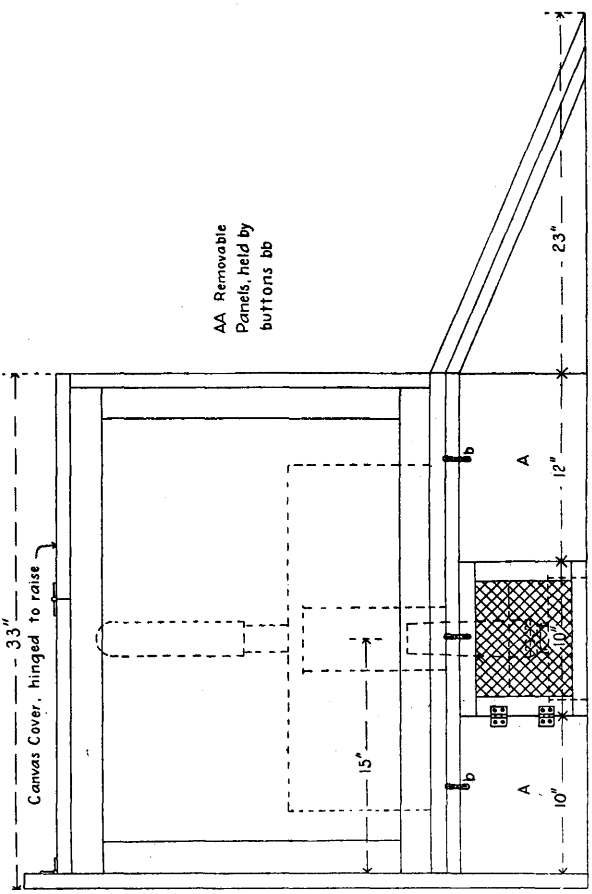


FIG. 3. End elevation of brooder. Note sloping run to floor, hinged cover, removable side panel *AA* on base of brooder. In the center of this is a small door made of 1-4 in. mesh galvanized wire. Through this door the lamp is withdrawn for filling and cleaning. The panel *AA* is removed from the brooder is dismantled, and the whole superstructure is then packed away under the base. See text for further explanation.

which the brooder is operated. This becomes a very serious matter when, as is the case at this Station, two of these brooders are operated in a small colony house, with a floor area of only 6 or 7 feet by 12 feet. In the cold weather of April it is necessary to shut these houses at night in order to maintain anything like the proper temperature underneath the hovers. When the door of such a house with two of these brooders operating in it is opened in the morning the air is plainly very bad. Not only does it contain all the lamp fumes, but it also has a peculiarly dry, burned-out smell. (3) When these brooders are operated in small colony houses, and the same houses are used for growing the chickens on the range throughout the summer, a considerable labor expense and a good deal of wear and tear on the brooders themselves is involved in

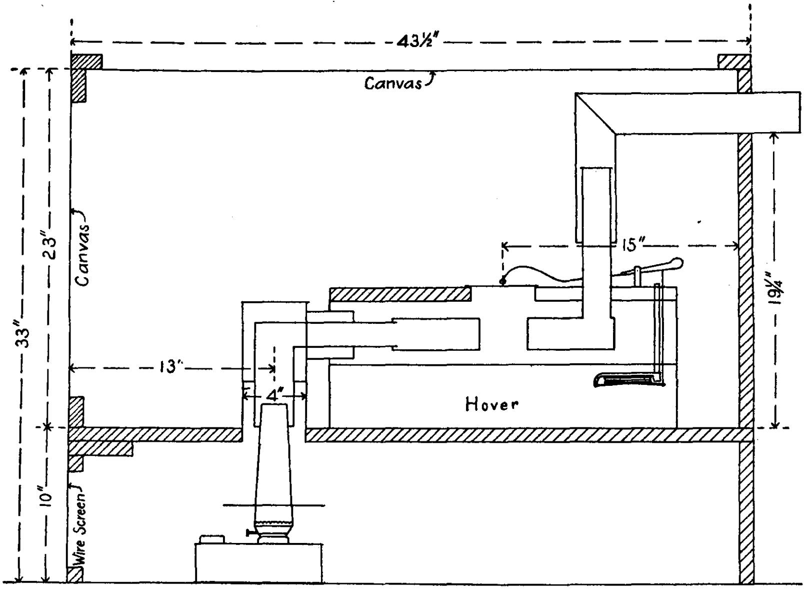


FIG. 4. Section through middle of brooder. Note cloth cover and side, large space between floor of brooder and floor of house, in which the lamp is placed while the brooder is in operation, and which serves as a storage place for the whole upper part of the brooder when the latter is not in use.

moving them about. After the chicks have reached a size when it is no longer necessary for them to have a hover the brooders must be moved out and stored somewhere until the houses are cleaned out in the fall. Then the brooders have to be moved back in again in preparation for the next year's hatching season. All this involves a good deal of labor. Every poultryman knows, or ought to know, that one of the primary factors in determining financial success or failure in the poultry business is the labor cost. Any plan which attains a real saving of labor, without involving any disadvantages in other ways, is to be welcomed. Certainly the operation of brooders which

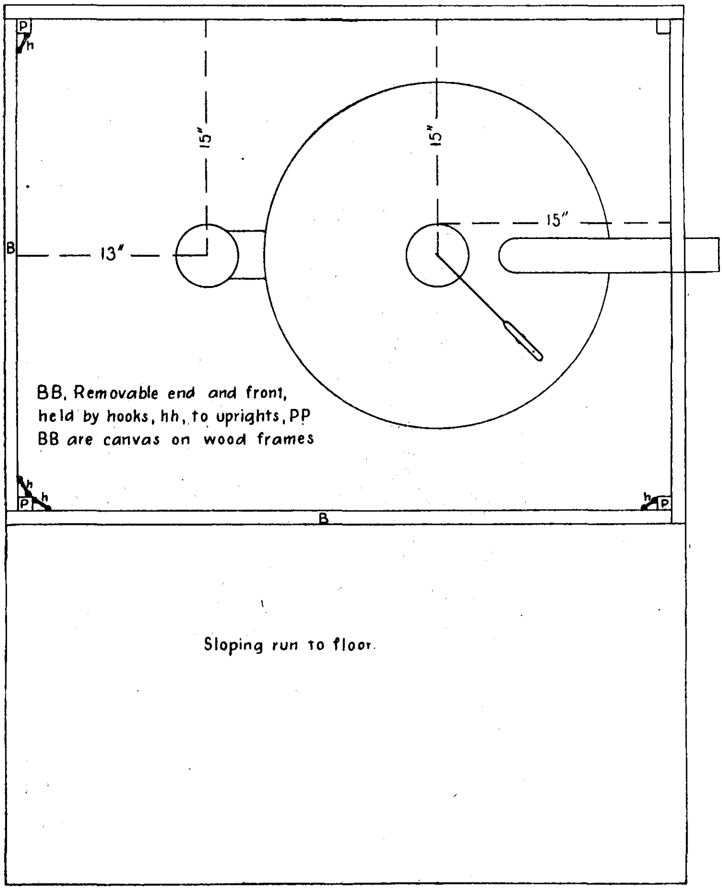


FIG. 5. Floor plan of brooder. For further explanation see text.

have to be handled about so much every season constitutes a labor leak, which on a large plant operating 50 to 100 brooders is considerable in amount.

In view of these considerations it was decided in the hatching season of 1909 to begin some experiments looking toward an improvement in the brooders used for rearing the chickens at this Station. At first some different types of commercial brooders were tested. The results, however, were not satisfactory. Before the hatching season of 1910 it was decided to try on an experimental scale a brooder devised to overcome the objections mentioned above to brooders of the type formerly used. The results obtained were strikingly favorable to

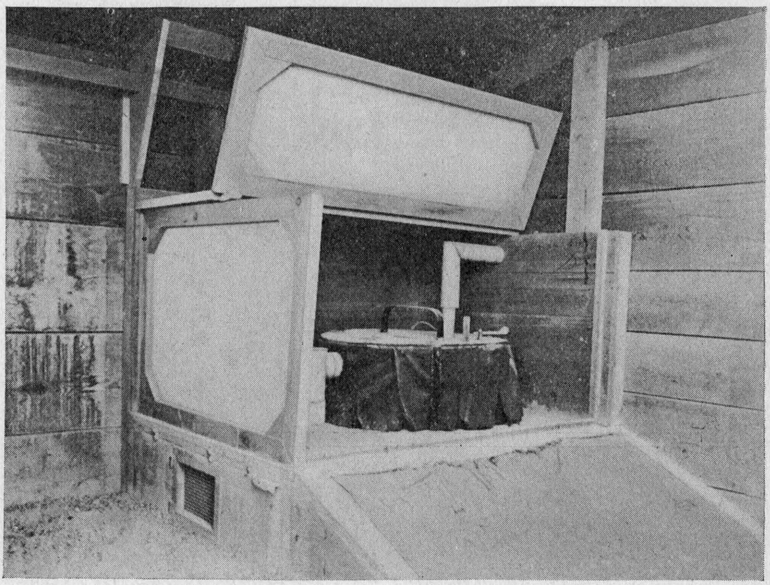


FIG. 6. Showing brooder installed and ready for operation.

the new brooders. In this bulletin is given a detailed description of this brooder, together with working plans so that any poultryman can construct one for his own use if he cares to do so.

The advantages which have been found to accrue from the use of this brooder at the Maine Station fall into two general categories. The first of these is that it is possible to rear in this brooder a larger number of chickens in proportion to the number originally put in than in any other brooder with which the Station has had any experience. That is, the mortality rate of chicks raised in this brooder, is relatively low, particularly as compared with brooders of the old type. Furthermore not only do the chicks live better in this new brooder but also, according to our experience, those which do live grow better and are thriftier than those raised in the other type of brooder. The second advantage lies in the great saving of labor which is effected by the use of the new brooder. The fact that the brooder never has to be taken away from the house where it is operated means a decided economy.

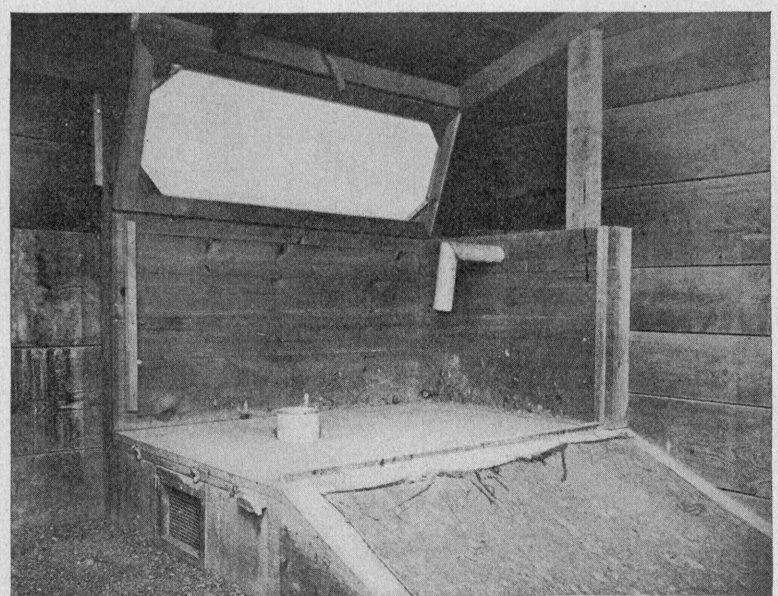


FIG. 7. Showing brooder dismantled and parts stored in base.

CONSTRUCTION OF BROODER.

In planning this brooder the primary point aimed at was to make it a "fresh air" and a "pure air" brooder. With this idea in mind it was thought advisable to make the wall of the brooder in some degree permeable to air. To meet this requirement the walls and cover of the brooder are made of cloth. Essentially the brooder is a cloth box containing a hover, of the type in which the lamp fumes are conducted outside of the building by an exhaust pipe.

These brooders are built as a constituent part of the houses which they occupy. Two brooders are placed in each colony house, one in each of the back corners of the building. In this way one end wall and the back wall of the building form two of the sides of each brooder. The remaining side and cover are made of cloth tacked on light wooden frames as shown in the working drawings.

The floor of the brooder stands 10 inches above the floor of the house. From the front of the brooder a sloping walk extends down to the house floor, reaching in width clear across the whole front of the brooder. The cloth front and side of the brooder are not permanently fixed in position but are removable panels, which are held together and to the frame work by hooks and eyes (see fig. 5). The cover is hinged in the middle in such a way that it can be either half opened or entirely opened and folded back out of the way. In consequence of this arrangement it is possible to regulate with great nicety the amount of air which shall be admitted to the brooder. Either the front or the side panel may be tilted out as much as desired at the base thus admitting air there. Furthermore by partly opening a panel and the cover it is possible to insure that there shall be a circulation of air through the brooder at all times.

The hover used in this brooder is the Universal Hover, made by the Prairie State Incubator Co., Homer City, Pa. It is, however, modified in certain particulars for present use. In the first place the arrangement is such that the lamp is inside the house underneath the brooder rather than in a box outside the house, as in the usual arrangement of this hover. The lamp in this brooder is in the house directly under the hover. The reason for this modification is that in this climate, where one is likely to have bad weather during the early part of the hatching and rearing season, with heavy winds, snow, and rain, it is much easier and more satisfactory to take care of the lamp inside the house than from a small box outside the house. Another modification is that in the hovers which are installed in these brooders an especially heavy insulation is put on top of the drum to reduce the loss of heat by radiation in extremely cold weather early in the spring.

One of the essential points about the brooder is its compactness in storage, and the fact that all the parts may be stored in the base of the brooder itself. In this way the labor expense of carrying back and forth parts from a storage house each year is avoided. To bring about this result the size of the base is so calculated that all the parts of the brooder may be enclosed in it. The way in which this is done is apparent from an examination of fig. 3. It will be seen that the end of the brooder base, (marked *AA* in the diagram) is removable, being held in place by buttons *bb*. When the end of the brooding season is reached and there is no further use for the brooder that year, the side and front end panel of the brooder are removed, the canvas cover folded back and tacked to the wall of the building and the hover dismantled. All of the parts are then shoved under the brooder floor and the panel *AA* put back in place again. The floor of the brooder is removable so that it, and the floor underneath, may be cleaned and disinfected. By removing its legs the hover may be stored in the brooder base along with the other parts, or if one does not desire to do this the hover may be suspended close up to the roof of the building. In that position it will be impossible for the birds to roost on it. Of course, all movable parts should be taken from the hover before it is hung up in this way. These parts may be stored in the brooder base. After the chickens are out of the house in the fall the parts of the brooder are taken out, thoroughly cleaned and disinfected, and then the whole is reassembled and made ready for the hatching season of the next year.

Detailed working drawings of the brooder are given herewith. Fig. 3 shows the end elevation of the brooder; fig. 4 shows a section through the middle of the brooder; fig. 5 shows a floor plan; fig. 6 shows the brooder in operation; and fig. 7 shows its appearance when dismantled and with the parts stored in the base, while the large chickens are using the house. All dimensions are given on these drawings and from them it should be possible for anyone to construct the brooder for himself.

As material any sort of planed lumber may be used. Probably pine will be found satisfactory and economical in most cases. Spruce or hemlock may be used to build the base, if one desires. For the cover and removable sides almost any sort of cloth may be used. Here we have employed the lightest weight canvas (duck) that could be obtained locally. Burlap may be used, or even unbleached cotton cloth in localities where the outside temperature is not too low.

TREATMENT OF YOUNG CHICKS.

In the work of the Maine Station all of the birds are hatched in incubators, and in pedigree wire baskets* since all are pedigreed. They are not disturbed on the 21st day of incubation, but on the morning of the 22nd day the chicks are removed from the baskets and leg-banded. Each chick is then returned to the basket from which it came and put back in the incubator. There they are left until they are from 48 to 72 hours old. The reason for keeping the chicks isolated in this way for so long a time is to prevent their eating each others droppings. It has been shown by Rettger and Stoneburn† that one of the most important chick scourges, bacillary white diarrhea, is (a) transmitted through the egg, and (b) can only infect non-infected birds during the first 48 hours of their life.

After this time the chicks are carried in warm covered baskets to the brooders, and 50 or 60 are put under each hover, where the temperature is between 95° and 100° F. The temperature is not allowed to fall below 95° F. during the first week, or 90° F. during the second week; then it is gradually reduced according to the temperature outside, care being taken not to drive the chicks out by too much heat, or cause them to crowd together under the hover because they are cold. They should flatten out separately when young, and a little later lie with their heads just at the edge of the fringe of the hover. They should never be allowed to huddle outside of the brooder. They huddle because they are cold, and they should be put under the hover to get warm, until they learn to go there of their own accord. Neither should they be allowed to stay under the hover too much, but in the daytime should be forced out into the cooler air where they gain strength. They ought not to be allowed to get more than a foot from the hover during the first two days; then a little farther away each day, and down on the house floor about the fourth or fifth day, if the

* See Bulletin 159, Maine Agricultural Experiment Station.

† Storrs Agr. Expt. Stat. Bulletin 60.

weather is not too cold. They must not get cold enough to huddle or cry, but must come out from under the hover frequently.

The floor of the brooder is cleaned every day and kept well sprinkled with alfalfa meal. So far as we are aware sand may be used for this purpose, but it has never been tried at this Station. The floor of the house is covered with clover leaves or with hay chaff from the feeding floor in the cattle barns.

FEEDS AND FEEDING.

FEEDING YOUNG CHICKENS.

The best method of feeding young chicks is at present a matter of some uncertainty, and it is doubtful if there ever will be general agreement as to the one best method. One condition, however, appears to be imperative, and that is that the young things be not allowed to overeat. A number of different methods of feeding young chickens have been used at the Station in the past. The most useful of these methods follow.

Method 1.—Infertile eggs are boiled for half an hour and then ground in an ordinary meat chopper, shells included, and mixed with about six times their bulk of rolled oats, by rubbing both together. This mixture is the feed for two or three days, until the chicks have learned how to eat. It is fed with chick grit, on the brooder floor, on the short cut clover or chaff.

About the third day the chicks are fed a mixture of hard, fine-broken grains, as soon as they can see to eat in the morning. The mixture now used has the following composition:

	Parts by weight.
Cracked wheat	15
Pinhead oats (granulated oat meal)	10
Fine screened cracked corn	15
Fine cracked peas	3
Broken rice	2
Chick grit	5
Fine charcoal (chick size)	2

It is fed on the litter, care being taken to limit the quantity, so they shall be hungry at 9 o'clock a. m.

Several of the prepared, dry, commercial chick feeds may be substituted for the broken grains. They are satisfactory when made of good, clean, broken grains and seeds, but they contain no secret properties that make them more desirable than the home-mixed broken grains mentioned above. Their use is simply a matter of convenience. When only a few chicks are raised, it is generally more convenient, and probably not more expensive, to buy the prepared feed, but when many are raised it is less expensive to use the home-mixed feeds.

Sharp grit, fine charcoal, and clean water are always before the chicks. At 9 o'clock the rolled oats and egg mixture is fed in tin plates with low rims. After they have had the feed before them five minutes the dishes are removed and they have nothing to lunch on. At 12.30 o'clock the hard-grain mixture is fed again, as in the morning, and at 4.30 or 5 o'clock they are fed all they will eat in half an hour of the rolled oats and egg mixture.

When they are about 3 weeks old the rolled oats and egg mixture is gradually displaced by a mixture having the following composition:

	Parts by weight.
Wheat bran (clean)	2
Corn meal	4
"Daisy flour" (or other low grade flour)	2
Linseed meal	1
Screened beef scrap	2

This mixture is moistened with water just enough so that it is not sticky, but will crumble when a handful is squeezed and then released. The birds are developed far enough by this time so that the tin plates are discarded for light troughs with low sides. Young chicks like the moist mash better than that not moistened, and will eat more of it in a short time. There is no danger from the free use of the properly made mash twice a day, and since it is already ground the young birds can eat and digest more of it than when the feed is all coarse. This is a very important fact, and should be taken advantage of at the time when the young chicks are most susceptible to rapid growth, but the development must be moderate during the first few weeks. The digestive organs must be kept in normal condition by the partial use of hard feed, and the gizzard must not be deprived of its legitimate work and allowed to become weak by disuse.

By the time the chicks are 5 or 6 weeks old the small broken grains are discontinued and the two litter feeds are wholly of screened cracked corn and whole wheat. Only good clean wheat that is not sour or musty should be used.

When young chicks are fed as described, the results have always been satisfactory if the chicks have not been given too much of the scratch feed and if the dishes of ground material have been removed immediately after the meal was completed. The objections to this system of feeding are the extra labor involved in preparing the eggs, mixing the feed with water, and removing the troughs at the proper time.

Method 2.—This is like Method 1, except that fine beef scrap is used instead of boiled eggs and the mash is not moistened.

Early in the morning the chicks are given the hard feed on the floor litter as described in Method 1. At 9 o'clock they are fed a mixture having the following composition:

	Parts by weight.
Rolled oats	2
Wheat bran	2
Corn meal	2
Linseed meal	½
Screened beef scrap	1

This is given in the plates or troughs, and the dishes are removed after ten minutes' use.

At 12.30 the hard grains are fed again, and at 4.30 or 5 the dry-meal mixture is given to them for half an hour or left until their bedtime. The meal being dry, the chicks can not eat it as readily as they can the egg and rolled oats or the moistened mash. For that reason it is left for them to feed upon longer than when moistened with the egg and water, but is never left before them more than ten minutes at the 9-o'clock feeding time. The aim is to give them enough at each of the four meals so that their desire for food may be satisfied at the time, but to make sure that they have nothing left to lunch upon. It is desired to have their crops empty of feed before feeding them again. When treated in this way they will have sharp appetites when the feeder appears, and come racing out from the brooder to meet him. If they have been overfed at the previous meal, and have lunched when they saw fit, they do not care for the feeder's coming. If overfed a few times the creatures become debilitated and worthless.

What has been said so far is with reference to chicks that are hatched out in early spring, at a season of the year when it is impossible under the climatic conditions in Maine for them to get out of doors for work.

Method 3.—This is like Method 2, except that the first mash for the young chicks has the following composition:

	Parts by weight.
Wheat bran	4
Corn meal	3½
Linseed meal	½
Screened beef scrap	2
Alfalfa meal	1

This mixture is scalded and then dry rolled oats are mixed with it in the proportion of 2 parts rolled oats to 6 parts of the mixture. The reason for mixing in this way is that it has been found by experience that if rolled oats are mixed with the other materials of the mash before scalding there is a tendency for the mash to be soggy after it is wet. Mixing in the way here outlined has been found to improve the mash greatly.

This mash and the dry grains are fed as in Method 2 until the chicks are about 3 weeks old. From 3 weeks on to 6 or 8 weeks the composition of the mash is as follows:

	Parts by weight.
Wheat bran	2
Corn meal	3
Linseed meal	½
Daisy flour (or other low-grade flour)	1
Beef scrap	1

Method 4.—When warm weather comes and the later-hatched chicks are able to get out on the ground they find much to amuse them, and they work hard and are able to eat and digest more feed. Under these conditions the dry-meal mixture described in Method 2 is kept constantly before them in troughs, with good results. With two feeds a day of the broken grains in the litter

they have hard feed enough to insure health and they can safely peck away at the dry-meal mixture—a mouthful or two at a time—when they seem to happen to think of it, and thrive. This method has been considerably used in feeding April and May hatched chicks. Many times the results from it have been good. At other times, when the weather was dark and raw out of doors and the little things were held inside, they would hang around the troughs and overeat. They would grow rapidly for a few days, then commence to go lame, eat little, and seek the warm hover never to recover.

Method 5.—This consists in feeding the cracked corn, cracked wheat, pin-head oats, and millet seed in the litter four times a day, and keeping a trough of fine beef scrap within reach all the time. Sometimes commercial chick feeds have been used instead of the cracked corn, wheat, oats, and millet. By this system the losses of birds have been small when the feeding has not been so liberal as to clog the appetite. Much care is necessary in adjusting the quantity of feed to the needs of the birds.

Other methods of feeding young chicks have been tried and the results watched. Method 1 has been used for several years and no other has been found that gives better growth or less losses of birds. The only objection to it is the labor required in preparing the feed. In the work of the Station Method 3 is now preferred and used. The losses of chicks are small by either of the methods. The labor in Method 2 is considerably less than is required in Method 1. Where either Methods 1, 2, or 3 are used the liability of injury to the chicks is much less than when Methods 4 or 5 are followed.

There are no mysteries connected with the raising of the young chickens. Every chick that is well hatched out by the twenty-first day of incubation should live, and will do so as a rule if kept dry, at reasonable temperatures, and not allowed to overeat.

The most careful work of the poultryman during the whole year is required in getting the chicks through the first three weeks of their lives successfully. If they are vigorous up to the fourth week, there is little liability of injuring them thereafter by any system of feeding, if it is only generous enough and they have their liberty.

FEEDING CHICKS ON THE RANGE.

By the middle of June the chickens that were hatched in April are being fed on cracked corn, wheat, and the mash. At about that time the portable houses containing the chickens are drawn from their winter locations out to an open hayfield where the crop has been harvested and the grass is short and green. If not too much worn, the same field may be used a second season for chickens, but this is not recommended. A new, clean piece of turf land should be used each year. At least two acres should be allowed for each 1000 chickens, if the land can be had. It is possible, as has been demonstrated repeatedly, to grow good sound vigorous stock on smaller areas. But to do this is much more difficult and trying work than with larger areas.

When the chickens are moved to the range, the sexes are separated. The methods of feeding the cockerels and pullets differ, and there has been a gradual change in the methods of feeding. Each method has given good results. The changes have been introduced to save labor. After the chickens were moved to the range they were fed in the morning and evening with a moistened mixture of corn meal, middlings, and wheat bran, to which one-tenth as much beef scrap was added. The other two feeds were of wheat and cracked corn.

In 1904 a change was made in the manner of feeding 1,400 female chickens by omitting the moist mash and keeping in separate slatted troughs cracked corn, wheat, beef scrap, cracked bone, oyster shell, and grit where they could help themselves whenever they desired to do so. Grit, bone, oyster shell, and clean water were always supplied. There were no regular hours for feeding, but care was taken that the troughs were never empty.

In 1905 another trough containing a dry mash consisting of 1 part wheat bran, 2 parts corn meal, 1 part middlings, and 1 part beef scrap was used in addition to those containing the grains. The results were satisfactory. The labor of feeding was far less than that required by any other method tried. The birds did not hang around the troughs and overeat, but helped themselves, a little at a time, and ranged off, hunting or playing, and coming back again to the food supply at the troughs when so inclined. There was no rushing or crowding about the attendant, as is usual at feeding time where large numbers are kept together. While the birds liked the beef scrap, they did not overeat of it. During the range season, from June to the close of October, the birds ate just about 1 pound of the scrap to 10 pounds of the cracked corn and wheat. This is practically the proportion eaten when the moist mash was used.

THE FEEDING TROUGH.

The difficulty of keeping the feed clean and dry during continued exposure is nearly overcome by using troughs with

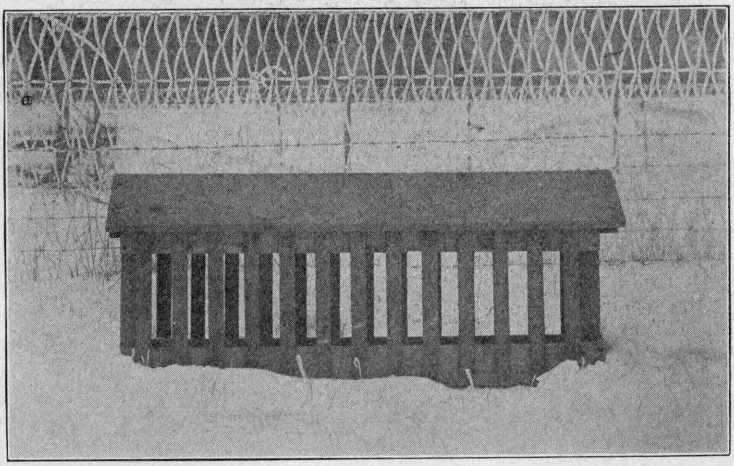


FIG. 8. Chicken feeding trough, accessible from both sides, with cover on.

slatted sides and broad, detachable roofs (figs. 8 and 9). The troughs which were formerly in use at the station were from 6 to 10 feet long, with the sides 5 inches high. The lath slats are 2 inches apart, and the troughs are 16 inches high from floor to roof. The roofs project about 2 inches at the sides and effectually keep out the rain except when high winds prevail.

The roof is very easily removed by lifting one end and sliding it endwise on the opposite gable end on which it rests, as shown in figure 9. The trough can then be filled and the roof drawn back into place without lifting it. This arrangement is economical of feed, keeping it in good condition and avoiding waste. When dry mash is used there may be considerable waste by the finer parts being blown away, and on this account the dry-mash should be put in a sheltered place out of the reach of wind.

AN IMPROVED RANGE FEED TROUGH.

The type of slatted feed trough described above is open to certain objections. It is very difficult to keep the grain dry in it in wet stormy weather. Furthermore, the fact that very small chickens cannot use this type of trough entails additional labor. There must be flat boards with narrow rims for the very young chickens in adition to the range troughs for the older

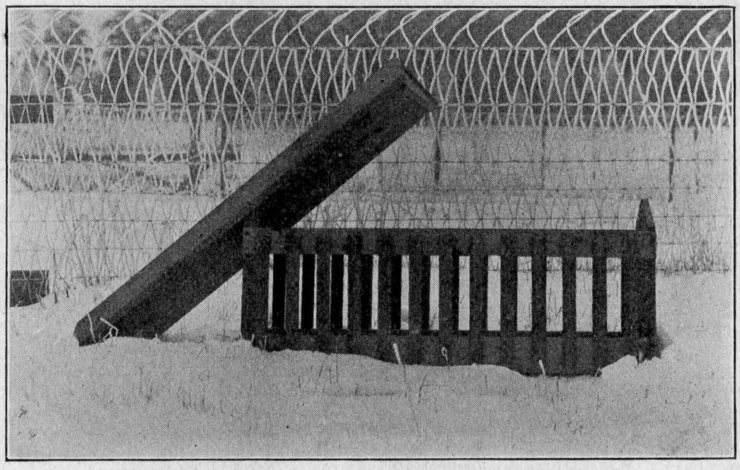


FIG. 9. Chicken feeding trough with cover removed.

chicks. An improved range trough obviates both of these disadvantages and has other points to recommend it. The essential features of this trough are shown in Figs. 10 to 12. The improvements consist, first, in making the slatted front of the trough removable as a whole, leaving then a flat board bottom with a rail in front of it an inch high to hold the grain in place. With the slat front removed the trough duplicates the conditions of the flat chick feeding board, used by many poultry keepers for feeding chicks during the first two or three weeks of life. As the chicks grow older this slatted front can be put on the trough and held in place with the hooks and eyes shown in the photograph.

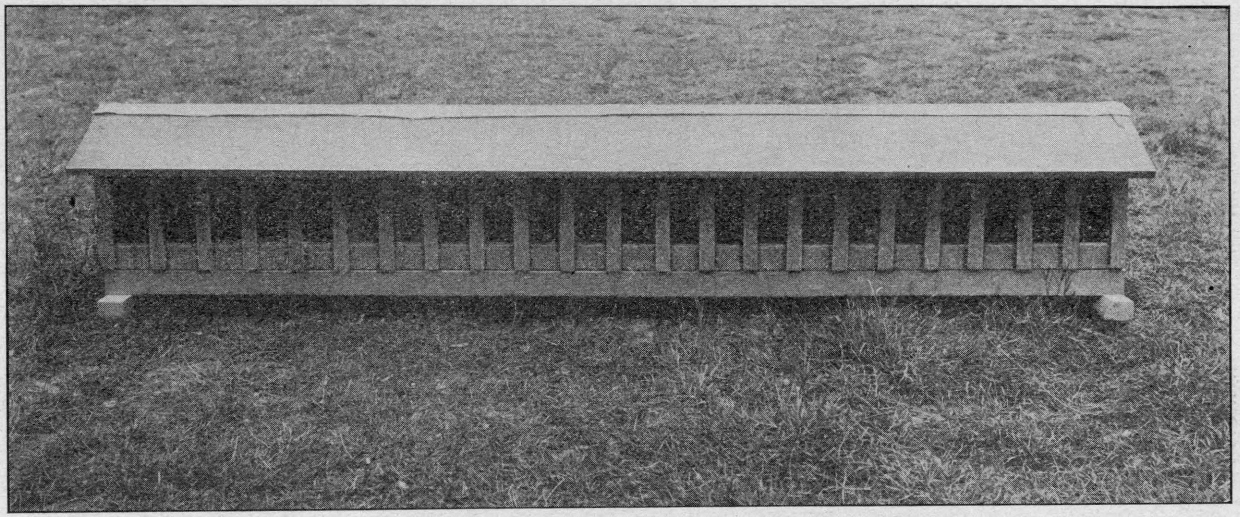


FIG. 10. Front view of feed trough, with slats in place. For large chickens.

A second improvement consists in hinging the top rather than making it in one piece and removing as a whole, as was the case with the older feed troughs at this Station. It will be noted that this feed trough is open to the birds only from one side. The reason for this arrangement is that it is designed to place the feed troughs in holes cut in the longitudinal fences in the range yards, with the back part of the trough and the hinged cover extending into a long walk running the whole length of the range behind the yards. In this way the troughs can be filled from the outside without the necessity of going into the yard, opening gates, etc., thus reducing the labor cost of operation considerably.

Of course it is entirely possible to make troughs in accordance with the principle of this improvement, with removable slatted openings on both sides, to be set down in the middle of the yards so that the birds can get at the feed from both directions.

The dimensions of the troughs as used here are those given in the following table. It is, of course, not essential that these dimensions be absolutely followed in building feed troughs according to this principle, particularly the length dimensions. The dimensions of the boards forming the roof, however, and their angle, are of more or less importance since actual trial has shown that when built as here pictured and described the grain will keep dry in the trough even in driving showers or storms. A strip of canvas keeps the hinged joint of the roof dry.

Dimensions of Improved Feed Trough.

Length	8 ft.	4 inches
Height to peak	1 "	6 "
Width at bottom		3 "
Width at widest point		9½ "
Height of front opening		12½ "
Width of roof boards (front and back same)		11 "

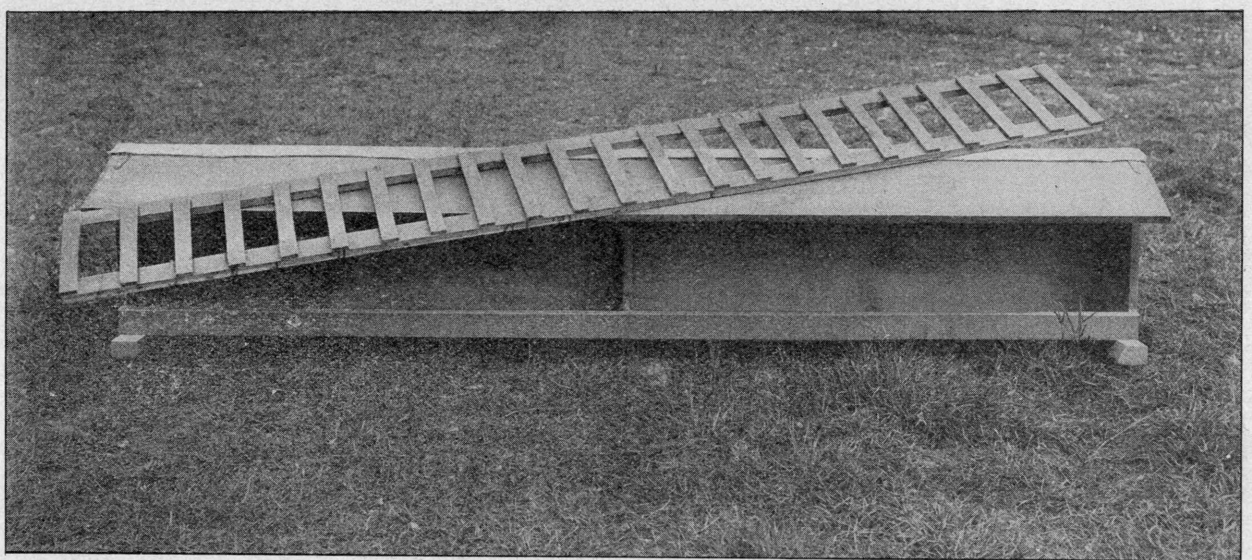


Fig. 11. Front view of feed trough with slats removed and laid across top. This trough is now in condition for the use of very small chicks.

FEEDING THE COCKERELS FOR MARKET.

At the Maine Station many of the cockerels are to be used for breeding purposes, and they are fed in flocks of about 100 on the range in about the same way as the pullets. The dry-feed method is now used for them as satisfactorily as for the pullets.

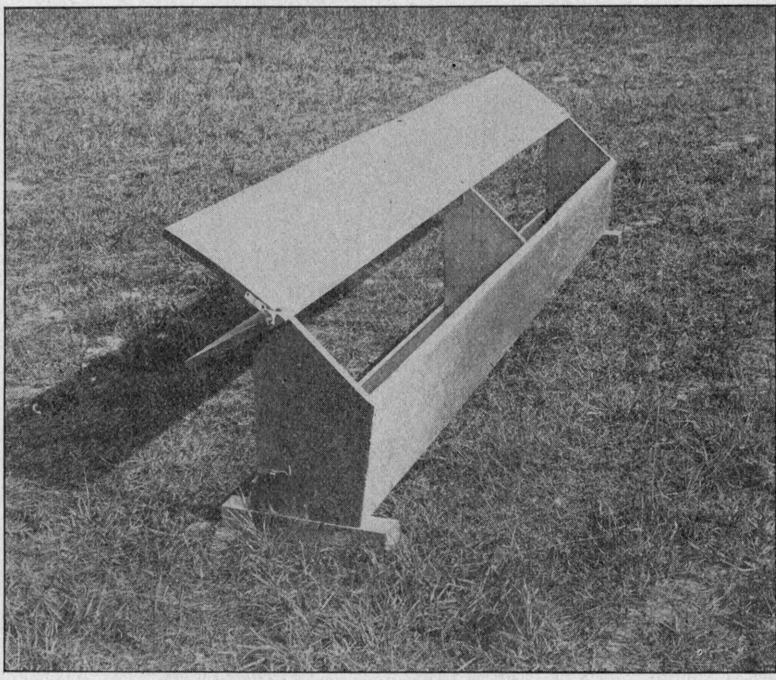


FIG. 12. End and top view of trough with cover open and slatted front removed. Note hook which holds front in place.

A very large proportion of the cockerels raised in New England are sent to the market alive, without being fattened. Quite extended experiments at the Maine Station with many birds in different years indicate very clearly that keeping the cockerels for a few weeks with special feeding will add materially to the selling price. Not infrequently this will make the difference between loss from the low price obtained for slow-selling unfattened birds and the profit from comparatively quick-selling specially fed birds at a much higher price. The higher price is due partly to the increased weight and partly to the superior quality of the well-covered soft-fleshed chickens. As the bulletins containing the results of these feeding experiments with cockerels are out of print, the following brief summary of the results obtained is given:

The number of pounds of grain required to produce 1 pound of gain in fattening cockerels was ascertained in experiments comparing (1) the effect of housing, (2) the effect of age, and (3) the effect of skim milk. The grain mixture used in these series of experiments was the same, consisting of 100 pounds of corn meal, 100 pounds of wheat middlings, and 40 pounds of meat meal. This was fed as a porridge thick enough to drop but not to run from a spoon.

The French and English fatteners who make a specialty of the business, fattening thousands of chickens each year, confine the chickens in small coops. The coops used at the Maine Station gave a floor space of 16 by 23 inches, in each of which 4 chickens were placed. The coops were constructed of laths with closed-end partitions of boards. The floors, sides, and tops were of laths placed three-quarters of an inch apart. By simply moving the pens thus constructed the floors were kept clean. V-shaped troughs with 3-inch sides were placed in front and about 2 inches above the level of the floors of the coops. Cockerels thus fed were compared with others kept in small houses 9 by 11 feet in size, with an attached yard 20 feet square. The yard was entirely free from anything that would serve as green feed. Twenty birds were put in each of these houses. As a result of experiments with fattening 286 birds it was found that on the average 7.9 pounds of grain were required to produce 1 pound of gain in the case of birds fed in the coops, and 5.9 pounds in the case of those fed in the small houses and yards.

An experiment with 150 birds when they were 4 months old showed that they required 4.9 pounds of grain to produce 1 pound of gain, while birds from the same stock, when they were 6 months old, required 7.4 pounds of grain to produce 1 pound of gain.

An experiment with 68 birds showed that when the porridge was wet with skim milk only 4.3 pounds of grain were required to produce 1 pound of gain, against 5.3 pounds when the porridge was wet with water. Eight pounds of skim milk was used with each pound of grain.

These experiments warrant the following conclusions: (1) As great gains are made just as cheaply and more easily when the chickens are put into small houses and yards as when they are fed in small lots in lattice coops just large enough to hold them. (2) Four weeks is about the limit of profitable feeding, both individually and in flocks. (3) Chickens gain faster while young. Birds that are from 150 to 175 days old have uniformly given comparatively small gains. (4) The practice of successful poultrymen selling chickens at the earliest marketable age is well founded. The spring chicken sold at Thanksgiving time is an expensive product.

The experiments clearly indicate that it is profitable to fatten chickens in cheaply constructed sheds or in large coops with small runs for about four weeks and then send them to market dressed. In quality the well-covered, soft-fleshed chickens are so much superior to the same birds not specially prepared that the former will be sought for at a higher price. The dairy farmer is particularly well prepared to carry on this work, as he has the skim milk which these experiments show to be of so great importance in obtaining cheap rapid growth and superior quality of flesh.

FEEDING THE LAYING PULLETS.

The feed of all adult birds, whether pullets or not, consists of two essential parts: (a) the whole or cracked grains scattered in the litter, and (b) the mixture of dry ground grains which has come to be generally known as a dry mash. These two component parts of the ration and the methods of feeding them will be considered separately. In addition to the grains and dry mash, oyster shell, dry cracked bone, grit, and charcoal are kept in slatted troughs, and are accessible at all times. Plenty of clean water is furnished. About 5 pounds of clover hay cut into 1-2-inch lengths is fed daily to each 100 birds in the breeding pens during the breeding season. When the wheat, oats, and cracked corn are given, the birds are always ready and anxious for them, and they scratch in the litter for the very last kernel before going to the trough where an abundance of feed is in store.

It is very evident that the hens like the broken and whole grains better than the mixture of the fine, dry materials; yet they by no means dislike the latter, for they help themselves to it, a mouthful or two at a time, whenever they seem to need it, and never go to bed with empty crops, so far as noted. They apparently do not like it well enough to gorge themselves with it, and sit down, loaf, get overfat, and lay soft-shelled eggs, as is so commonly the case with Plymouth Rocks when they are given warm morning mashes in troughs.

Some of the advantages of this method of feeding are that the mash is put in the hoppers at any convenient time, only guarding against an exhaustion of the supply, and the entire avoidance of the mobbing that always occurs at trough feeding when that is made a meal of the day, whether it be at morning or evening. There are no tailings to be gathered up or wasted, as is common when a full meal of mash is given at night. The labor is very much less, enabling a person to care for more birds than when the regular evening meal is given.

Taking first the dry grains, the following may be said in regard to the method in which they are fed: Early in the morning for each 100 hens 4 quarts of whole or cracked corn is scattered on the litter, which is 6 to 8 inches deep on the floor. This is not mixed into the litter, for the straw is dry and light, and enough of the grain is hidden so the birds commence scratching for it almost immediately. At 10 o'clock they are fed in the same way 2 quarts of wheat and 2 quarts of oats. This is all of the regular feeding that is done.

When corn is used freely and made a prominent factor in the ration it has been thought best to have the kernels broken, so that in hunting and scratching for the small pieces the birds might get the exercise needed to keep themselves in health and vigor. It was reasoned that even a small quantity of whole corn could be readily seen and picked up from the straw litter with little exertion, and that the vices of luxury and idleness would follow. In order to test this view an experiment was carried out at the Station in the winter of 1906-7 in which whole corn was substituted for cracked corn in the ration of 500 laying pullets. A control lot of 500 received cracked corn. All other conditions affecting the two lots were kept as nearly identical as possible. The result of the experiment was that there was no appreciable difference in regard to either egg production, health, or general well-being between the two flocks of birds.

The litter which the Station now uses for its houses in preference to all others which have been tried, consists of a mixture of dry pine shavings and straw. The shavings can be obtained in this part of the country from box mills in bales, which are sold at a price of from 5 to 10 cents per bale. These shavings are spread on the floor of the pen to a depth of some 5 to 7 inches. From 6 to 8 bales will cover the floor of a pen which accommodates from 100 to 125 birds. On top of these shavings is spread a thin layer of straw. Straw which has not been baled is preferred because it is less liable to be broken and will consequently wear longer in the pen. This combination of straw and shavings gives excellent satisfaction as a litter. The straw serves the purpose of protecting the shavings so that they last a longer time than would otherwise be the case before they are finally worked up into a mass of fine material which packs down and becomes damp. The shavings became damp much less quickly than does a litter of straw alone. This is because they are finer, and the birds can keep them worked over much more thoroughly. This constantly exposes and dries out new portions of the mass of litter. Using this combination of shavings and straw it is not usually found necessary to change the litter in the pens oftener than once in three months.

It is in regard to the dry mash portion of the ration in which the changes already referred to have been made. The dry mash which was *formerly used* at the Station had the following composition:

	Pounds.
Wheat bran	200
Corn meal	100
Daisy flour (or other low-grade flour)	100
Gluten meal or brewers' grains	100
Linseed meal	100
Beef scrap	100

The experience of the Station with this mash extending as it has over a number of years has indicated that it was somewhat too rich. The relatively large amount of such concentrated feeds as linseed meal and gluten meal seemed to make too rich a ration for the well-being of the fowls. During the years when this mash was fed more or less difficulty was always experienced with liver troubles in the birds. Birds died with all the symptoms that would be expected to come from indigestion arising from feeding too rich food.

In planning the new dry mash ration consideration was given to the physiological conditions under which the birds developed and under which they were placed in the laying houses. It is evident that the bringing of the birds in from the range upon which they have grown from little chickens, into the laying houses, is apt to be a very violent and abrupt transition. It has seemed in studying the birds in the fall of the year that this change was an important time in the life of the bird, and that the results during the subsequent winter with reference to egg production depended much upon the way the transition from range conditions to the laying house was made. It seemed advisable both on general grounds and from observation of the birds themselves to make this change as gradual as possible. With this idea in mind the pullets have been brought into the houses from the range much earlier during the past few years than was the custom before. It is the custom at the present time to bring in the pullets from the range as soon as possible after the first of September.

When the pullets are brought in as early as this it is not, of course, advisable to shut them up entirely in the houses at once. On the contrary, the work is planned in such a way that there is always a freshly seeded yard full of green grass for the birds to run in after they are brought into the house until cold weather sets in in the fall. In other words, the birds are brought from free range into a condition of restricted range, but with better pasturage on the restricted than on free range. The yards are freshly seeded and have not been trampled down or burned and dried out by the sun, as is the grass on the open range from which the birds are taken. In this way the attempt is made to have the transition from open range conditions to house conditions as gradual as possible. After about two months, or occasionally even a little longer of restricted range, the birds are finally shut up in the curtain front house for the winter season.

Further in accordance with this idea of gradual change it is thought wise not to put the pullets which are brought in from the free range conditions abruptly on to the heavy, forced-laying mash which it seems to be necessary for them to have during the winter months if they are to do their best in the way of egg production. It has been said that a hen will not lay her best unless she is on full feeding. This is quite true, but it is probably equally true that a great deal of harm can be done to a pullet in regard to her future egg production by abruptly bringing her from free range conditions into restricted yards or to entire confinement in the house and putting her on a heavy, rich laying mash like the one which was formerly fed at this Station. On the contrary, it seems reasonable to bring the birds more gradually on to this rich ration. It is in accordance with this idea that the dry mash feed which is now used at the Station has been planned. The formulas and method of feeding this new dry mash are given below. It will be noted that the mash is made richer in successive months. These formulas are planned on the assumption that the pullets will be brought into the winter laying quarters sometime during the month of September.

Composition of Dry Mash Fed to Laying Pullets.

First month in laying house (September):—

Bran	300 lbs.
Corn meal	100 lbs.
Daisy flour (or other low-grade flour)	100 lbs.
Meat scrap	100 lbs.

Second month in laying house (October):—

Bran	200 lbs.
Corn meal	100 lbs.
Daisy flour, or other low-grade flour	100 lbs.
Gluten meal	100 lbs.
Meat scrap	100 lbs.

Third month in the laying house (November):—

The mash has the same composition as that of the second month given above *with the addition of 50 pounds of linseed meal.*

Fourth month in the laying house:—

The mash has the same composition as that of the second month given above.

Fifth month in the laying house:—

The mash has the same composition as that of the third month as given above.

From this time on 50 pounds of linseed meal are put into the mash as given for the second month above every alternate month. That is to say, one month linseed meal is fed and the next month it is not.

This dry mash made as described above is kept before the birds all the time in open hoppers of the type described farther on.

The advantages which it is believed have resulted from this method of feeding the laying pullets are two fold: first, in the good effect on the vitality of the birds, and, second, in its effect on the evenness of egg production during the winter months. It is a fact well known to poultrymen that if pullets are too rapidly forced for egg production in the early fall there is a marked tendency for them to moult during the winter at just the time when they should be doing their best work in egg production. Since adopting the method of feeding the pullets described above, not only have the birds been much freer of digestive troubles and diseases involving the liver, but also there has been no moulting in the early winter after a short spurt of egg production in the fall months. On the contrary the egg production on this plan begins in September and October and gradually and steadily increases through the winter months. During the past two years while this method of feeding has been used, there has been hardly a pullet in winter moult, whereas on the old system of feeding such birds were common every year.

FEEDING THE HENS, COCKERELS AND COCKS KEPT OVER THE WINTER FOR BREEDING PURPOSES.

Observations made in connection with the work of this Station, as well as a study of the literature which exists upon the subject, have led to the opinion that in order to get the best results in respect to the fertility and hatching quality of eggs it is not desirable to feed birds which are to be used as breeders the heavy laying ration which is used to force egg production during the winter months in pullets. The feeding of such rich food has a tendency, it is believed, to reduce or impair the fertility and hatching quality of the eggs. Therefore, a plan of feeding birds kept to be used as breeders has been devised with the idea of getting over this difficulty so far as possible. This method of feeding is used for old hens, cockerels and cock birds which are kept from one season to another for breeding. The aim is to keep these birds on as light a ration as is consistent with the maintenance of good condition until just before the beginning of the breeding season when they are to be used and then to put them on a more stimulating and richer ration. The scratch food given to this breeding stock is the same as that given to the pullets, namely, corn for the first morning feed and a mixture of wheat and oats for the second feed of the day, both scattered in the litter. If, however, there is any tendency for the yearling hens kept as breeders to get unduly fat during the winter corn is not fed as a litter grain. The hens, under such circumstances, are simply given the mixture of wheat and oats at both feedings.

The dry mash used for these birds kept as breeders has the following composition:—

Bran	400 lbs.
Corn meal	50 lbs.
Daisy flour, or other low-grade flour	50 lbs.
Meat scrap	100 lbs.

Birds kept over from one season to another are managed in the following way. The birds completing their pullet year which are to be kept as breeders are continued on the usual pullet ration until after they have finished their moult in the early fall, usually in September or early October with the birds here. Immediately after the moult is over and the hens are well feathered out they are put on the dry mash ration given above. They are fed in the way described until the beginning of their second breeding season. At this Station the breeding pens are usually mated up about the first of February. During the breeding season all birds, both hens and pullets are fed the following mash:

Wheat bran	200 lbs.
Corn meal	100 lbs.
Daisy flour	100 lbs.
Meat scrap	50 lbs.
Dry bone meal	50 lbs.

The experience of the Station indicates that by reducing animal food to a minimum it is possible to improve markedly the hatching qualities of the eggs. Besides the dry mash the breeders are fed wheat, corn and oats in the same way as the laying pullets. Further they are given an abundance of green food, always including green sprouted oats.

GREEN FOOD FOR POULTRY.

During recent years an increasing amount of attention has been paid by poultrymen everywhere to the furnishing of green food to their fowls during the winter months, when it is impossible, in northern parts of the country, at least, for the birds to get fresh succulent pasturage out of doors. General experience seems to teach that an addition of green succulent food to the ration of laying hens tends to keep them in better physical condition and helps towards a better egg production. On the poultry plant of the Maine Station considerable attention has been given to this matter of supplying green and succulent food and as a result of experience extending now over a number of years, a satisfactory scheme of furnishing this necessary part of the ration under our conditions has been worked out.

To be satisfactory not only must the green food given to poultry be of the proper kind to give good results in egg production, but also it must be something which can be produced and handled at small cost Furthermore a factor which is frequently lost sight of is that fowls need something besides succulence in their so-called "green" food. There is a distinction between a succulent fodder and a "green food" in the strict sense. One can supply succulence in the form of root crops such as mangolds. A careful consideration of the case, however, indicates that apparently the fundamental need of the fowls is not for succulence as such, but rather for the tonic effect which is produced by green plants, probably primarily because of the presence of chlorophyll. In feeding fowls for high egg production it is necessary that they be given a ration rich in protein. Only fowls of strong constitution, and with thoroughly sound digestive systems, can handle the heavy laying rations carrying meat scrap and other protein concentrates, which are now so widely used by poultrymen for egg production with successful results. On these heavy rations there is always a tendency for the birds' livers to become impaired in function, and ultimately to become enlarged and diseased. As the matter has been studied here it would appear that one of the chief functions of green food in the ration is to counteract this tendency of the digestive system, and especially the liver, to break down under the strain of handling heavy laying rations over a long period of time. It would appear that the green food given to poultry acts primarily rather as a mild tonic than as a food in the proper sense There seems to be very little of this tonic effect produced from succulent non-green foods like mangolds.

The practical problem then becomes to devise a system which shall insure a supply of green food for the birds at all seasons of the year. The following system of rotation in the green food supply has been in use for several years on the poultry plant here with satisfactory results. It should be said that, owing to the small area of ground available for the poultry work at the Station in relation to the number of birds it is necessary to carry, green food must be added to the ration practically throughout the year, not only for the adult fowls in the laying houses, but also for the chicks growing on the range.

Beginning in the early fall when the pullets are put in the laying house they are given green corn fodder cut fine in a fodder cutter. Stalks, leaves and ears are cut together in pieces averaging about 1-2 inch in length. The birds eat this chopped corn fodder greedily. It is one of the best green foods for poultry that we have yet been able to find. Its usefulness is limited only by the season within which it is possible to get it. The feeding of corn fodder is continued until the frost kills the plants.

When the corn can no longer be used cabbage is fed. The supply of this usually lasts through December. In the event of the supply of cabbage failing before it is desirable to start the oat sprouter* the interval is filled out by the use of mangolds. From about January 15 to May 15 green sprouted oats from the source of green food. From about May 15 until the corn has grown enough to cut, fresh clover from the range is used. During the summer the growing chicks on the range are given rape (Dwarf Essex) and green corn fodder cut as described above, to supplement the grass of the range, which rather rapidly dries out and becomes worthless as a source of green food under our conditions. The very young chicks in the brooders are given the tops only of green sprouted oats chopped up fine.

Dwarf Essex rape is an excellent source of green food for poultry but it must be fed with great caution to birds which are laying because if eaten in any considerable amounts it will color the yolks of the eggs green with disastrous results in the market.

THE PREPARATION OF GREEN SPROUTED OATS.

Green sprouted oats have been very widely exploited in recent years as a green food for poultry. There are some so-called "poultry" systems on the market which really consist of

*For description of the method of sprouting oats used at the Station see below.

very little else than the use of this food. The first experiments with this material at the Maine Agricultural Experiment Station were not satisfactory. It was found difficult to get the oats to make a sufficiently quick growth. Experience here has indicated that in order to make a satisfactory green food the oats must be grown very quickly. In order to get quick growth it is necessary to have three things:—first, warmth; second, plenty of moisture; and third, sunlight. After a number of experiments to get the right combination of these three factors the plan to be described was finally worked out and has proved very satisfactory.

There is in connection with the poultry plant a hot water heating system which has a 3-inch out-go pipe. This out-go pipe as it leaves the heater passes along the rear wall of a small room which was formerly used as a grain storage room. To provide a place in which to sprout oats the back part of this room was partitioned off as a closet inclosing the 3-inch hot water pipe. The partition wall which forms the front of this closet consists of glass doors, made from regular storm window sash, hinged so as to swing open as an ordinary door does. These glass doors face towards the south side of the building which has a window directly in front of the doors. Throughout the day the closet gets plenty of light. The dimensions of this sprouting closet are as follows:—

Length	9 ft. 3 inches
Depth	2 ft. 6 inches
Height	6 ft.

The place of shelves in this closet is taken by large, square green-house flats made of 7-8-inch stuff. These flats have the following dimensions:—

Length	2 ft. 5 inches	(inside)
Breadth	2 ft. 5 inches	(inside)
Depth	2 inches	(inside)

The length of the closet is such as just to accommodate three tiers of these flats, which slide on supports so that they can be moved in or out or turned around to suit the convenience of the operator, and the needs of the sprouting grain. These flats set

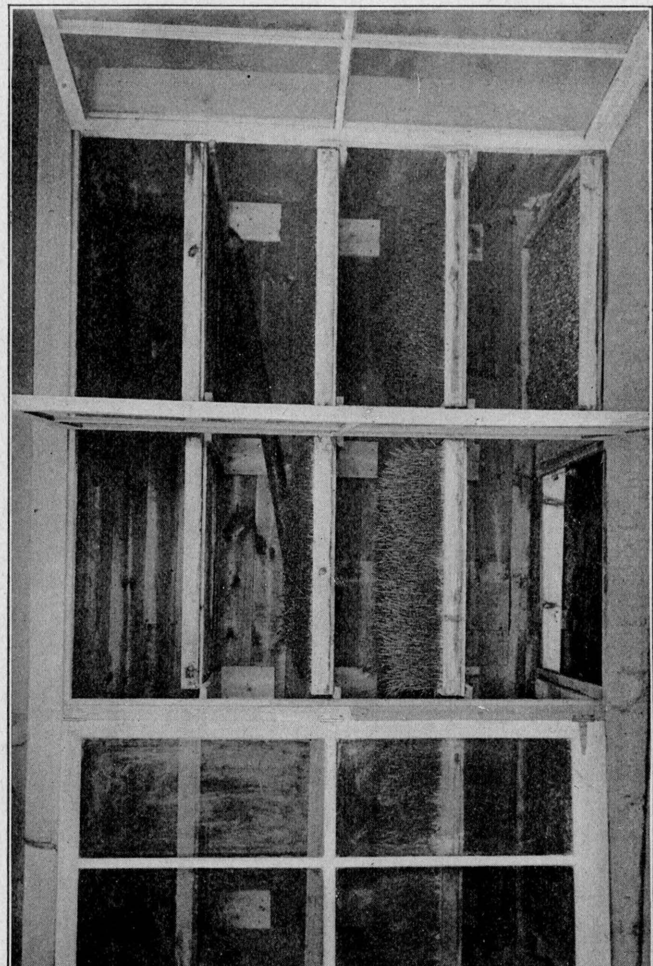
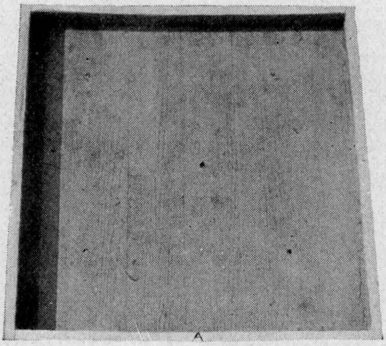
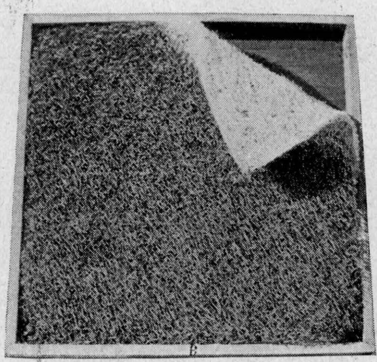


FIG. 13. Green Food Grower.

15 inches apart (i. e., vertically). There can be accommodated four rows of flats, three in a row, in the closet at one time. A number of holes are bored in the bottom of each one of the flats in order to drain off the surface moisture which comes with the wetting of the oats.



A



B

FIG. 14. A, empty flat. B, started to sprout.

The arrangement of the sprouting closet and the flats is shown in Figs. 13 and 14.

The advantage of the closet arrangement described is that it enables one to control the three necessary factors of heat, moisture and light, quite completely. In this closet it is easily possible to maintain a temperature which does not run at any time below 70 degrees. The closet being perfectly tight it is possible to saturate the air with moisture quite easily and virtually convert the whole space into a great moist chamber. With this arrangement one is able to grow oats from 4 to 6 inches high in one week's time. The only difficulty with which one has to contend is the matter of mould. There is always a tendency for the oats to mould in the sprouting process. The only way in which it has been found possible to control this mould is by thoroughly cleaning the flats after each time when they are used. After a flat has been emptied it is thoroughly scrubbed with a 50 per cent. solution of formalin (that is, equal parts of commercial formalin and water). Enough formalin is used to soak the flat well. With this precaution, and if the oats are further made to grow rapidly, the mould does not give any trouble whatever.

The actual method of sprouting the oats is as follows: Clean and sound oats are soaked in water over night in a pail. The next morning flats are filled to the depth of about two inches, and put into the sprouting closet. At the beginning freshly filled flats are placed near the top of the closet so as to get the maximum amount of heat, and in that way get the sprouts started at once. During the first few days, until the sprouts have become from a half to three-quarters of an inch long, the oats are thoroughly stirred and raked over at least two or three times during the day. This stirring insures an even distribution of moisture throughout the mass of oats in the flat. After the sprouts become sufficiently long so that the oats form a matted mass it is not desirable to stir them, or to disturb them in any way. Stirring at that time will break off and injure the sprouts and the green portion above the mass will not grow so well. The matter of prime importance in growing the oats successfully has been found to be sufficient moisture. The tendency at first is to use too little moisture. The oats should be kept quite wet. The aim here is to keep condensed moisture standing on the glass doors which form the front of the closet at all times. In order to do this it is found necessary to wet the oats three times a day. This is done with an ordinary greenhouse sprinkling can, with very little expenditure of time or labor. As the oats grow the flats are moved to different positions in the closet. The taller the green material gets the nearer the flats are moved towards the floor, because the growing grain then needs less heat. This procedure leaves the desirable places in the closet for the grain just beginning to sprout where high temperature is needed.

The oats are fed when they are from 4 to 6 inches in height. They are fed at the rate of a piece of the matted oats and attached green stalks about 6 to 8 inches square for each 100 birds per day. In feeding, this 6 to 8-inch square piece is broken into smaller pieces and scattered over the pen, so to ensure that all the birds shall have an opportunity to get some. Fed at the rate indicated, this material has never caused any bowel trouble among the birds.

It should be clearly understood that the purpose for which green sprouted oats are fed is their tonic and stimulative influence on the digestive organs. They are not fed for the food value of the oats themselves. If one wishes merely to feed oats they can be most economically fed not sprouted. The point of sprouting is to furnish fresh, succulent, *green* food during the winter months.

Housing The Hens.

When work in poultry management was first undertaken at the University of Maine, the hens were kept in small colonies in accord with what was at that time believed to be the best practice. Houses 10 feet square were erected with the idea of accommodating about 15 birds each. Although the houses were well warmed they were apt to be damp and lined with white frost in very cold weather, when the windows had to be kept shut to protect the birds from cold at night. Another disadvantage of this kind of house is its small size. A person can not care for hens in such small pens without getting them into a condition of unrest for fear of being cornered in such a small room. The question of extra labor in caring for hens in these small colonies scattered over quite a large area is an important factor in a commercial plant. When the Maine Station began experiments in 1897 a warmed house 150 feet long by 16 feet wide was erected. This house was burned the next spring, but was replaced by another of the same kind. This warmed house, while constructed after the most approved model of the time, was never a satisfactory house for laying hens. For some years it was used only for the keeping of surplus stock and for carrying cockerels over the winter. Finally it was abandoned entirely in favor of curtain-front houses to be described below.

THE ROOSTING-CLOSET HOUSE.

Fourteen years ago one of the 10-foot square houses described above was taken for a nucleus and an addition made, so that the reconstructed house was 10 feet wide and 25 feet long. The inside end of the old house was taken out, so that there is one room with a floor space of 250 square feet. The walls are about 5 1-2 feet high in the clear inside of the building. The whole of the front wall is not filled in, but a space 3 feet wide and 15 feet long is left just under the plate. This space had a frame covered with white drilling, hinged at the top on the inside, so that it could be let down and buttoned during driving storms and winter nights, but hung up out of the way at all other times. The cloth of the outer curtain was oiled with hot linseed oil. The roost platform extended the whole length of the back of the room. It was 3 feet 4 inches wide and 3 feet above the floor. The back wall and up the roof for 4 feet was lined and the space filled and packed hard with fine hay. The packing also extended part way across the ends of the room. Two roosts were used, but they did not take the whole length of the platform, a space of 4 feet at one end being reserved for a crate where broody hens could be confined until the desire for sitting was overcome. The space, from the front edge of the platform up to the roof was covered by frame curtains of drilling, similar to the one on the front wall, except that it was not oiled. They were hinged at the top edge and kept turned out of the way during the daytime, but from the commencement of cold weather until spring they were closed down every night after the hens went to roost. The hens were shut in this close roosting closet and kept there during the night, and were released as early in the morning as they could see to scratch for grain which was sprinkled in the 8-inch deep straw on the floor.

This building was used through five winters with 50 hens in it. The birds laid as well as the others in the large warmed house; their combs were red and their plumage bright, and they gave every evidence of perfect health and vigor. While they were on the roosts they were warm. They came down to their breakfasts and spent the day in the open air. Such treatment gives vigor and snap to the human being, and it seems to work equally well with the hen.

This house was given the name of the "pioneer" house.

THE ABANDONMENT OF THE ROOSTING CLOSET.

When the curtain-front house was first devised it was thought essential to provide such a roosting closet as described above to conserve the body heat of the birds during the cold nights when the temperature might go well below zero. Experience has shown, however, that this was a mistake. Actual test shows that the roosting closet is of no advantage, even in such a severe climate as that of Orono. On the contrary the birds certainly thrive better without the roost curtain than with it. It has been a general observation among users of the curtain front type of house that when the roost curtains are used the birds are particularly susceptible to colds. It is not hard to understand why this should be so. The air in a roosting closet when it is opened in the morning is plainly bad. The fact that it is warm in no way offsets physiologically the evils of its lack of oxygen and excess of carbon dioxide, ammoniacal vapors and other exhalations from the bodies of the birds.

For some time past it has been felt that the roosting closet was at least unnecessary, if not in fact a positive evil. Consequently the time of beginning to close the roost curtain in the fall has been each year longer delayed. Finally in the fall of 1910 it was decided not to use these curtains at all during the winter. Consequently they were taken out of the houses, or spiked to the roof as the case might be. The winter of 1910-11 was a severe one. On several occasions the temperature dropped to 30 degrees below zero. Yet during this winter the mortality was exceptionally low and the egg production exceptionally high. The roost curtain will not again be used at this Station.

CURTAIN-FRONT HOUSES.

The result of the use of the "pioneer" house indicated that this was essentially a correct system of treating and housing hens, and it was decided to build several houses on the same plan and join them together under one roof as one house.

A curtain-front house 12 feet wide by 150 feet long, known as house No. 2, was erected in 1903. The back wall is 5 feet 6 inches high from floor to top of plate inside, and the front wall is 6 feet 8 inches high. The roof is of unequal span, the ridge being 4 feet in from the front wall; and the height of the ridge above the floor is 9 feet. The sills are 4 by 6 inches in size and rest on a rough stone wall laid on the surface of the ground. A central sill gives support to the floor. The floor timbers are 2 by 8 inches in size and are placed 2 feet apart; the floor is of two thicknesses of hemlock boards. All the rest of the frame is of 2 by 4 inch stuff. The building is boarded, papered, and shingled on roof and walls. The rear wall and 4 feet of the lower part of the rear roof are ceiled on the inside of the studding and plates, and the space between inner and outer walls is packed very hard with dry sawdust. In order to make the sawdust packing continuous between the wall and roof, the wall ceiling is carried up to within 6 inches of the plate; then follows up inclining pieces of studding to the rafters, the short pieces of studding being nailed to the studs and rafters. By this arrangement there are no slack places around the plate to admit cold air. The end walls are packed in the same way. The house is divided by close-board partitions into seven 20-foot sections;* one 10-foot section is reserved at the lower end for a feed-storage room.

Each of the 20-foot sections has two 12-light outside windows screwed to the front, and the space between the windows (which is 8 feet long) for a distance of 3 feet down from the plate is covered during rough winter storms and cold nights by a light frame covered with 10-ounce duck, oiled and closely tacked on. This door, or curtain, is hinged at the top and swings in and up to the roof when open.

*The house is now used as a breeding house, and temporary partitions divide each of the 20-foot pens into two 10-foot pens.

In the front of each section is a door 2 feet 6 inches wide. The roost platform is at the back of each room and extends the whole 20 feet. The platform is 3 feet 6 inches wide and 3 feet above the floor. The roosts are of 2 by 3 inch stuff placed on edge and are 10 inches above the platform. The back one is 11 inches out from the wall, and the space between the two roosts is 16 inches, leaving 15 inches between the front roost and the front of the platform.

Six trap nests are placed at each end of each room. They are put near the front so that the light may be good for reading and recording the numbers on the leg bands of the birds. Several shelves are put on the walls 18 inches above the floor for shell, grit, bone, etc. The doors which open from one room to another throughout the building are frames covered with 10-ounce duck, so as to make them light, and are hung with double-action spring hinges. The advantages of having all doors push from the person passing through are very great; otherwise they would hinder the passage of the attendant with his baskets and pails. Strips of old rubber belting are nailed around the studs which the doors rub against as they swing to, so as just to catch and hold them from being opened by the wind. Tight board partitions are used between the pens instead of wire, so as to prevent drafts. An outside platform 4 feet wide extends along the entire front of the building.

This house accommodates 350 hens—50 in each 20-foot section—is well made of good material, and should prove to be durable. A rougher building, with plain instead of trap nests, and with the roof and walls covered with some of the prepared materials instead of shingles, could be built for less money, and would probably furnish as comfortable quarters for the birds.

Curtain front house No. 3 was constructed in 1904. It is 16 ft. wide by 120 ft. long and is of the same style as No. 2 except that it is wider. There are four pens in the building, each 16 ft. wide by 30 ft. long. The pens are arranged to hold from 125 to 150 hens each, depending on the exigences of the experimental work. One hundred and fifty birds per pen do very well in these pens. Unless there is special reason for it, it is usually preferred to put but 125 birds in each pen. The interior of one pen in this house is shown in Fig. 16.

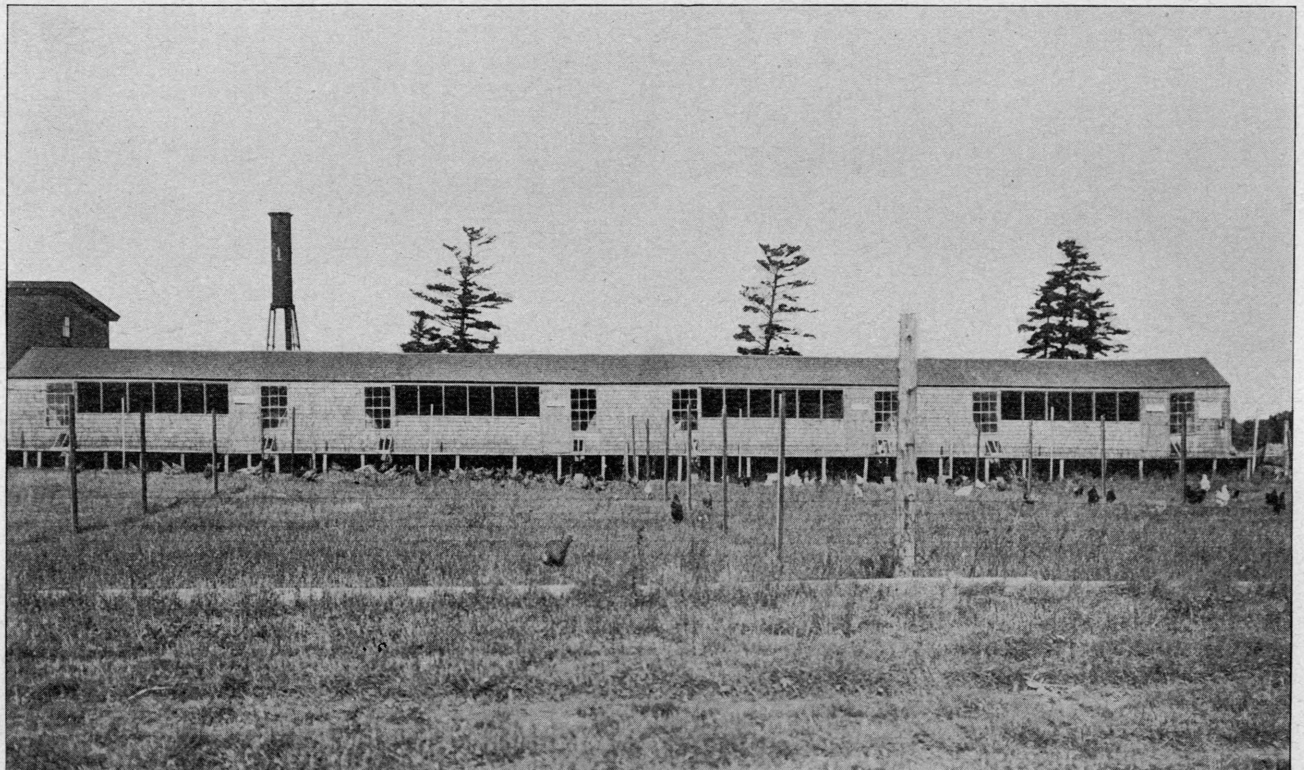


FIG. 15. Curtain-front poultry house No. 3.

The economy in cost of the wider house over the narrower one like No. 2 described above, when space is considered, is evident. The front and back walls in the narrower house cost about as much per linear foot as those in the wide house and the greatly increased floor space is increased by building in a strip of floor and roof running lengthwise of the building. The walls, doors, and windows remain the same as in the narrow house, except that the front wall is made a little higher. Three six inch square sills run lengthwise of the house. The outer ones rest on rough stone walls high enough from the ground for dogs to go under the building to look after rats and skunks that may be inclined to make their homes there. The stone walls rest on the surface of the ground. The middle longitudinal 5 in. x 6 in. timber rests on cedar posts. The floor timbers are 2 by 6 inch in size and rest wholly on the top of the sills. All wall studs rest on the sills. The front ones are 8 ft. long and the back ones 7 ft. 3 in. long. The two sides of the roof are unequal in width, the ridge being 5 ft. and 4 in. from the front wall. The height of the ridge from the sill to the extreme top is 11 ft. and 2 in. All studding is 2 by 4 in. in size and the rafters are 2 by 5 in. The building is boarded by 1 in. boards and is papered and shingled with good cedar shingles on walls and roof. The floor is two thicknesses of hemlock boards which break joints in the laying and have building paper between.

The building is divided by tight board partitions into four sections, each being 30 ft. long. All of the sections are alike in construction and arrangement. The front side of each section has two storm windows of 12 lights of 10 by 12 in. glass. These windows are screwed on upright and as high up as possible on the front, so that the top of the window just clears the eaves. The opening in the front which is closed by a cloth curtain is 14 ft. and 6 in. long and 3 ft. high. Between one end of this curtain opening and the window is placed a door for the attendants to pass through into the pen. A small door is placed under each of the windows on the front side of the house with a runway through which the birds may pass under the front walk into the yard. A single door in the center of the back wall under the droppings board allows the birds to pass out into the back yard when necessary. A light

FIG. 16. Interior of curtain front poultry house No. 3.

frame covered with 10 ounce white duck is hinged to the top of the front opening and covers it when closed down. This curtain is easily turned up into the room, where it is caught and held by swinging hooks until released.

The roost platform is made tight and extends along the whole length of the room against the back wall. It is 4 ft. 6 in. wide and 3 ft. above the floor, being high enough for a person to get under comfortably when necessary to handle or catch the birds. There are 3 roosts framed together in two 15 ft. sections. The tops of the roosts are 8 1-2 in. above the platform and hinged to the back wall so that they may be turned up out of the way when the platform is being cleaned. The back roost is 7 in. from the wall and the spaces between the next two are 16 in. They are made of 2 by 3 in. spruce lumber on edge with the upper corner rounded off.

In every pen there is a door placed 5 in. out from edge of the roost platform. Fifteen trapnests are placed in three tiers against the partition in each end of the room. The trapnests are described in a subsequent section of this bulletin.

Troughs similar to those described on page 40 are used for feeding mash, shell, bone, grit, and charcoal.

There is a walk outside of the building which extends along its entire front. It is 4 ft. and 8 in. wide and made of 2 in. planks and is on the level of the floor of the building.

Detailed working drawings and specifications for one section or unit of this curtain front house follow. From these data anyone can figure what the cost of building one of these houses of any desired length at the prices of building material in his locality.

Material needed for one unit of curtain front house:

LUMBER.

(Spruce is specified simply because that is the material actually used in the building described. Any other equally strong lumber may be used. Amounts are given in board feet unless otherwise specified.)

The following estimates do not allow for waste in cutting:

9 cedar posts, 6 feet long, 6-inch butts.
270 feet 2 by 4 inch spruce for studs, door, window, and coop frames.
550 feet 2 by 6 inch plank for floor joists, outside walk, etc.
370 feet 6 by 6 inch spruce for sills.
40 feet 4 by 4 inch spruce for corner studs and wall stringers.

70 feet 2 by 3 inch spruce for roosts, etc.
235 feet 2 by 5 inch spruce for rafters.
115 feet 1 by 7 inch spruce for rafter braces.
33 feet 1 by 9 inch spruce for doors.
10½ feet 1 by 6 inch spruce for door braces.
3200 feet boards for outside, floor, nests, etc.
20 linear feet 2 in. x 2 in. planed to 1 3-4 in. x 1 3-4 in.
12 linear feet 2 in. by 3-4 in. spruce.
66 board feet 1 in. spruce for feed and grit trough.
35 linear feet spruce for curtain frames.
20 laths.
12,000 shingles.
11 feet boards, spruce, for roost frames.

HARDWARE.

4 pr. heavy 6 inch T hinges with screws.
4 pr. light 3 inch T hinges with screws.
2 pr. 3 by 3 inch butts with screws.
60 pr. 2 by 2 inch butts with screws.
40 lbs. 3 penny shingle nails.
100 lbs. 8 penny common nails.
35 lbs. 10 penny common nails.
15 lbs. 20 penny common nails.
2 lbs. 3 penny common nails.
1 lb. 3 inch staples.
2 thumb latches complete with screws.

MISCELLANEOUS.

2 storm windows, 12 lights 10 by 12 inch.
6 squares building paper.
10 feet 42 inch poultry netting.
14½ feet 42 inch 10-ounce duck.

ADVANTAGES OF CURTAIN FRONT HOUSES.

The "Pioneer House" was in use for 5 years with 60 pullets in it each year. No. 2 house has been in use 9 years and the No. 3 house 8 years. No. 2 and No. 3 houses have proven entirely satisfactory, especially No. 3. This is the type of house described in the present bulletin which the Station after 8 years experience feels warranted in recommending. Some years ago the experiment was tried of building a house on the same general plan as that of No. 3 but making it 20 ft. wide instead of 16 ft. wide with the pens 20 ft. long. This house was given a trial for a number of years on a private plant in Orono, but

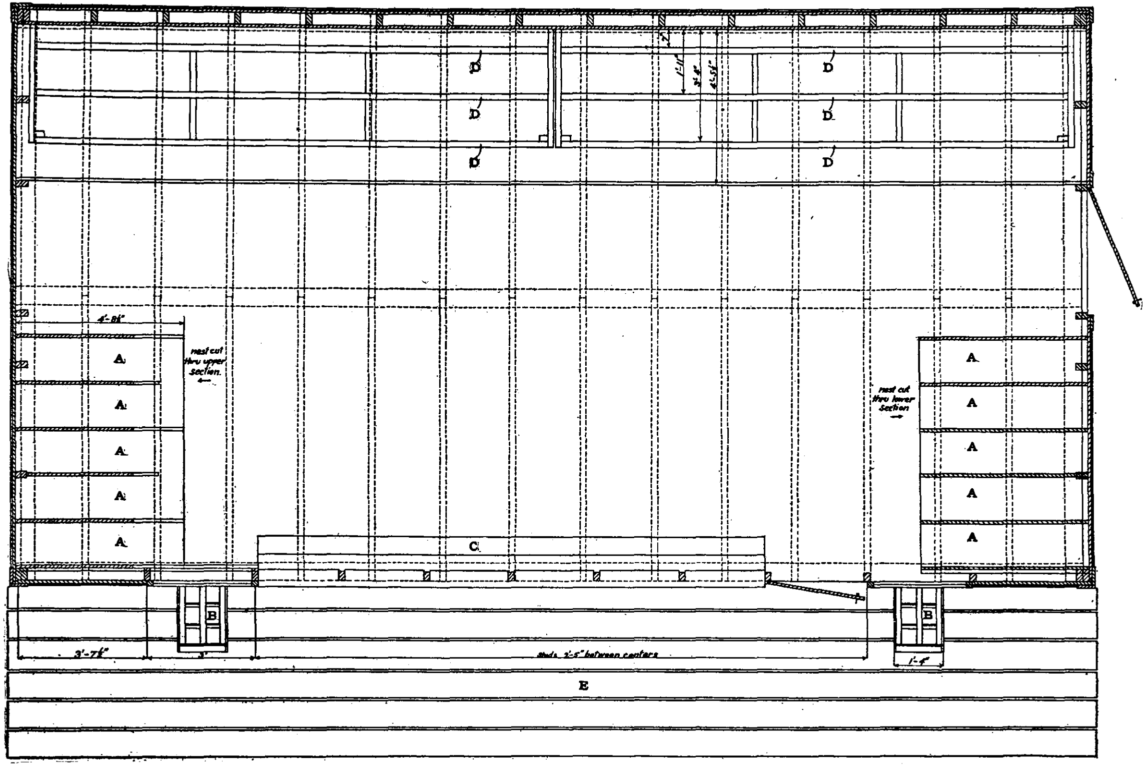


FIG. 17. Floor plan of one unit of No. 3 curtain front poultry house. In this and the following four figures the significance of the letters is as follows: A.—trap nests. B.—runways to yards. C.—dry mash trough. D.—roosts. E.—walk. F.—front opening. G.—coop for broody hen. H.—spike to hang green food on. I.—grit trough. J.—curtain front.

from all that can be learned the house was never so satisfactory as the 16 ft. house at the Station, and has finally been abandoned.

Maine is subject to long spells of severe cold weather, with the temperature considerably below zero at night, and about zero during the day, and with a good deal of high wind. During such rough weather the bedding on the floor has kept comparatively dry. The yields of eggs during severe weather and immediately following it are rarely below those immediately preceding it. It should be borne in mind that had the weather been mild all that time the hens probably would have increased in production rather than remained stationary. They are doubtless affected by the severe weather, but not seriously, as they uniformily begin to increase in production very soon after the weather becomes normal for midwinter.

These curtain front houses have all proved eminently satisfactory. The egg yields per bird have been better in these houses than in warmed ones. The purpose of having rooms and flocks of different sizes was to compare the welfare and egg yields of the birds under the different conditions.

The Yards.

The yards to most poultry houses are at the south, or on the sheltered sides of the buildings, to afford protection during the late fall and early spring, when cold winds are common. The warmed house had yards on both north and south sides, with convenient gates. This is a highly desirable arrangement since it permits the alternate use of the two sets of runs. In this way trouble from soil contamination may be avoided. The south yards were used until the cold winds were over in spring, when the hens were allowed to go to the north yards, which were well set in grass sod. The birds are kept shut in the curtain front house until the weather is suitable and the ground dried out in the spring. The necessity for getting them out of the open-front house, where they are really subject to most of the out-of-door conditions during the daytime, is not so great as when they are confined in closed houses with walls and glass windows. The clear, open fronts of the curtain-front houses

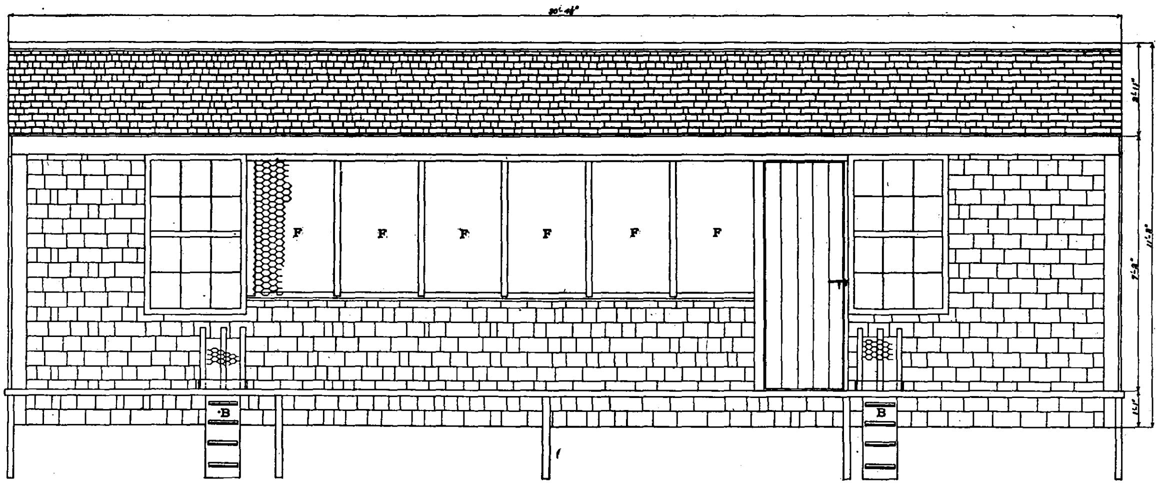


FIG. 18. Front elevation of one unit of No. 3 curtain front poultryhouse. Letters as in Fig. 17.

allow teams to pass close to the open doors of the pens for cleaning out worn material and delivering new bedding, and also allow attendants to enter and leave all pens from the outside walk and reach the feed room without passing through intervening pens.

LICE.

One of the most difficult and trying problems which the poultry keeper has to meet is that of keeping his poultry houses and stock reasonably free from lice, mites and other external parasites. There are many proprietary preparations on the market designed to accomplish this end in one way or another. Most of these preparations are, in proportion to their efficiency, very expensive. Many of them have been tried at the Maine Experiment Station. The Station has finally, however, come to follow the procedure outlined in this circular to the exclusion of all others, and with results which are extremely satisfactory. Indeed, it may be said that vermin on the poultry or in the houses no longer cause any appreciable annoyance in the work of the Station plant.

The routine method which the Station uses in handling its stock with reference to the lice problem is as follows:—

All hatching and rearing of chickens is done in incubators and brooders. The growing chickens are never allowed to come into any contact whatever with old hens. Therefore, when the pullets are ready to go into the laying houses in the fall they are free from lice. Sometime in the late summer, usually in August or early in September, the laying houses are given a thorough cleaning. They are first scraped, scoured and washed out with water thrown on the walls and floor with as much pressure as possible from a hose. They are then given two thorough sprayings, with an interval of several days intervening, with a solution of cresol such as is described on page 7. Then the roosting boards, nests, floors and walls to a height of about 5 feet are thoroughly sprayed with the lice paint (kerosene oil and crude carbolic acid). Finally, any yearling, or older birds, whether male or female, which are to be kept over for next year's work are given two or three successive dustings, at in-

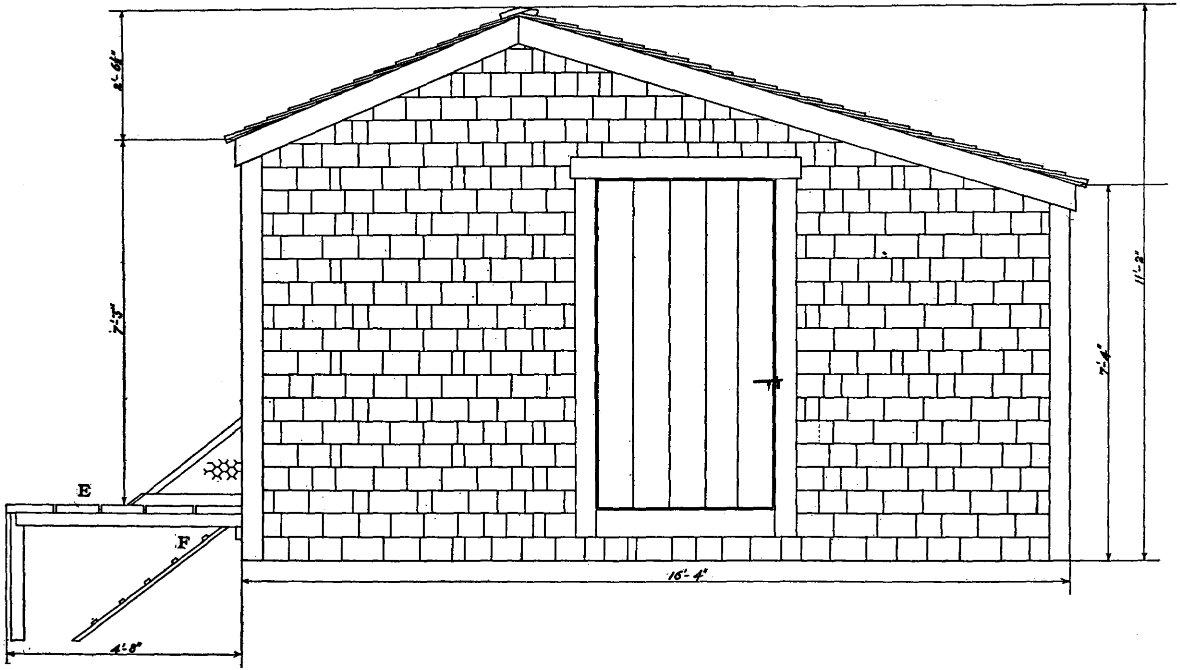


FIG. 19. End elevation of No. 3 curtain front poultryhouse. Letters as in Fig. 17.

tervals of several days to a week between each application, with the lice powder described below, before they are put into the cleaned houses.

As a result of these methods the Station's poultry plant is at all times of the year practically free from lice.

In keeping a poultry plant reasonably free from lice there are two points of attack: One, the birds themselves; the other, the houses, nest boxes, roosting boards, etc. For the birds themselves experience has shown that the best way to get rid of the lice is by the use of a dusting powder to be worked into the feathers. In using any kind of lice powder on poultry it should always be remembered that a single application of powder is not sufficient. When there are lice present on a bird there are always unhatched eggs of lice ("nits") present too. The proper procedure is to follow up a first application of powder with a second at an interval of 4 days to a week. If the birds are badly infested at the beginning it may be necessary to make still a third application. To clean the cracks and crevices of the woodwork of houses and nests of lice and vermin a liquid spray or paint is probably the most desirable form of application.

The most efficient lice powder known to the writer is that invented by Mr. R. C. Lawry, formerly of the Poultry Department of Cornell University. This powder is made by incorporating the liquid mixture of

3 parts of gasoline
1 part of crude carbolic acid

in sufficient plaster of paris to take up all the moisture.

Twe difficulties have arisen regarding the practical utility of the powder as above described. In the first place a great many druggists appear to have a deep-seated and ineradicable prejudice against furnishing their customers *crude* carbolic acid at any price. Reports have reached the Station of druggists making such utterly preposterous and absurd claims as that carbolic acid is a highly explosive substance, which they do not dare to handle! In the second place difficulty has arisen over the fact that there are in the drug trade three grades of crude carbolic acid. Two of these are very much weaker than the other and are quite useless for making the lice powder. The three grades

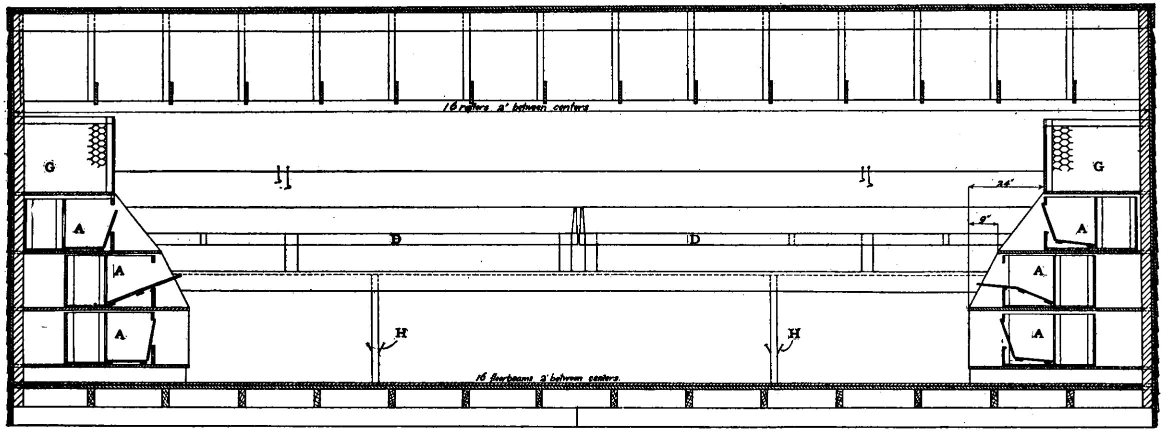


FIG. 20. Longitudinal section of one unit of No. 3 curtain front poultry house. Letters as in Fig. 17.

are listed as follows by a reputable chemical house. These are retail prices.

Acid Carbolic, *Crude,*		per gallon 25c.
Acid Carbolic, *Crude*	50-60 per cent.,	per gallon 40c.
Acid Carbolic, *Crude*	90-95 per cent.,	per gallon 50c.

To get the proper results *only the 90-95 per cent. should be used for making lice powder.* The weaker acids are ineffective.

Owing to the difficulty in getting the strong crude carbolic acid locally in this State at reasonable prices, the Station has experimented to see whether some other more readily obtainable substance could not be substituted for it. It has been found that *cresol* gives as good results as the highest grade crude carbolic.

The directions for making the powder are, therefore, modified as follows:

Take *3 parts of gasoline, and*

1 part of crude carbolic acid, 90-95 per cent. strength, or, if the 90-95 per cent. strength crude carbolic acid cannot be obtained take

3 parts of gasoline and
1 part of cresol.

Mix these together and add gradually with thorough stirring, enough plaster of paris to take up all the moisture. As a general rule it will take about 4 quarts of plaster of paris to 1 quart of the liquid. The exact amount, however, must be determined by the condition of the powder in each case. The liquid and dry plaster should be thoroughly mixed and stirred so that the liquid will be uniformly distributed through the mass of plaster. When enough plaster has been added the resulting mixture should be a dry, pinkish brown powder having a fairly strong carbolic odor and a rather less pronounced gasoline odor. The powder may be passed repeatedly through a sieve to aid in the mixing.

Do not use more plaster in mixing than is necessary to blot up the liquid. This powder is to be worked into the feathers of the birds affected with vermin. The bulk of the application should be in the fluff around the vent and on the ventral side of the body and in the fluff under the wings. Its efficiency, which is greater than that of any other lice powder known to

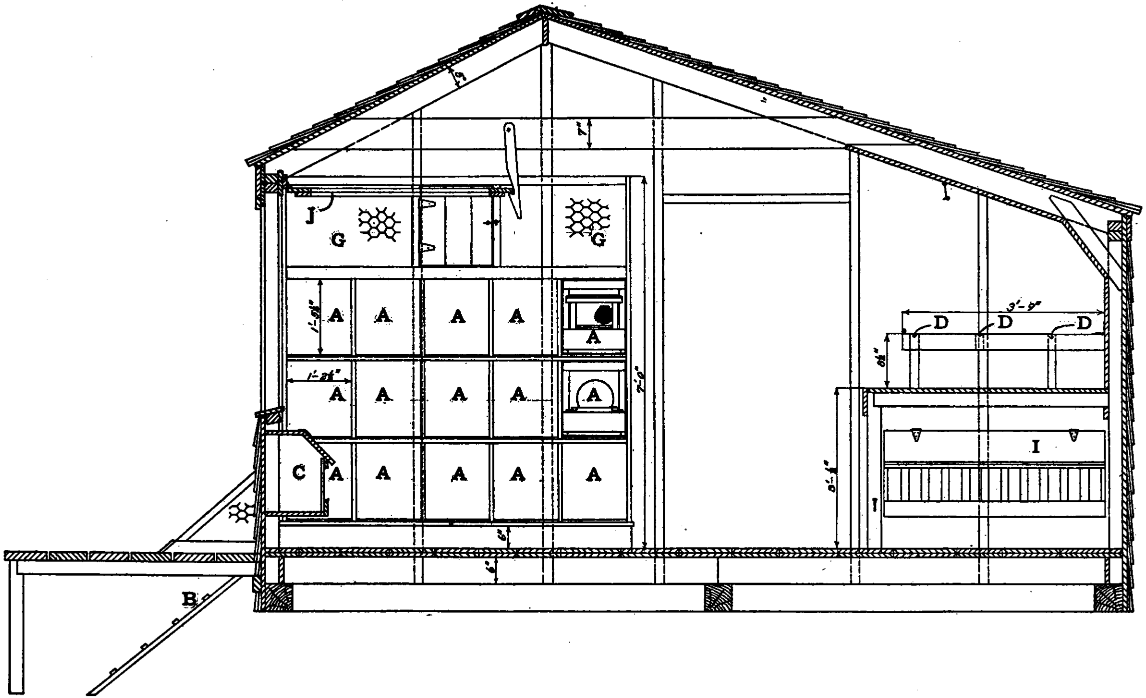


FIG. 21. Cross section of one unit of No. 3 curtain front poultry house. Letters as in Fig. 17.

the writer, can be very easily demonstrated by anyone to his own satisfaction. Take a bird that is covered with lice and apply the powder in the manner just described. After a lapse of about a minute, shake the bird, loosening its feathers with the fingers at the same time, over a clean piece of paper. Dead and dying lice will drop on the paper in great numbers. Anyone who will try this experiment will have no further doubt of the wonderful efficiency and value of this powder.

For a spray or paint to be applied to roosting boards, nest boxes or walls and floor of the hen houses the following preparation is used:—*3 parts of kerosene and 1 part crude carbolic acid, 90-95 per cent. strength.* This is stirred up when used and may be applied with any of the hand spray pumps or with a brush.

If 90-95 per cent. crude carbolic acid cannot be obtained cresol may be substituted for it in this paint.

At the present time very little use of lice powder of any sort is made at the Station. Instead a mercurial ointment is employed when a bird needs individual treatment. After several years experience we find the ointment to be more satisfactory than any powder. The ointment used for this purpose is *Ammoniated Mercurial Ointment.* This is a standard U. S. P. preparation, but as the Pharmacopoeia calls for it to be made with wool-fat or lanolin as a base, and as this is more expensive than other forms of fat equally good for the present purpose we have the druggist make up the ointment exactly as called for by the U. S. P. *except* that lard is substituted for lanolin.

In using this ointment a piece about as big as a pea should be well rubbed into the skin under the vent, and a piece of similar size well rubbed in under each wing. In using a mercurial ointment always spread it around well, so that the bird cannot eat it.

Natural Enemies of Poultry.

One of the chief difficulties that the poultryman has to contend with is the continued loss of chicks, and sometimes even of nearly full grown birds, as consequence of the depredations of natural enemies. It is safe to say that the magnitude of the loss from this source is not anything like fully realized by any one who has not kept an accurate account of all his birds. In the experimental breeding work with poultry at the Maine Station it is necessary to keep account of every bird on the plant. It has, therefore, on this account been possible to check up and form an adequate estimate of the losses due to the creatures that prey upon poultry. A good deal of attention has been devoted to the problem of how these losses may be cut down and the results of this experience may be of benefit to other poultry keepers.

In the experience of this Station the most destructive natural enemy of poultry in the long run has been found to be the crow. The depredations of the hawks are more spectacular perhaps, but in the long run far less destructive. A hawk will only visit a poultry yard occasionally, and especially if he is shot at once or twice will be very wary about approaching it again. On the contrary the crow is a steady and persistent robber. He will continue his depredations just as long as it is physically possible for him to do so. While there may be some doubt as to whether crows are beneficial or harmful as regards other phases of agriculture, there can be no question that, so far as the poultry man is concerned, the only good crow is a dead one. For a number of years the crows killed and either carried away, or left behind partly eaten, a large number of chicks on the Station poultry plant. The losses were not by any means confined to the small chicks, but half grown birds, each nearly equal in weight to the crow itself, were killed, partly eaten, and left behind on the range.

One after another all the devices which had been suggested by others, or could be thought of by those in charge of the poultry work, were tried in order to stop these ravages. In a single year the crows destroyed something over 500 chicks. One important reason for these heavy losses is the location of our poultry range. It borders upon a pine forest in which the crows congregate in great numbers. In the case of a range farther from the woods the losses, without protection, would not be nearly so heavy. Various sorts of "scare-crows" were tried but with no effect whatever. Dead crows were hung up on stakes about the yards as solemn warnings to their fellows, but instead of operating as warnings they appeared rather to serve as "invitations to the dance." Decoying the birds in various ways so that they might be shot was tried, but with very slight individual success and no substantial effect on the steady losses. Poisoning is reported to have been used with success in other places, but has never been tried on the Station plant. It is doubtful whether it is justifiable, save under very exceptional circumstances. The point is that it is difficult to manage affairs in such way as to insure that only the crows will get the poison. There are so many useful and valuable animals about the farm that easily might get the poison before the crow did, with a resulting loss greater than that caused by the crow, that it would seem wise to resort to poisoning only when it can be done under well controlled conditions.

The plan which has finally been adopted at the Station poultry plant for dealing with crows is one which is perfectly safe and sure in its operation. It consists simply in running strands of binder twine about two feet apart over the whole of the poultry range occupied by the young birds, until they reach such size that they are able to take care of themselves. These strings are run over the tops of the brooder houses, and on supports made by cross strands of either wire or two or three strings of binder twine twisted together. These cross strands are held up where necessary by posts. The whole network of strings thus formed is put at such height that the attendants in working about the yard, will not hit the string when standing upright. The area covered in with strings in this way on the Station poultry plant is usually about 3 acres per year. The expense of covering this area is from $15 to $20 for twine. The labor of putting it up is comparatively small. It forms a perfect and complete protection against both crows and hawks.

The appearance of the range when covered with strings is shown in figure 22.

Next in importance to the predaceous birds, as poultry enemies, stand the rats and the foxes. In times past foxes have destroyed many chickens from the Station's poultry plant. Of late years, however, none has been lost. The protection is afforded by a fox proof fence surrounding the whole plant. Rats may become a very serious pest. They live under the brooder houses and take the young chicks, Various methods have been tried at the Station, but no wholly satisfactory way of dealing with rats has yet been found. Trial was made some years ago of one of the most widely advertised of the bacterial

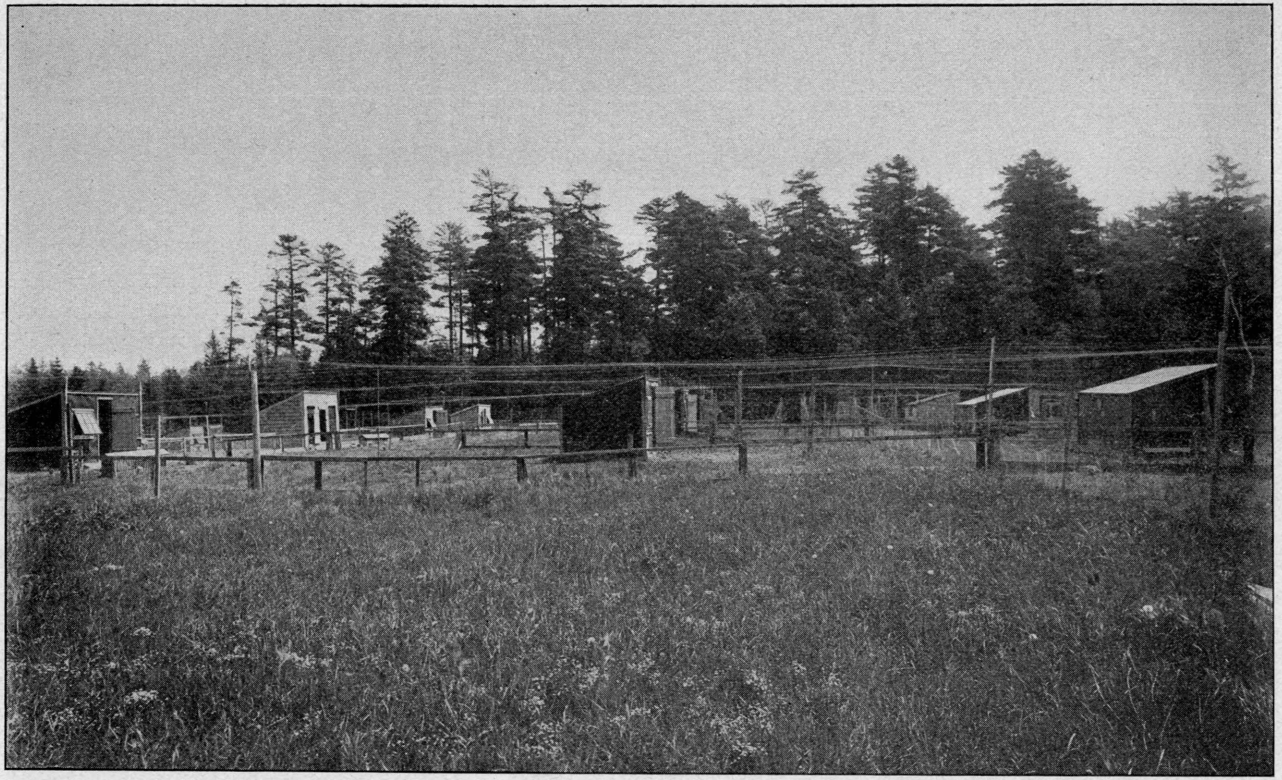


FIG. 22. Showing poultry range in 1913 covered with strings two feet apart, as a protection against crows and other predaceous birds.

rat destroyers, which when fed to rats is supposed to induce a disease which kills them all. No effect whatever was observed to follow the use of this preparation. The rats ate freely of grain which had been moistened with it and if any disease developed as a consequence it has not yet benefited us, or perceptibly inconvenienced the rats. Digging the rats out of their holes and shooting them is one effectual method of dealing with them. Several good cats on the place also aid materially in fighting this pest. A systematic trapping campaign is productive of good results. It must however, be continued without interruption over a considerable period of time. Desultory trapping produces little effect on the rat population. A thorough-going campaign, however, tends to drive the uncaught rats away from the premises.

Trap Nests.

In all the experimental work with laying hens at the Maine Agricultural Experiment Station use is made of trap nests. In 1908 a new type of trap nest was devised which has proved extremely satisfactory. The features in which this nest is superior to the type formerly used at the Station are (1) certainty and precision of operation; (2) greater simplicity of construction, with less tendency to get out of order and work badly; (3) saving of labor in resetting the nest after use.

The nest is a box-like structure, without front, end, or cover, 28 inches long, 13 inches wide, and 16 inches deep, inside measure. A division board with a circular opening 7 1-2 inches in diameter is placed across the box 12 inches from the rear end and 15 inches from the front end. Instead of having the partition between the two parts of the nest made with a circular hole, it is possible to have simply a straight board partition extending up 6 inches from the bottom, as shown in figure 23. The rear section is the nest proper.

The front portion of the nest has no fixed bottom. Instead there is a movable bottom or treadle which is hinged at the back end (fig. 23). To this treadle is hinged the door of the nest. The treadle is made of 1-2-inch pine stuff, with 1 1-2-inch hard-wood cleats at each end (figs. 24 and 25) to hold the screws which fasten the hinges. It is 12 inches wide and 12 1-4 inches long. Across its upper face just behind the hinges holding the door is nailed a pine strip 4 inches wide, beveled on both sides, as shown in figures 24 and 25. The door of the nest is not made solid, but is an open frame (figs. 18 and 20), to the inner side of which is fastened (with staples) a rectangular piece of 1-8-inch mesh galvanized screening (dimensions 8 by 9 inches). The sides of the door are strips of 3-4-inch beech stuff 12 inches long and 1 1-2 inches wide, halved at the ends to join to the top and bottom of the door. The top of the door is a strip of hard wood 13 inches long and 1 1-2 inches wide, halved in 2 3-4 inches from each end. The projecting ends of this top strip serve as stops for the door when it closes (fig. 23). The bottom of the door is a hard-wood strip 10 1-4 inches by 4 inches. The side strips are fitted into the ends of this bottom strip in such way as to project slightly (about 1-32 inch) above the front surface of that strip, for a reason which will be apparent.

When the nest is open the door extends horizontally in front, as shown in figure 24. In this position the side strips of the door rest on a strip of beech 1 1-2 inches wide, beveled on the inner corner, which extends across the front of the nest. This beech strip is nailed to the top of a board 4 inches wide, which forms the front of the nest box proper. To the bottom of this is nailed a strip 2 inches wide, into which are set two 4-inch spikes from which the heads have been cut (compare fig. 24). The treadle rests on these spikes when the nest is closed. The hinges used in fastening the treadle and door are narrow 3-inch galvanized butts with brass pins, made to work very easily. It is necessary to use hinges which will not rust.

The manner in which the nest operates will be cleared from an examination of figures 24 and 25 which show a sample nest with one side removed to show the inside. A hen about to lay steps up on the door and walks in toward the dark back of the nest. When she passes the point where the door is hinged to the treadle her weight on the treadle causes it to drop. This at the same time pulls the door up behind her, as shown in figure 25. It is then impossible for the hen to get out of the nest till the attendant lifts door and treadle and resets it. It will be seen that the nest is extremely simple. It has no locks or triggers to get out of order. Yet by proper balancing of door and treadle it can be so delicately adjusted that a weight of less than half a pound on the treadle will spring the trap. All bearing surfaces are made of beech because of the well-known property of this

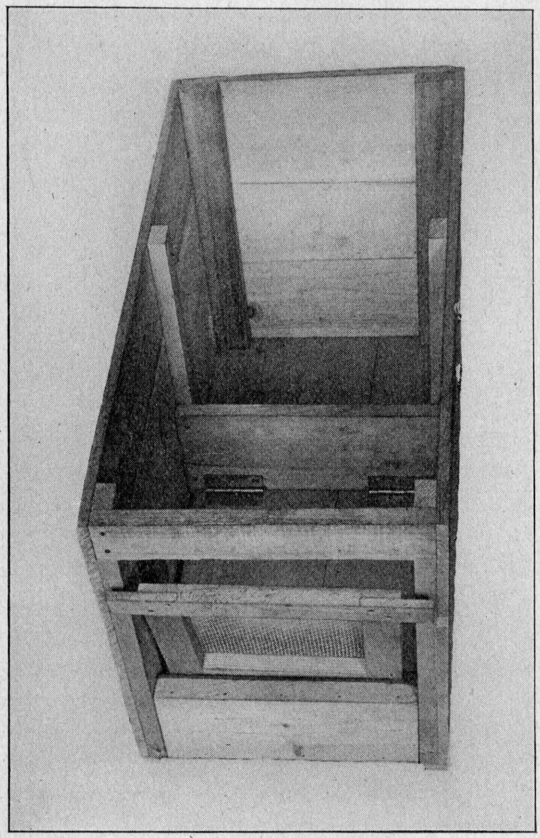


FIG. 23. Trap nest closed. View from above.

wood to take on a highly polished surface with wear. The nests in use at the Maine Station have the doors of hard wood, in order to get greater durability. Where trap nests are constantly in use, flimsy construction is not economical in the long run. For temporary use the nest door could be constructed of soft wood.

The trap nests are not made with covers because they are used in tiers and slide in and out like drawers. They can be carried away for cleaning when necessary. Four nests in a pen accommodate 20 hens by the attendant going through the pens once an hour, or a little oftener, during that part of the day when the hens are busiest. Earlier and later in the day his visits are not so frequent. The hens must all have leg bands in order to identify them; a number of different kinds are on the market.

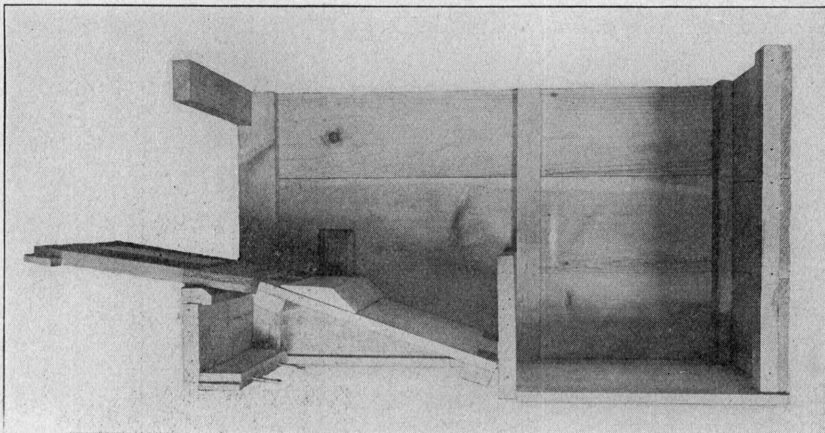


FIG. 24. Trap nest open. One side removed to show method of operation.

The double box with the nest in the rear is necessary. When a hen has laid an egg and desires to leave the nest, she steps out into the front space and remains there until she is released. With only one section she would be likely to crush her egg by stepping upon it, and thus learn the pernicious habit of egg eating.

To remove a hen, the nest is pulled part way out, and as it has no cover she is readily caught, the number on her leg band is noted and the proper entry made on the record sheet. After having been taken off a few times the hens do not object to being handled, most of them remaining quiet, apparently expecting to be picked up.

Before commencing the use of trap nests it was thought that some hens might be irritated by the trapping operation and object to the noise incident to it, but such does not seem to be the case. Trap nests have been used at the Maine Station for

Leghorns, Brahmas, Wyandottes, and Plymouth Rocks and a number of other breeds.

The amount of time required in caring for the trap nests can only be estimated, since the attendant's time is divided with other duties. The time varies from one day to another and with the number of nests in use. By noting the total time used each day in caring for the nests when the hens were laying most heavily, it has been estimated that one active person devoting his entire time to trap nests could take care of 400 to 500 nests used by 2,000 to 2,500 hens. When commencing the year's work he would need assistance in banding the birds, but after that

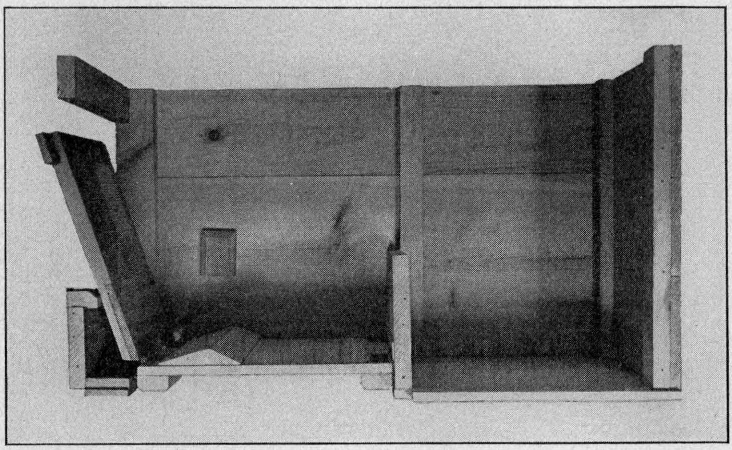


FIG. 25. Trap nest closed. One side removed to show method of operation.

was done he could care for the nests without assistance until midsummer, when the egg yield would probably be diminished and a part of his time could be spared for other duties.

THE VALUE, METHOD OF PRESERVATION, AND ECONOMICAL USE OF HEN MANURE.

One of the most valuable by-products of any live-stock industry is the manure. Its proper care and use is one of the distinguishing features of a successful stock farm. The high nitrogen content of poultry droppings makes them in certain respects the most valuable of farm manures. At the same time this quality necessitates special treatment to preserve the nitrogen and utilize it economically.

According to experiments carried on at this Station some years ago* the night droppings average 30 pounds per hen per year.

They contain .8 pound of organic nitrogen, .5 pound of phosphoric acid and .25 pound of potash. At the present price of fertilizers this material would be worth about 20 cents. No data are available on the amount of day-voided dung. Since the hens spend less than one-half their time on the roosts, and since more dung is voided while the birds are exercising than when at roost, the authors estimate that during a year probably 45 pounds of dung are voided by each bird while off the roost. Allowing that more than one-half of the fertilizing elements of the day dung are necessarily lost, the value of the total droppings, if properly cared for, should be at least 30 cents per bird per year.

The poultryman or farmer who properly cares for the droppings can add a neat further profit to his business. For example the droppings from 1000 birds, if preserved without needless loss, will be worth at least $300.

Poultry manure contains more nitrogen than other farm manure, because in birds the excretion of the kidneys is voided in solid form (uric acid), with the undigested portions of the food. This form of nitrogen is easily available to plants. Unfortunately, however, it is not stable. Putrifactive processes easily change it to ammonia compounds, and unless special care it taken of the droppings one-third to one-half of the nitrogen passes off as ammonia gas.

The mechanical condition of poultry manure is poor. As Storer† says: "It is apt to be sticky when fresh and lumpy when dry" On this account, if used untreated, it can only be successfully applied to the land by hand, as it does not work well in drills or spreaders. Hen manure used alone is very

*Woods, C. D. and Bartlett, J. M. Ann. Rept. Me. Agr. Expt. Sta. 1903, pp. 199-204.

†Storer, F. H. Agriculture in Some of its Relations with Chemistry. Chas. Scribner's Sons, New York, 1899, Vol. 1.

wasteful of nitrogen as it carries this element in too large a proportion to its phosphorus and potassium.

In the experiments referred to above the problem undertaken by Woods and Bartlett was the determination of a method of treatment of hen manure which would first prevent the loss of nitrogen; second, add sufficient phosphorus and potassium in forms available for plant food to make a balanced fertilizer; and third, so improve the mechanical condition of the dung that it can be applied to the land with a manure spreader. Seven different methods of treatment were tested. The authors give the following summary of their results.

"By itself, hen dung is a one-sided nitrogenous fertilizer. As usually managed, one-half or more of its nitrogen is lost, so that as ordinarily used it does not carry so great an excess of nitrogen. Because of its excess of nitrogen it will be much more economically used in connection with manures carrying phosphoric acid and potash. As both acid phosphate and kainit prevent the loss of nitrogen, it is possible to use them in connection with sawdust or some other dry material as an absorbent (good dry loam or peat will answer nicely) so as to make a well balanced fertilizer. For example, a mixture of 30 pounds of hen manure, 10 pounds of sawdust, 16 pounds of acid phosphate, and 8 pounds of kainit would carry about .25 per cent nitrogen, 4.5 per cent phosphoric acid, and 2 per cent potash, which, used at the rate of 2 tons per acre, would furnish 50 pounds nitrogen, 185 pounds phosphoric acid, and 80 pounds potash."

At the usual prices of fertilizing ingredients this mixture is worth from $10.00 to $20.00 per ton. It is a well balanced, stable, fertilizer which, while still not fine enough to work well in drills, can be successfully applied with a manure spreader.

The kind of absorbent used should be the one which can be obtained at least cost, since the amount of plant food added by any of those suggested is negligible, and since they are about equally effective as dryers (the slight acidity of peat gives it some advantage as it helps a little to preserve the nitrogen). It is probably that one of the three can be obtained by any poultryman or farmer at little or no expense.

The absorbent and the acid phosphate and kainit should be kept conveniently at hand and each day when the droppings are collected they should be treated. It may be best to weigh the ingredients a few times, after which it will be possible to make sufficiently close estimates by measure.

The treated droppings should be well sheltered until time to apply them to the land, i. e., shortly before plowing. Any form of shelter may be used. For a temporary plant, or for a small farm, a small wooden building or a bin in a larger building will probably be the best place practicable; but for a large, permanent poultry plant a cement manure shed or tank is advisable. A general farmer also will find such an equipment for the storage of all farm manure a paying investment. A portion of this shed can be partitioned off for hen manure.

A properly constructed cement building will not have to be constantly repaired and frequently replaced like a wooden structure, which rots out quickly when used for the storage of manure. The cement building is water tight, preventing the entrance of water from without and the escape of any unabsorbed liquid manure. It is, in fact, a perfect permanent shelter.

THE MAINE STATION MANURE SHED.

In 1912 this Station built at its poultry plant a manure shed large enough to accommodate the droppings from one thousand adult birds, over a period of a year, and the droppings collected from the range where about three thousand chicks are annually reared.

The inside measurements of this shed are 12-7 feet. It is 5 feet high at the eaves and 8 feet 2 inches to the peak of the roof. It is illustrated in figures 58 and 59.

The droppings are thrown into the shed through trap doors in the roof, and taken out from one end, which is of removable plank. The other three walls, and enough of this end wall to form the grooves which hold the ends of the planks; the floor; and the foundation are formed of one continuous cement mass (monolithic construction). The gables are board. The gable at the open (plank) end of the shed is removable to give more head room, when shoveling the manure into carts. It is held in place by hooks.

It was necessary to place this building on a very heavy clay soil which heaves badly with frost. For this reason it was placed on a much deeper foundation than would be necessary in a more favorable location. The foundation is a solid block of cement and rock, the size of the outside measurements of the shed and extending five feet below the surface of the ground.

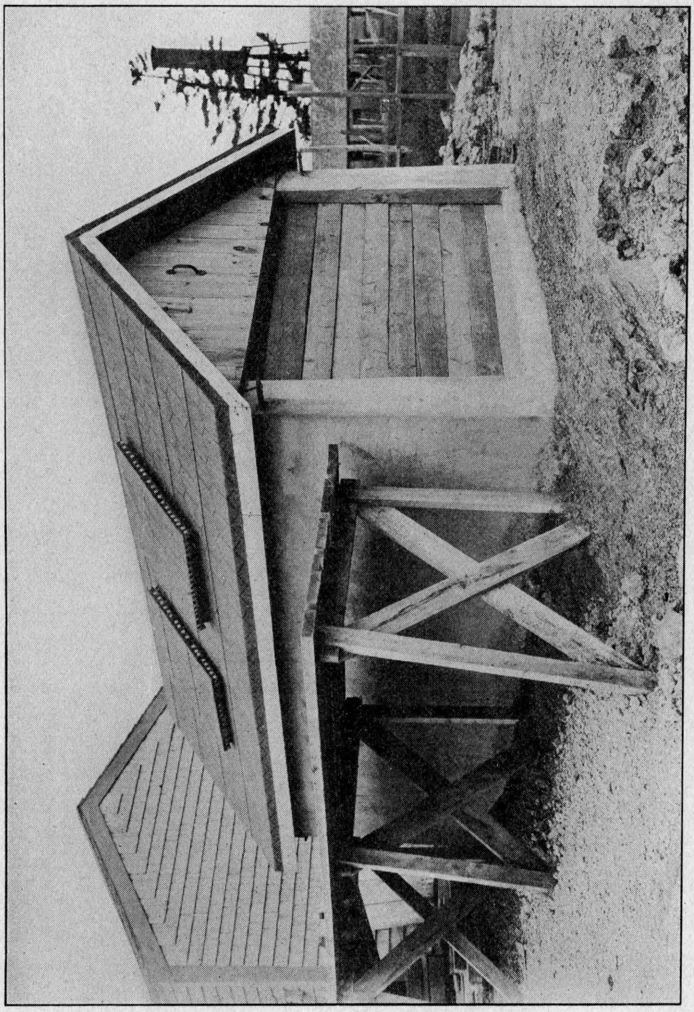


FIG. 26. Photograph of manure shed on poultry plant of Maine Agricultural Experiment Station. Note walk, trap-doors in roof, plank end, and removable gable.

It was made by using as many rocks and as little cement as was consistent with the formation of a firm solid mass. For a few inches near the top, however, clear cement was used and this was smoothed off at ground level to form the floor. At the edges of this foundation the cement was continued up into the wall forms which were built so that the walls are ten inches thick at the base and six at the top.

An iron bar ending in a ring was set in the cement near the top of the wall at each corner of the building. These rings project a few inches from the end walls. The roof is firmly secured to the walls by bolts passing through it and through these rings.*

As stated above the larger part of one end of the shed is plank. The cement wall is continued on this end only far enough from either corner to provide a place for the slot into which the planks are slipped. This slot is formed by a groove two inches deep and a little more than two inches wide in each end of the cement wall. See Figs. 26 and 27. These grooves were formed by placing angle iron posts within the board forms.

This completes the description of the cement work in the building.

The removable end is of two inch planks which are slipped into the above described slot in the cement wall.

The plates and rafters are of 2x4 timbers. Inch boards were used for roof boards, gables, etc. The gable on the plank end is removable. It is held in position by hooks and is provided with a handle in the center.

The roof is covered with roofing paper. In one side are two trap doors also covered with this roofing. Each of these doors is 2 feet 4 inches x 2 feet 10 inches and fits over a frame in the roof to which it is hinged at the top. The end of a lath is attached by a double screweye hinge to the inside of each door at the right edge about half way from bottom to top. The edge of the lath is provided with notches which hook over a nail on the inside of the door frame. When hooked this lath holds the door open. A 2x4 strip is nailed across the inside of each door frame a little more than half way from bottom to top. This serves as a rest for the basket when droppings are emptied into the shed.

This shed is placed at the end of the line of poultry houses. The wide raised walk which extends along the entire front of

*This is an awkward and unnecessary arrangement, and was only used through a misunderstanding on the part of the builder.

the houses is continued past the shed as a 2-foot walk. Between the last poultry house and the shed the walk is built on an incline so that at the end of the shed it is only 1 foot 8 inches from the eaves. This is a convenient height from which to reach the doors with the baskets of droppings.

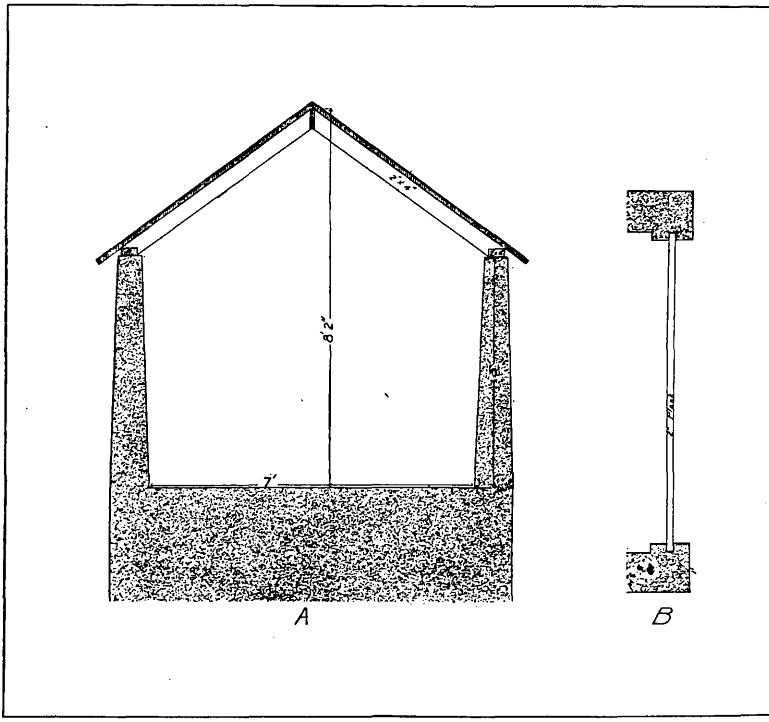


Fig. 27. *A.* Cross section of manure shed, showing dimensions and plan of construction. *B.* Horizontal section of front, showing planks in the grooves in the cement walls.

The Cost of the Shed.

Cement	$45.60
Gravel	20.00
Inch boards	17.50
2x4 timber	13.00
2 in. plank	1.20
Finishings	10.00
Roofing	8.00
Labor	70.00
	$185.50

On many large poultry plants little or nothing is received for the manure. Probably few poultry plants save more than one-half the fertilizing elements possible, if proper methods of treatment and shelter were used. If the droppings are treated by the methods described above, and are kept properly sheltered, the saving on any large poultry farm would in 1 to 3 years easily equal the cost of a permanent shed similar to the one here described.

(518-12-15)

University of Maine.

MAINE
AGRICULTURAL EXPERIMENT STATION,
ORONO, MAINE.
CHAS. D. WOODS, Director.

CULTURAL METHODS WITH OATS USED BY THE MAINE AGRICULTURAL EXPERIMENT STATION.

In connection with the oat breeding work of the Experiment Station there have been adopted certain cultural methods which under our conditions have given excellent results. This circular is issued in reply to numerous requests as to the methods used in our work. No claim is made that these methods are ideal or that they are the best that might be obtained. They are simply the result of our experience and based on certain general principles. The only criterion by which they are judged is that by their use we obtain satisfactory yields under our conditions. The Station has been growing oats at Aroostook Farm for only two seasons. The methods for Highmoor Farm are based upon several years experience and apparently are well adapted to oat growing on that soil and in that climate.

The methods employed at Aroostook Farm differs somewhat from those used on Highmoor Farm. These differences will be pointed out in the following paragraphs.

Preparation of the Land.

Wherever possible the land for oats should be plowed in the fall. This method is followed on both of our farms. There are many reasons for this. In the first place it exposes many insect larvæ to freezing and thawing which results in their destruction. For this reason the plowing should be done rather late in the fall. In the second place the freezing and thawing of the plowed land has a very beneficial effect upon its physical structure making it much more mellow than freshly plowed land. Another very important reason is that fall plowing enables the grower to plant his grain much earlier in the spring.

At Highmoor Farm just as soon at the land is dry enough in the spring so that it will not "puddle" it is gone over with a disk harrow. Usually once is enough but if not, it is disked twice and finally it is gone over with a smoothing harrow. This makes a loose mellow seed bed. Some soils will require more and some less working to produce the same kind of a seed bed. On Aroostook Farm we have usually found it sufficient to harrow the field each way with a springtooth harrow. This produces a fine deep seed bed and nothing would be gained by going over the land again. In each case the amount of harrowing should be judged by the condition of the seed bed and not by any rule of thumb.

Plant Early.

Of the several recommendations which we have to make there are none more important than this. The writer has frequently seen oats sown in the southern part of the State the last of May or even in June. The farmer who cannot plant his land before that time will do well to grow some other crop than oats. The oat plant is a native of cool northern climates. To do its best it must get most of its growth before the hot weather. *Oat should be planted just as soon as the ground can be worked in the spring.* This should be taken literally, for even a few days difference in planting will sometimes make a difference of bushels in the yield. The soil of Highmoor Farm is underlaid by a stiff clayey subsoil which prevents rapid drainage. In no sense of the word is it an early soil, yet we have always been able to sow our oats either the latter part of April or the very first days of May. In Aroostook the land is ready to plant just as soon as the frost is out, which in some years is as soon as the snow is off. This ordinarily varies from the 15th to the 25th of May.

There is practically no danger of well matured oat seed rotting in the ground unless water stands over it for some time. Oat plants will stand quite severe freezing without injury. There is practically no danger of planting too early, provided the soil is dry enough to work.

FERTILIZER.

Stable manure should be applied to the land in the fall before it is plowed. It should be evenly distributed over the ground. Ordinarily the Station has not had any manure to apply to its oat land.

In place of this we have used 500 lbs. per acre of a 4-8-7 commercial fertilizer. Ordinarily we have distributed this broadcast before harrowing the land in the spring. Some labor can be saved if the fertilizer is distributed in the drill. The results are as satisfactory one way as the other. Under the present conditions brought about by the war, potash will have to be omitted in part, if not entirely. In fact at the price that will have to be paid for potash it is doubtful if it can be profitably used on any farm crops in 1916.

Many farmers do not plan to fertilize their grain crops. In Aroostook, grain usually follows potatoes. It has been the custom of many farmers there to use a ton or more of fertilizer to the acre. Under such conditions it is probably not necessary to add fertilizer to the grain crop. However, the Station believes that much more satisfactory results are obtained by using 1500 pounds of a high grade fertilizer to the potato crop and 500 pounds to the following grain crop. The total outlay for fertilizer is the same and the results more satisfactory.

For the southern and central part of the State where oats do not always follow potatoes we have only to say that a satisfactory grain crop cannot be grown without sufficient plant food. Much of the soil in Maine is so deficient in available plant food that it must be added in some way.

At the price of oats in the eastern market the increase in yield and quality of the grain is ordinarily sufficient to more than cover the cost of 500 pounds of high grade fertilizer.

Sowing.

There has been much discussion over the relative merits of broadcasting and drilling. The Experiment Station has not carried out any experiments in this direction. On the basis of results obtained elsewhere we have adopted the method of drilling. There are many reasons why drilling is better than the ordinary broadcasting. In the first place, a force feed drill secures a much more even distribution of the seed. In the second place, the seed is placed in the gound at a more uniform depth. In any method of broadcasting some of the seed is deeply covered and some lies on top of the ground. This causes uneven germination and uneven growth of the plants. The chief argument in favor of broadcasting is that the individual plants are less crowded. This is largely offset by the fact that air and sunlight are more accessible to the plants in drills and further by the fact that the oat plants send their rootlets under the surface of the soil in such a manner that they will absorb nourishment from a relatively large area.

At both farms we use large disk drills which place the rows 7 inches apart. A note of warning should be given in regard to the use of heavy disk drills in very loose soil like that over much of Aroostook. In our first year on Aroostook Farm it was found that the oats were being buried too deeply. After that the method of rolling the land before drilling was adopted with very good results.

In all cases the land should be rolled immediately after sowing. This packs the soil around the seed and promotes more rapid germination and stronger growth.

Rate of Seeding.

With ordinary oats the rate of seeding within certain limits is of less importance than many other things. With a light seeding the plants stool more and with a heavy seeding they stool less so that on the average nearly the same number of heads and the same amount of grain is obtained. Some farmers claim good results with a seeding as light as 5 pecks per acre, while others think they must sow 5 or 6 bushels. To a large extent the proper seeding depends upon the variety. The large grained, heavy strawed, varieties, like the various kinds of side-headed (horse-mane) oats, require much heavier seeding than the smaller varieties.

For an oat like the Senator probably 4 bushels per acre is not too much. The very small grained, early varieties like the Kherson, Daubeney or 60-day oats require a lighter seeding than the medium varieties.

At Highmoor Farm we have used 2 and 2½ bushels per acre for the small and medium varieties and 3 bushels for the larger varieties. At Aroostook Farm rate of seeding experiments carried out for two years indicate that 3 to 3½ bushels per acre with a medium variety like the Prosperity gives the best yield of both straw and grain.

It is probable that in broadcasting a slightly heavier seeding is required to compensate for grains not covered and for those eaten by crows. This is especially true where the broadcasting is done by hand.

Treatment for Smut.

It is estimated that more than 60 per cent of the oat acreage in Maine is seriously infected with smut. The spores of this fungus are present on the oat grain at the time of planting. After planting this spore germinates and sends its mycelium into the growing plant. Nothing unusual about the plant is noted until the head appears. It is then seen that the grains are all blighted and that the glumes (chaff) are covered with brownish dust-like spores. During harvesting and threshing these spores become scattered over other grains and infect the next year's crop.

This serious disease can be effectively controlled by simply treating the seed grain with a solution of formaldehyde. The oats should be treated just before sowing. The most satisfactory method and the one used by us is to immerse a bag of oats for 20 minutes in a barrel containing one pint of commercial formaldehyde (40 per cent) to 50 gallons of water. The oats are then spread out to dry. They should be stirred once or twice but may be sown as soon as they are dry enough to run through the drill. The formaldehyde solution should not be stronger than that given above nor should they be allowed to stay in the solution much over 20 minutes. Otherwise there is some danger of injuring the germination. The treated oats should always be put back into bags which have been soaked in the solution. Otherwise there is danger of reinfection with spores clinging to the bags.

This method has proved very successful. There have been practically no smutted heads in any of our plots or fields.

Eradication of Mustard and Other Weeds.

Weeds are often a serious pest in oat fields. It is not unusual for the yield to be decreased as much as 25 per cent by weeds. In addition to this the seeds of many weeds are so nearly the same weight and size as the oat kernels that it is impossible to separate them by the ordinary fanning mill. Every farmer should see to it that his seed oats are free of weed seeds.

The best method of eradicating weeds in the field is by hand pulling. However, where weeds are very abundant this is a tedious and expensive operation. It has been estimated that 50 per cent of the oat acreage in Maine is so badly infested with noxious weeds that hand pulling cannot be resorted to with profit.

The most noxious weeds in our grain fields are those belonging to the mustard family including wild mustard, wild radish, and wild turnip. It is impossible to separate these seeds from oats or barley by even the most improved fanning mill. If these weeds are allowed to mature and are harvested with the grain it means again seeding the fields with these weeds or else the continued purchase of seed grain.

Experiments reported in Bulletin 224 of this Station show that it is possible to satisfactorily control not only wild mustard but also wild radish and wild turnip by spraying with iron sulphate. It is of the utmost importance to spray the plants while they are small and before the buds form. They should not be in more than the third or fourth leaf, for if they are much larger than that there is danger that the plants will not be killed but only injured by the spray. The plants should be so small that they can be completely covered by an ordinary drinking tumbler.

Dissolve 100 pounds iron sulphate in 70 gallons of water, or 70 pounds in 50 gallons, as is most convenient. Apply at the rate of about 70 gallons per acre. Use a powerful pump and have the pressure at least 60 pounds. Use a fine nozzle. This should develop a fine dust-like mist. A coarse mist will not do. Spray after the dew has dried off when the plants are in the fourth leaf. Choose, if possible, a bright warm day without wind. But spray when the plants are the proper size even if the day is not all that could be desired. If the field is badly infested or the conditions of the first spraying were not satisfactory, a second spraying three days later is desirable. Later go over the field and pull by hand any plants that may have escaped.

Harvesting.

A word needs to be said as to the time of harvesting, especially with oats to be used for seed. By some authorities directions are given for harvesting as soon as the grain is in a hard dough stage. In our experience this is too early for the best results in this climate. The best criterion we have found for judging ripeness is the color of the straw. We aim to cut our oats as soon as all of the green color is out of the straw. This, of course, applies to the body of the field. There are always marginal plants and a few spots in the field which are still green. If left until this time the grain will be heavier, have a better color and as seed will produce more vigorous plants.

It hardly needs to be said that the only satisfactory way of harvesting grain is with a self-binder. Harvesting with self-rake reapers and mowing machines is wasteful of time and grain.

At Highmoor the grain is shocked about eight bundles to a shock and capped with sheaves. Canvas hay caps 4 feet square are also used to cover the shocks. The grain is allowed to stand in the shocks from 10 days to two weeks and is then threshed from the field.

On Aroostook Farm the uncertainty of the weather makes such field curing very risky. The grain is set up in long loose stocks without caps and allowed to stand three or four days or longer if the weather is not bright. If the grain is well matured when cut, three days of bright sunshine will dry out the sheaves very thoroughly. It is then put in the mow and allowed to undergo the "curing" there. In some cases grain has been threshed from the field after standing only 5 or 6 days. No ill results were observed but this method is not advised unless absolutely necessary. Such grain should be frequently stirred for some weeks after threshing.

[519-12-15]

University of Maine.

MAINE
AGRICULTURAL EXPERIMENT STATION
ORONO, MAINE.
CHAS. D. WOODS, Director.

REPORT OF PROGRESS ON ANIMAL HUSBANDRY INVESTIGATIONS IN 1915[1].

By RAYMOND PEARL.

During the past year work on the investigations outlined in earlier reports has been prosecuted energetically. It is possible to report definite progress along several lines at this time. In presenting this report each of the general lines of investigation going forward will be separately considered.

[1]Papers from the Biological Laboratory of the Maine Agricultural Experiment Station, No. 92.

This report of progress during the year 1915 of the work on animal breeding and related lines (exclusive of work with poultry) carried on in the Biological Laboratory of the Maine Agricultural Experiment Station, was presented as the report of the Committee on Breeding of the Maine Dairymens' Association, at the meeting held in Lewiston on December 7, 1915.

I. The Study and Analysis of Milk Records.

During the past year the work in this direction has fallen into three chief divisions: viz., (a) The preparation for the press of the results of the extended study of the relation of milk flow to age in dairy cattle; (b) The preparation of a Dairy Efficiency Table; (c) the transfer and analysis of the Biltmore herd records.

(a) RELATION OF MILK FLOW TO AGE IN DAIRY CATTLE.

The main essential results of this investigation were in hand at the time of the last annual report. It has been possible to demonstrate in the most complete manner from extensive data on the three breeds, Jersey, Holstein-Friesian, and Ayrshire, that the change in milk-flow as a cow grows older follows a definite law, expressible in the form of a mathematical equation. A preliminary statement of this law has been published.[2]

The preparation of this material for printing has been a very laborious and time-consuming task. It is now hoped that within a few months following this report the complete manuscript will be ready for the printer. In connection with the preparation of this material for the press a number of interesting subsidiary matters have come to light. One may be briefly considered here. It has to do with a

Comparison of American Advanced Registry Ayrshires with Ayrshires in Scotland in Respect of Milk Production.

As set forth in our last report, the records furnished by the Scottish Milk Records Society have been the basis of our study of Ayrshire milk production. These records, it will be recalled, correspond to American cow-test association records in this particular that the records of *all* cows in each herd good, bad, and indifferent, are included. During this past year we have been able, through the kindness of Dr. J. A. Ness, President of the Ayrshire Breeders' Association, and Mr. C. M.

[2]Pearl, R. On the Law Relating Milk Flow to Age in Dairy Cattle. Proc. Soc. Exper. Biol. and Med., Vol. XII, pp. 18-19, 1914.

Winslow, Secretary, to compare the American Advanced Registry Ayrshire records with these Scottish records. The results of such comparison, in part, are shown in Table 1.

TABLE 1.

Comparing Mean Weekly Yields (in Gallons) of (a) American Advanced Registry, and (b) Scottish Milk Record Society Ayrshire Cows.

AGE OF COW.	American Advanced Registry.	Scottish Milk Records Society.	Difference.
Two years	14.84 ± .08	13.61 ± .18	1.23
Three years	16.76 ± .14	13.84 ± .04	2.92
Four years	17.47 ± .14	15.23 ± .06	2.24
"Mature"	20.32 ± .13	18.56 ± .09[3]	1.76

[3]This figure is for 9-year-old cows.

From this table it will be seen that the American Advanced Registry Ayrshires outyield their Scottish sisters, on the average, from about one and a quarter gallons to three gallons per week, or roughly from 10 to 25 pounds. Looked at from a relative standpoint it appears that the American Advanced Registry animals give, as two year old heifers or as mature cows, about 9 per cent. on the average more milk than the Scottish herds. For the three year and four year ages the percentage is higher.

The standards for admission to advanced registry are just as high for the Ayrshire as for any other breed. It appears a fair question as to whether a standard which runs less than 10 per cent. above the general average of the breed for mature cows is sufficiently high to get the best results in the direction of breed improvement.

(b) A DAIRY EFFICIENCY TABLE.

The following kind of question constantly arises in cow-test association work: Herd X is made up of cows of various ages from 2 to 14 years, the majority of the cows being fully matured (6 years or over). These cows last freshened at various times. The average production of the herd per cow in the last year was 7500 lbs. of milk. Herd Y is also made up of cows of various ages, but most of them are young, i. e., *under* full maturity. They freshened at various times and gave for the year an average flow of 6000 lbs. per cow. Is Herd X a better producing herd than Herd Y, taking age of cows, average stage of lactation, etc., into account?

Hitherto there has been no definite scientific method of dealing with this problem. The need for something of the sort was first urged to the writer by Mr. H. M. Look, the tester for the Winthrop Cow Test Association. It was suggested that the problem might be looked at in the following way. On the average a cow may be regarded as working at her maximum efficiency when she is, on the one hand, fully mature in age, but not too old, and on the other hand, at the beginning of a lactation period, say during the first month. Suppose this maximum efficiency be designated as 100 per cent. Then the cow's efficiency in performance at any other age or stage of lactation will be represented by some percentage below 100. Given the proper data, and by the use of appropriate mathematical methods, it is possible to construct a table which will give these efficiency percentages at various ages and months of lactation. Such a table has been prepared in this laboratory and is herewith presented as Table 2. The method of calculating this table cannot be gone into here for lack of space, but will be presented in a later publication.

The manner in which the table is to be used may be shown by an example. Let us compare two herds of Holstein cattle, of approximately the same size and on nearly the same date.

TABLE 2.

Table of Efficiency Percentages for Milk Production in Dairy Cattle.

Age of Cow in Years and Months.	Months Since Freshening (Stage of Lactation).																							
	1	2	3	4	5	6	7	8	9	10[4]	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1: 6-1: 11	58%	54%	51%	47%	44%	41%	37%	34%	30%	27%	27%	27%	26%	26%	26%	26%	26%	26%	25%	25%	25%	25%	25%	25%
2: 0-2: 5	73	69	64	60	56	52	48	43	39	35	35	35	34	34	34	34	34	34	33	33	33	33	33	33
2: 6-2: 11	82	77	72	67	62	57	52	47	41	36	36	36	36	36	35	35	35	35	35	34	34	34	34	34
3: 0-3: 5	89	83	77	71	66	60	54	48	43	37	37	37	37	37	36	36	36	36	36	35	35	35	35	35
3: 6-3: 11	93	87	81	75	69	62	56	50	44	38	38	38	38	38	37	37	37	37	37	36	36	36	36	36
4: 0-4: 11	97	91	84	78	71	65	58	52	45	39	39	39	39	38	38	38	38	38	37	37	37	37	37	36
5: 0-5: 11	100	93	86	79	72	66	59	53	46	39	38	38	38	38	38	37	37	37	37	37	37	36	36	36
6: 0-6: 11	100	93	86	79	72	65	58	52	45	38	38	38	38	37	37	37	37	37	36	36	36	36	36	35
7: 0-7: 11	99	92	85	78	71	64	57	51	44	37	37	37	37	37	37	36	36	36	36	36	36	35	35	35
8: 0-8: 11	97	90	84	77	70	63	56	50	43	37	37	37	37	37	36	36	36	36	36	35	35	35	35	35
9: 0-9: 11	94	88	82	75	69	62	55	49	43	36	36	36	36	36	36	35	35	35	35	35	34	34	34	34
10: 0-10: 11	91	85	79	73	67	61	54	48	42	36	36	36	36	35	35	35	35	35	35	34	34	34	34	34
11: 0-11: 11	88	82	76	71	65	59	53	47	41	35	35	35	35	35	35	34	34	34	34	34	33	33	33	33
12: 0-12: 11	85	80	74	68	63	57	52	46	40	35	35	35	35	34	34	34	34	34	33	33	33	33	33	33
13: 0-13: 11	82	76	71	66	61	55	50	45	39	34	34	34	34	34	33	33	33	33	33	32	32	32	32	32

[4]From this point to the end of the table it is to be understood that the figures apply only to cows which do not breed and consequently have greatly prolonged periods of lactation. For cows *ending* the lactation in earlier months the curve should be considered to drop abruptly to zero. For all ordinary purposes it may be assumed with quite sufficient accuracy that the mean percentage efficiency of a cow for the month in which her lactation ends is *one-half* the tabled figure for the same month in the above table.

TABLE 3.

Herd A. October 6, 1915.

Cow (or Heifer) No.	Is the cow milking now or dry?	When did she calve (freshen) last?	What is her age? (approximate).	Month of lactation.	Efficiency percentage (from Table 2).
1	Milking	January '15	6	9	46
2	Milking	December, '14	4	10	38
3	Milking	September, '15	11	1	88
4	Milking	March, '15	7	7	58
5	Milking	April, '15	7	7	58
6	Milking	January, '15	9	9	43
7	Milking	January '15	2	9	30
8	Milking	December, '14	2	10	27
9	Milking	February, '15	2	8	34
10	Milking	December, '14	2	10	27
11	Dry	October, '14	6	....	0
12	Dry	October, '14	5	....	0
13	Dry	April, '14	8	....	0
14	–	Heifer	1	....	....
15	–	Heiter	1	....	....
16	–	He fer	1	....	....
17	–	Heifer	1	....	....
18	–	Heifer	1	....	....
19	Milking	September, '15	3	1	89

Total cows and heifers in herd = 19. Total cows dry = 3.
Total cows milking = 11. Total heifers not yet freshened = 5.
Total cows which have borne calves = 14.
Average Efficiency Percentage for all cows which have borne calves=

$$\frac{46+38+88+58+58+43+30+27+34+27+0+0+0+89}{14} = \frac{538}{14} = 38.43\%$$

Average Efficiency Percentage for all cows now milking $= \frac{538}{11} = 49.00\%$.

Total lbs. milk production October 6, 1915 = 260.

Average per cow which has borne a calf $= \frac{260}{14} = 18.57$ lbs.

Average per cow now milking $= \frac{260}{11} = 23.64$.

Calculated total milk if herd were operating at 100 per cent. efficiency (on the basis of all cows capable of milking) $= \frac{26000}{38.43} = 676.6$ lbs.

Calculated total milk (on the basis of all cows now milking) $= \frac{26000}{49.00} = 530.6$ lbs.

Average per cow = 48.2 lbs.

TABLE 4.

Herd B. October 1, 1915.

Cow (or Heifer) No.	Is the cow milking now or dry?	When did she calve (freshen) last?	What is her age? (approximate).	Month of lactation.	Efficiency percentage (from Table 2).
1	....	Heifer	2	....	....
2	....	Heifer	2	....	....
3	Milking	September, '15	3	1	89
4	Milking	September, '15	2	1	73
5	Milking	November, '14	3	11	36
6	Dry	August '14	3	....	0
7	Dry	July, '14	3	....	0
8	Milking	December, '14	4	10	38
9	Milking	April, '14	6	18	37
10	Milking	September, '15	2	1	73
11	Milking	September, '15	3	1	89
12	Milking	September, '15	3	1	89
13	Milking	February, '15	6	8	53
14	Milking	April, '15	8	6	63
15	Milking	May, '15	8	5	70
16	Milking	March, '15	12	7	53
17	Milking	April, '15	12	6	57
18	Dry	October, '14	6	....	0
19	Dry	October, '14	3	....	0
20	Milking	September, '15	2	1	73

Total cows and heifers in herd = 20. Total cows dry = 4.
Total cows milking = 14. Total heifers not yet freshened = 2.
Total cows which have borne calves = 18.

Average Efficiency Percentage of all cows which have borne calves =

$$= \frac{89+73+36+0+0+38+37+73+89+89+53+63+70+53+57+0+0+73}{18} = \frac{893}{18} = 49.61\%$$

Average Efficiency Percentage for all cows now milking

$$= \frac{893}{14} = 63.79\%.$$

Total lbs. milk produced October 6, 1915 = 290.

Average per cow which has borne a calf $= \frac{290}{18} = 16.1$ lbs.

Average per cow now milking $= \frac{290}{14} = 20.7$ lbs.

Calculated total milk if herd were operating at 100 per cent efficiency (on the basis of all cows which have borne calves) $= \frac{29000}{49.61} = 584.6$ lbs.

Calculated total milk (on the basis of all cows now milking) $= \frac{29000}{63.79} = 454.6$ lbs.

Average per cow = 32.5 lbs.

From the above figures it is possible to make precise and definite comparisons between these two herds. We note, in the first place, that Herd B was operating with more than 10 per cent. greater efficiency at the time the records were made than was Herd A. Bringing both herds to the same basis of efficiency (100 per cent),[5] however, it is plain that *the cows in Herd A are much better cows than those in Herd B,* the average production per cow on the same efficiency of operation basis being about 16 lbs. per day higher in the former than in the latter. This is the fact. Herd A is one of the best herds of pure-bred Holstein Friesian cattle in the state, nearly every cow having an A. R. O. record. Herd B is only a fair average herd.

Table 2 has many uses besides that of herd comparison here illustrated. It may be used for the comparison of individual cows. It forms a much more scientifically accurate basis for the age correction of advanced registry records than do the rules of entry to advanced registry of any association in this country.

(c) ANALYSIS OF BILTMORE RECORDS.

This matter will be considered in a later section of this Report (cf. p. 26).

II. The Study of Inbreeding in Dairy Cattle.

During the past year the work on the theoretical side of this problem has been extended along two lines. The first[6]

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[5]Of course any other percentage could have been taken instead of 100. The essential thing is to compare *both* herds on the *same* percentage basis of operation efficiency. One hundred per cent is as good, and in some regards perhaps better than any other basis on which to make the comparison.

[6]Pearl, R. Studies on Inbreeding. VI. Some further considerations regarding cousin and related kinds of mating. Amer. Nat., Vol. XLIX, pp. 570-575, 1915.

deals with the results which may theoretically be expected to follow the continued mating of first cousins of different types, and also continued mating of the type uncle x niece. The second[7] has to do with a system of recording types of pedigrees in experimental or other breeding operations. This will chiefly be of use to those who are keeping precise records and breeding more or less along experimental lines. There has also been prepared a bulletin on the general subject, which is now in press[8].

With the very efficient aid of Mr. S. W. Patterson the study of inbreeding in Jersey cattle has been brought to completion and the results are now being prepared for the press. They give us for the first time a definite, comprehensive, and quantitative idea of the average degree of inbreeding prevailing in a race or breed of domesticated animals, at a particular time in the history of that breed. Because of the novelty and general interest of these results certain of them are here reproduced in Table 5 and Figs. 1-4 inclusive. The derivation and significance of coefficients of inbreeding have been explained in earlier publications[9] and need not be repeated here. For reasons which cannot be gone into here, but will be in the detailed publications, it is impossible in the case of cattle to arrive at an absolutely exact value of the mean inbreeding coefficients. What we can do is to determine upper and lower limiting values, between which the true, and undeterminable value lies. Such upper and lower limiting values are presented in Table 5. Recalling that the *higher* the value of a coefficient of inbreeding the *more intensely* the animal is inbred, we may turn our attention to Table 5 and the diagrams.

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[7]Pearl, R. A System of Recording Types of Mating in Experimental Breeding Operations. Science, N. S., Vol. XLII, pp. 383-386, 1915.

[8]Pearl, R. Further Data on the Measurement of Inbreeding. Me. Agr. Expt. Stat. Bull. 243, 1915.

[9]Cf. for example, Pearl, R. The Measurement of the Intensity of Inbreeding. Me. Agr. Expt. Stat. Bull. 215, 1913.

TABLE 5.

Showing Mean or Average Coefficients of Inbreeding for American Jersey Cattle, for both Random Samples of the General Population of both Sexes and Samples of the Animals in the Register of Merit.

Class or Group.	No. of pedigrees included in sample.	Mean Coefficients of Inbreeding.					
		Z^0 Parents.		Z^1 Grandparents.		Z^2 Great-grandparents.	
		Lower limit.	Upper limit.	Lower limit.	Upper limit.	Lower limit.	Upper limit.
1. General population (random sample) bulls..	67	0	0	1.87	1.87	5.41	5.41
2. Register of Merit bulls..................	63	0	0	1.59	1.59	5.36	5.62
3. General population (random sample) cows..	61	0	0	4.10	4.10	6.97	6.97
4. Register of Merit cows..................	63	0	0	0	0	2.98	2.98

Class or Group.	Mean Coefficients of Inbreeding.					
	Z^3 Great-great Grandparents.		Z^4 Great-great-great Grandparents.		Z^5 (Great)^4 Grandparents.	
	Lower limit.	Upper limit.	Lower limit.	Upper. limit.	Lower limit.	Upper limit.
1. General population (random sample) bulls...	11.01	11.21	19.59	20.79	29.48	32.77
2. Register of Merit bulls	14.88	15.91	23.32	28.39	30.28	43.99
3. General population (random sample) cows...	12.50	12.59	21.26	21.89	31.53	33.82
4. Register of Merit cows	9.23	9.42	15.33	16.27	24.63	28.53

Class or Group.	Mean Coefficients of Inbreeding.			
	Z^6 (Great)^5 Grandparents.		Z^7 (Great)^6 Grandparents.	
	Lower limit.	Upper limit.	Lower limit.	Upper imit.
1. General population (random sample) bulls	39.14	47.93	46.07	63.12
2. Register of Merit bulls.................	34.80	62.03	37.07	77.77
3. General population (random sample) cows	41.03	48.18	47.56	63.10
4. Register of Merit cows.................	33.12	44.06	39.22	61.45

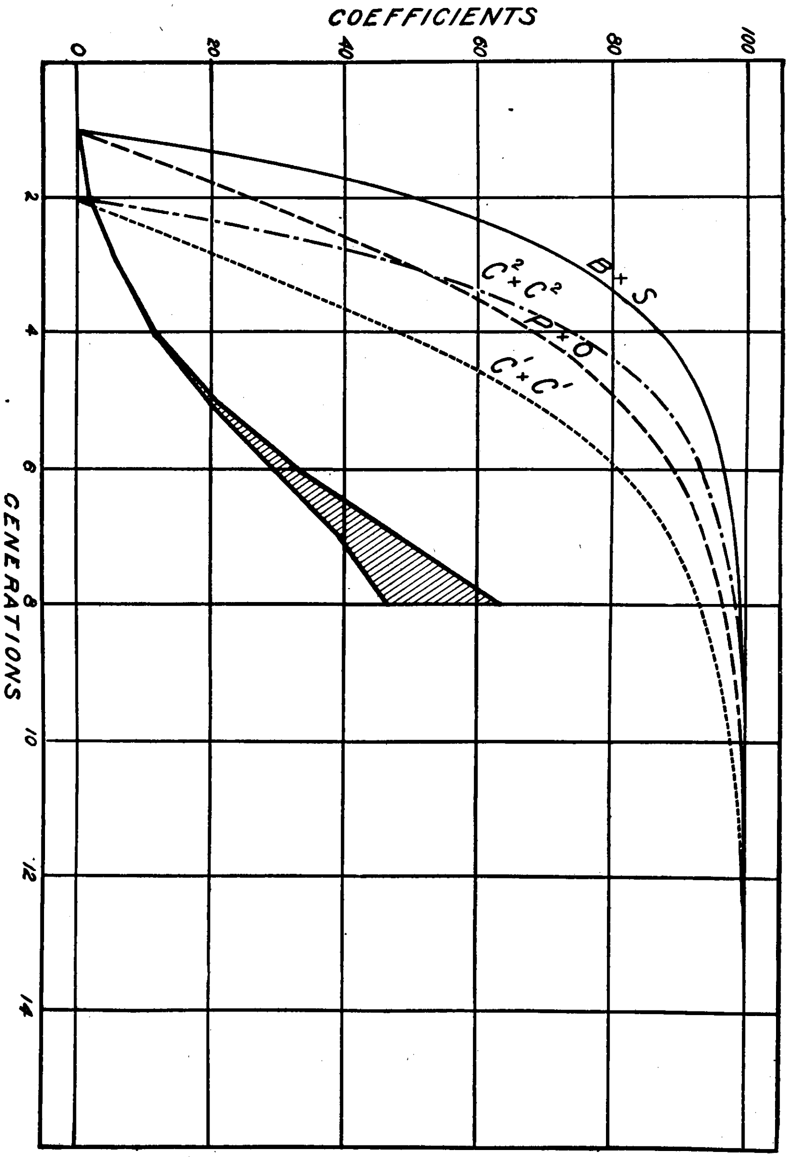

Fig. 1. Diagram showing the inbreeding curves for a random sample of the general population of American Jersey bulls. The two heavy lines give the upper and lower limiting values for the successive mean inbreeding coefficients. The true value of the curve lies somewhere in the ruled area between these heavy lines. For comparison the curves for continued brother × sister (B × S), parent × offspring (P × O), and first cousin × first cousin breeding are included. $C^1 \times C^1$ denotes single cousin matings, and $C^2 \times C^2$ double cousin matings.

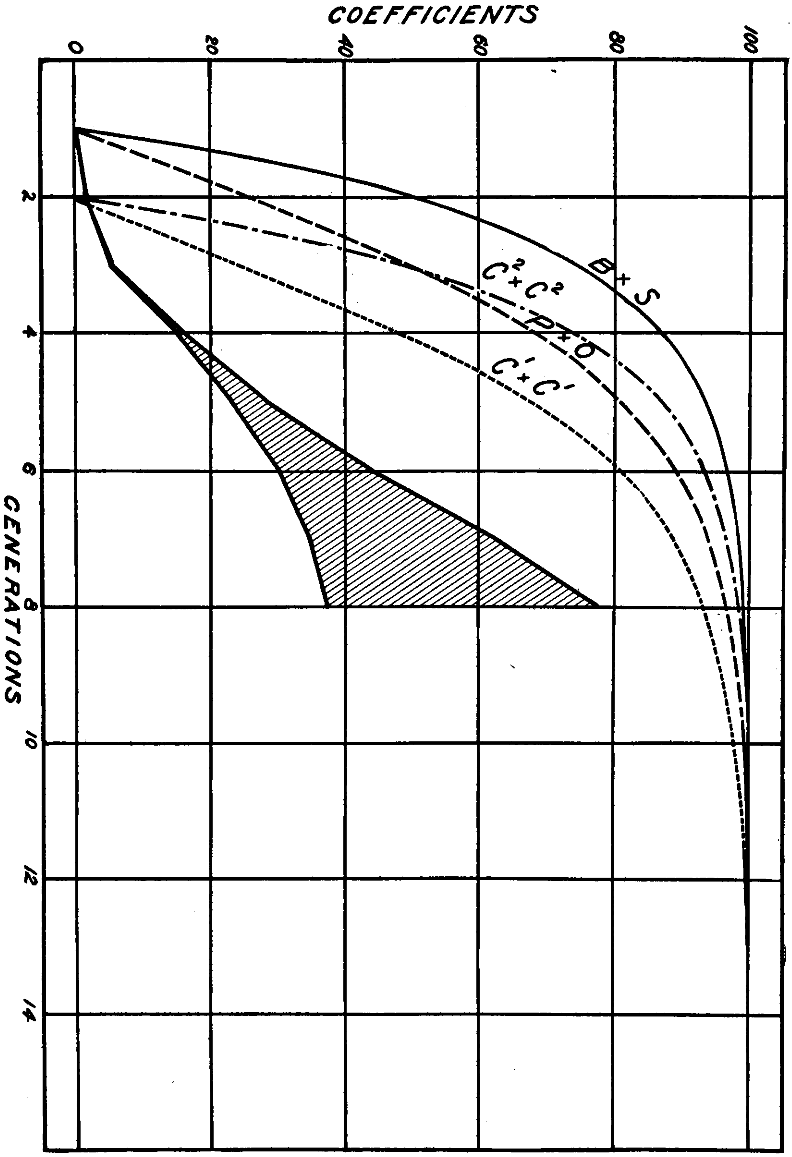

Fig. 2. Diagram showing the inbreeding curves for a sample of Register of Merit Jersey bulls. The lines have the same significance as in Fig. 1, *q. v.*

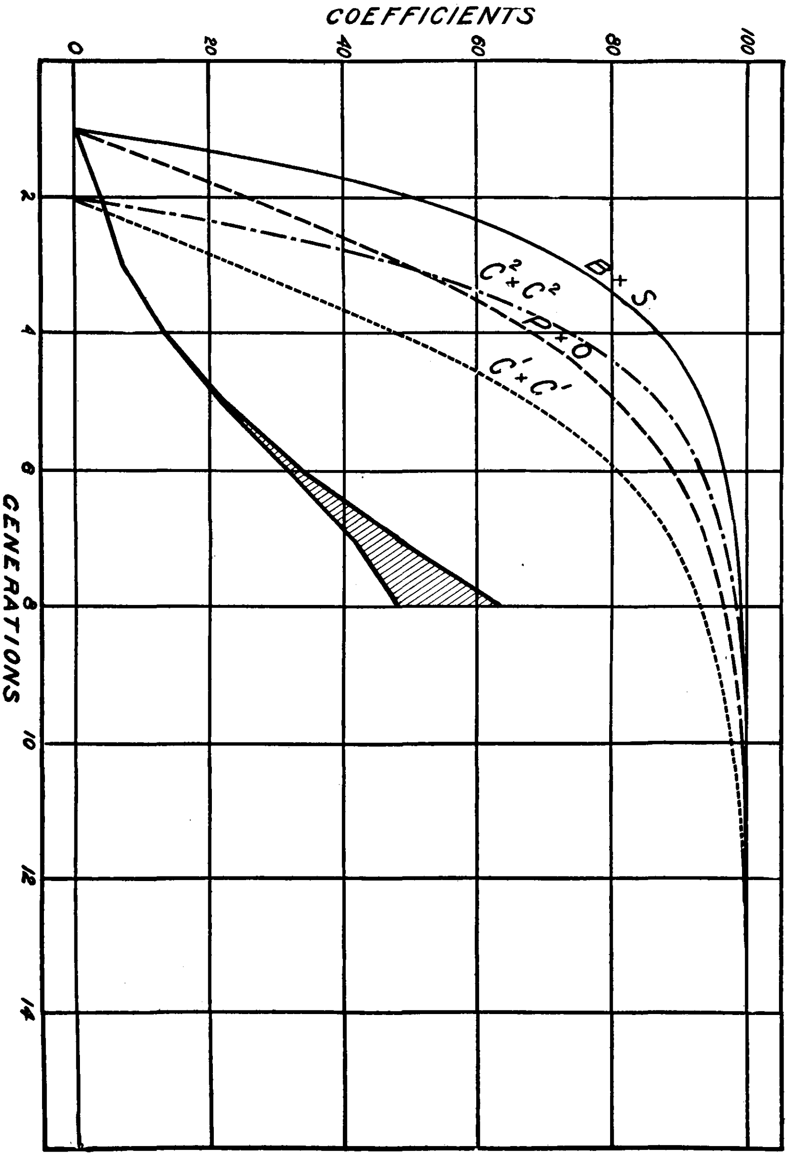

Fig. 3. Diagram showing the inbreeding curves for a random sample of the general population of American Jersey cows. The lines have the same significance as in Fig. 1, *q. v.*

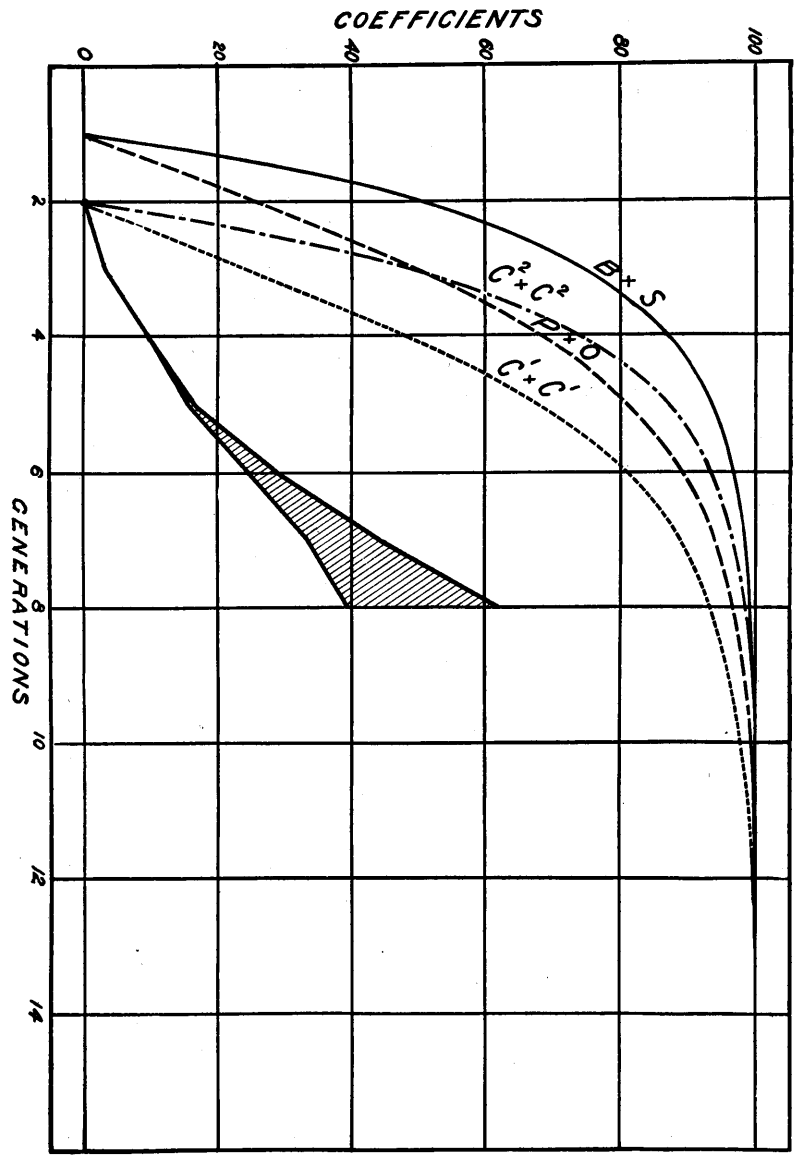

Fig. 4. Diagram showing the inbreeding curves for a sample of Register of Merit Jersey cows. The lines have the same significance as in Fig. 1, *q. v.*

For an analysis of Jersey inbreeding records two results, among others, stand out with particular clearness and significance. These are:

1. That American Jersey cattle at the present time, may be said in general and on the average to be about one-half as intensely inbred, when account is taken of the eighth ancestral generation, as would be the case if continued brother $\times$ sister breeding had been followed. The *form* of the inbreeding curve is, however, very different in the two cases, the brother $\times$ sister curve being concave to the base line throughout, while the actual Jersey curves tend to have their principal curvature convex to the base.

2. That, in general and on the average, Register of Merit animals are *less* intensely inbred than the general population of Jersey cattle.

A detailed report of the work on inbreeding in Jerseys will be published shortly. The above notes are intended to be merely of a preliminary character.

III. Cooperative Cattle Breeding Records.

During the past year this project has gone forward smoothly and satisfactorily. We are accumulating a unique and extremely valuable collection of data regarding many problems in the physiology of cattle breeding. Some of the original cooperators have, of course, dropped the work during the year, for various good reasons. A substantial group of progressive breeders have remained faithful to the project and sent in carefully made records with unfailing regularity.

At this time we wish to take occasion again to thank most heartily the breeders who have so kindly cooperated in this work. We realize that it is some trouble to the breeder to fill out these blanks and that when he does it, it is without any thought of immediate personal gain, but from the altruistic motive of helping along the general knowledge of the laws of breeding in dairy cattle. We are extremely grateful to those who are helping us.

We are always glad to add new cooperators to this list. Anyone interested in taking up the work, whether a resident of Maine or some other part of the country, should communicate with the writer of this Report. It is expected that the collection of breeding records will be continued for at least one more year.

It appears desirable at this time to present brief statements regarding certain of the results which have been reached from the study of these records. This is done in Section IV of this Report. Detailed publication will follow in due time in another place.

IV. Physiology of Cattle Breeding.

Here we shall consider certain topics based in part upon the cooperative breeding records, and in part upon other studies.

1. The normal duration of heat (oestrum) in cattle.

The cooperative breeding records furnish extensive data bearing upon this point. Table 6 shows for various breeds the number of hours which elapsed between (a) the time when the breeder observed that the cow was in heat and (b) the time when she was served by the bull. *All* of the services recorded in this table were successful, i. e., the cow became pregnant as a result of the recorded service, and either carried the calf to term, or aborted at some time before term.

TABLE 6.

Showing for Various Breeds of Cattle the Time in Hours between the Observance of Heat and the Successful Service of the Cow.

Breed.	Lapsed Time in Hours.																																									
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	Totals.
Jersey Grade	5	17	10	23	18	11	9	9	3	6	6	7	2	6	1	3	2	1	..	2	..	1	2	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	145
Guernsey Grade	6	5	7	11	7	8	6	8	7	3	..	3	4	5	4	5	2	..	..	1	2	4	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	1	100
Ayrshire Grade	..	4	7	8	3	3	3	2	1	4	2	..	1	..	2	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	41
Holstein Grade	20	22	22	32	13	19	11	16	11	6	9	12	10	6	5	5	1	..	..	..	1	..	..	..	..	..	..	1	2	..	..	..	..	1	..	..	..	..	..	..	..	..	225
Shorthorn Grade	2	..	..	1	1	1	1	2	3	1	1	1	1	2	1	1	..	2	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	22
Pure-bred Jersey	13	10	9	11	8	8	5	4	..	6	2	4	3	2	2	..	2	..	..	..	..	1	..	..	2	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	93
Pure-bred Guernsey	4	5	2	4	2	..	3	..	1	3	..	1	1	1	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	28
Pure-bred Ayrshire	4	7	9	6	7	3	1	2	..	..	1	..	1	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	42
Pure-bred Holstein	13	3	5	9	5	6	4	14	4	3	3	5	1	1	2	3	..	1	..	1	..	3	..	1	2	..	..	..	1	..	1	..	..	..	..	..	..	..	..	..	..	..	91
Other known breeds	3	3	1	4	1	..	3	2	1	2	..	3	..	2	..	..	1	..	..	1	..	..	1	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	29
Breed not known	2	3	1	4	..	2	1	1	1	1	..	..	..	1	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	18
Totals	72	79	73	113	65	61	47	60	32	35	24	36	24	26	17	18	8	4	..	6	3	9	4	1	8	1	..	1	4	..	1	..	..	1	..	..	..	..	..	..	..	1	834

From this table the following constants are deduced: *Average* number of hours from

Discovery of heat to service	=	$6.357 \pm .134$ hrs.
Standard deviation	=	$5.737 \pm .095$ hrs.
Coefficient of variation	=	90.25 per cent.

From the above data it appears that:

1. Successful fecundation of the cow may occur as many as $41 + x$ hours after the onset of heat. What the value of x in this expression is, is not entirely clear, but the available evidence indicates that it is small.

2. While in an isolated instance successful service after so long a time as 41 hours may occur, we see from Table 6 that, in general, the vast majority of successful services occur at much shorter time intervals than this after the discovery of heat. Thus over 79 per cent of these 834 successful services occurred within 10 hours after the discovery of heat. The inference from this table is plainly that if one wishes to be sure of getting a cow with calf it is not wise to postpone service much beyond 10 hours after the cow is known to be in heat.

3. There appear to be no significant differences between the distributions for the different breeds.

Further work on this subject, in which successful and unsuccessful services will be compared, is now in progress.

2. THE LENGTH OF TIME A BREEDING COW IS DRY.

One of the points on which the cooperative record blanks furnish data is as to the time each cow is dry prior to calving. Two important factors are involved here: one, the normal duration of lactation, which varies from individual to individual and is probably a matter of inheritance in large part; the other, the method of managing and feeding the animals. Some progressive dairymen aim to keep a cow continuously milking, never letting her go dry, but keeping her in good physical condition by appropriate feeding. It is of interest to examine statistically the facts regarding this matter from the herds of something like 150 of the most progressive dairymen in Maine. The data for 712 cows are given in Table 7.

TABLE 7.

Showing the Time (in days) during which Cows were Dry before Calving.

Days Dry.	Frequency.	Percentage Frequency.
0-39	205	28.79
40-79	408	57.30
80-119	65	9.14
120-159	28	3.93
160-199	4	.56
200-239	2	.28
Total	712	100.00

From this table we have the following constants:

Average number of days dry = $56.404 \pm .744$
Standard deviation in number of days dry = $29.410 \pm .526$
Coefficient of variation = 52.14 per cent.

It thus appears that on the average these cows were dry about 4 days short of two months. Only about 14 per cent of them were dry more than 79 days. On the other hand about 29 per cent were dry less than 40 days. Cows dry four, five, and six months can scarcely be profitable. There must be a very strong reason for desiring a calf from a particular cow to warrant carrying her dry in the herd for a long period of time.

3. THE AGE OF BREEDING STOCK.

The age of the animal is an important factor in many problems of cattle breeding. For example, as has been pointed out already (p. 2), the milk production of a cow changes with age in a definite way. This means that the profitable limits of age of a cow as a milker can be determined with precision. What is the composition of the average herd with reference to the age of the cows composing it? Is it in major part made up of cows at their most productive ages?

Again the question of age is of direct importance in any comprehensive scheme of herd improvement by breeding. No principle of genetic science appears to be more solidly grounded than that progeny performance is the only sure test of breeding worth. But if a herd bull is disposed of before any of his progeny have reached an age where their performance as milkers, for example, can be measured, then clearly this guiding principle of progeny test is playing no part in the breeding of the herd. Without this principle in active operation the breeder is in much the circumstances of a mariner without a compass. Progress towards a desired goal is *possible,* but it is likely to be by a very roundabout and haphazard route, and is sure to be very slow.

It is a matter of considerable interest to examine statistically the age of breeding cattle in the hands of progressive Maine farmers and breeders. Data on this point are presented in Table 8. It should be noted particularly that all ages recorded in this table are the ages of the animals *at the time when they were bred successfully.* Each entry in the table is based upon what we call a "completed record." Such a completed record comprises, on the one hand, a service record, and on the other hand a birth record, which sets forth the facts regarding the calf born as a result of the service accounted for on the service record. The ages tabled here are the ages at the time of service.

The more important biometric constants from this table are shown in Table 9.

TABLE 8.

Showing the Age in Years of Cattle Used as Breeders.

Age in years.	*a.* Bulls Used as Breeders.		*b.* Cows Which Have Dropped One or More Calves.		*c.* Heifers Bred for Their First Calves.		*d.* All Females (*b* + *c*).	
	Absolute frequency.	Percentage.	Absolute frequency.	Percentage.	Absolute frequency.	Percentage.	Absolute frequency.	Percentage.
1	213	22.03	4	.56	69	41.57	73	8.31
2	252	26.06	83	11.66	92	55.42	173	19.93
3	209	21.61	138	19.38	5	3.01	143	16.29
4	149	15.41	101	14.19	...	...	101	11.50
5	52	5.78	80	11.24	...	...	80	9.11
6	53	5.48	69	9.69	...	...	69	7.86
7	24	2.48	66	9.27	...	...	66	7.52
8	8	.83	44	6.18	...	...	44	5.01
9	3	.31	44	6.18	...	...	44	5.01
10	...	...	33	4.63	...	...	33	3.76
11	...	...	22	3.09	...	...	22	2.51
12	4	.41	13	1.83	...	...	13	1.48
13	...	...	9	1.26	...	...	9	1.03
14	...	...	...	...	...	...	...	...
15	...	...	2	.28	...	...	2	.23
16	...	...	2	.28	...	...	2	.23
17	...	...	1	.14	...	...	1	.11
18	...	...	1	.14	...	...	1	.11
Total	967[10]	100.00	712	100.00	166	100.00	878[10]	100.00

[10] The reason for the discrepancy between these two figures lies in the fact that on 89 out of the 967 blanks there was a failure on the part of the breeder to record the *cow's* age.

TABLE 9.

Showing the Chief Physical Constants for Variation in Age of Breeding Cattle.

Constant.	*a.* Bulls used as breeders.	*b.* Cows which have dropped one or more calves.	*c.* Heifers bred for their first calves.	*d.* All females (*b* + *c*).
Mean or average age	2.921 ± .037 years	5.553 ± .075 years	1.614 ± .024 years	4.809 ± .070 years
Median age	2.589 ± .047 years	4.875 ± .093 years	1.652 ± .030 years	3.975 ± .087 years
Third quartile age	3.844 ± .047 years	7.242 ± .093 years	2.103 ± .030 years	6.765 ± .087 years
Standard deviation	1.722 ± .026 years	2.952 ± .053 years	.462 ± .017 years	3.080 ± .050 years
Coefficient of variation	58.94 ± 1.18%	53.16 ± 1.19%	28.64 ± 1.14%	64.05 ± 1.39%

These tables present a number of points of interest to the breeder of cattle. We note:

1. The average age of the herd bulls used to sire the 967 calves included in the statistics was just under three years. The median age of these herd bulls was approximately two and a half years. This means that one-half of the calves were sired by bulls *under* two and a half years old at time of service. Seventy-five per cent of all the calves (as shown by the third quartile age) were sired by herd bulls less than about three years and nine months old at time of service. Less than 15 per cent of the calves were sired by bulls five or more years old. Let us consider for a moment what these facts mean. A bull must be at least three years old before the breeder can possibly have had any opportunity to test the milk producing capacity of his daughters. *But 58.9 per cent of all the calves covered in these statistics were sired by bulls under three years of age.* In other words, in the breeding operations of a large number of Maine's most progressive and wide-awake breeders (for such the cooperators in this record scheme are) more than half of the calves produced in a given interval of time are sired by bulls about whose ability to transmit milking qualities absolutely nothing definite can by any possibility be known. It is doubtless entirely fair to assume that essentially the same conditions regarding cattle breeding methods obtain in other places generally. Is it remarkable that progress is so slow?

2. In the female half of the herd the conditions are better. We see that if we exclude heifers bred for their first calves, the average age of the breeding cows is approximately five and a half years. This is an age when, on the average, cows are nearly if not quite at their best as regards milk production.

3. Out of 878 calves 166, or 18.9 per cent were the first calves of heifers. The average age of these heifers when successfully served for these first calves was approximately one one year and seven months. Three-quarters of the heifers were successfully served for their first calves before they were 2.1 years old.

4. THE RELATION OF THE TIME OF SERVICE TO THE SEX RATIO IN CATTLE.

One of the primary purposes for which the cooperative cattle breeding record plan discussed in the preceding sections was undertaken was to get comprehensive statistics to show whether any definite effect on the proportion of male and female calves born could be observed when service occurred at different times in the heat period. Work done at the Station some years ago suggested that when service occurred very early in heat there was likely to be born a larger proportion of heifer calves, and when service occurred very late in heat there was likely to be born a larger proportion of bull calves. With the hope of getting a very much larger amount of more precise data on this point, and demonstrating whether the suggestion of the earlier results was correct or not, the cattle breeding record plan was inaugurated.

A considerable mass of material on this point has accumulated, but it is thought desirable to wait until another year's records are in hand before reporting further in regard to the matter.

5. CYSTIC DEGENERATION OF THE OVARIES.

During the past year there has been published the results of the study[11] of an interesting case of a fairly common cause of sterility in cows. A pure-bred registered Ayrshire cow, named Dorothy of Orono (23010), belonging to the University of Maine, produced three calves, on dates an follows: September 17, 1909, September 10, 1910, February 24, 1912. When 3 years and 327 days old Dorothy of Orono was started on an official milk test of one year, which she completed with a record of 11463 lbs. of milk, carrying 417.71 lbs. of butter fat. For this record she was entered as No. 426 in the Ayrshire Advanced Registry. Her complete lactation record is shown in Table 10.

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[11]Pearl, R. and Surface, F. M. Sex Studies. VII. On the Assumption of Male Secondary Characters by a Cow with Cystic Degeneration of the Ovaries. Me. Agr. Expt. Stat. Ann. Rept., 1915, pp. 65-80.

TABLE 10.

Lactation Record of Dorothy of Orono.

Lactation Periods.	Days in milk.	Pounds of milk.	Pounds of fat.	Remarks.
Sept. 21, 1909--Aug. 4, 1910	316	7,840.6	293.62	
Sept. 11, 1910--Nov. 25, 1911	440	12,426.4	450.75	Lactation in which Advanced Registry record was made.
Feb. 26, 1912--Mar. 24, 1913	391	7,016.8	253.92	Cow was sick for some time during this period.

After March 24, 1913, the cow never gave any milk. The udder rapidly shrunk to a very small size and the animal began to show the external characteristics of a bull. This change was very slight at first but soon became much more marked. *After a lapse of 8 months the general external appearance and the behavior of the cow were like those of a bull to a remarkable degree.* The neck had become thickened in its posterior parts, and had developed a well marked crest, as is characteristic of a bull. If the cow had been so screened that only her forequarters and neck were visible any observer would have unquestionably pronounced her a male. The assumption of male characters in these regions was complete and perfect. In the hind-quarters the change from characteristic female conformation in the male direction, while less striking than in the anterior parts, was still clearly evident. The udder shrunk away to a very small size. The hips and rump took on the smooth rounded, filled-out appearance which is characteristic of the bull but not of the cow.

The cow was slaughtered on February 18, 1914. Autopsy showed as the only gross abnormality a simple cystic condition of the ovaries. Under the microscope these cystic ovaries differed from the normal cow's ovary in but one essential respect, namely that they had no corpora lutea.

A corpus luteum, or yellow body, is a peculiar cellular structure which forms in the ovaries of animals which give milk, where an ovum has been discharged. This yellow body pours into the blood a chemical substance, which is known to have the function (1) of preventing the ovary from discharging any more ova, and (2) of preventing the animal coming in heat during the course of pregnancy.

The case described presents for consideration certain definite and clear-cut results bearing on the problem of secondary sex characters. This cow had been a perfectly normal female and had performed all the reproductive functions, both primary and secondary, of the sex. It later assumed certain of the secondary characters of the male, both in respect of structure and behavior, with perfect definiteness, and, so far as the characters concerned go, completeness. The outstanding, and so far as could be determined the only significant, anatomical and physiological difference between the ovaries of this abnormal cow and those of a normal one, consists in the fact that the former lacked any of the tissue normally composing the yellow bodies or corpora lutea.

Cystic degeneration of the ovaries is one of the commonest causes of sterility (failure to breed) in cattle. No cure for it has been discovered up to this time, except a form of surgical interference, which has been reported from Switzerland as successful in a percentage of cases when applied by a skilled veterinarian. This is, however, not a practical treatment for the ordinary farmer. The results of the present study suggest, as worthy of trial, the administration of corpus luteum substance as a therapeutic measure in these cases of cystic degeneration. There is some reason to believe that if the case were not of too long standing a cure might be affected by this means. It must be understood that in the light of present knowledge this is merely a suggestion, *and is not put forth as a guaranteed cure in any sense of the word whatever.* It would, however, seem worth a trial. The use of this material for somewhat analogous conditions in human medicine has met with marked success in some cases.

Some experiments along the line suggested are being carried on at the present time.

V. The Inheritance of Milk and Butter Fat Producing Ability.

Work on this line has proceeded during the year along the two general divisions outlined in earlier reports, viz. (a) the analysis of existing records, and (b) breeding experiments along Mendelian lines.

(a) ANALYSIS OF MILK PRODUCTION RECORDS.

In this direction the outstanding event of the year is the transference and analysis of the production records of the Biltmore Farms herd, of Biltmore, N. C. Through the kindness of the manager, Dr. A. S. Wheeler, we were given permission to copy and make any use we wished of the records of production of this remarkable herd of registered Jersey cattle. In January, 1915, Mr. John W. Gowen, then a member of the staff of the Department of Biology, went to Biltmore and transcribed the records. In this work every facility was accorded him by Dr. Wheeler, to whom we desire to extend our heartiest thanks for this aid. After returning to the laboratory Mr. Gowen spent the remainder of the academic year in the reduction of these records. As a result of his very efficient and painstaking labors we have now in shape for study probably the most complete and satisfactory set of records for the study of the inheritance of milk production anywhere in existence. They are far superior to advanced registry records because they include records not alone of the good cows, but of *all* cows, good, bad, and indifferent.

(b) MENDELIAN EXPERIMENTS WITH CATTLE.

As has been pointed out in earlier reports definite cross-breeding experiments, carefully controlled, are absolutely essential to the study of the problem of the inheritance of milk production. The experiments along this line with the herd of the University of Maine are proceeding satisfactorily, if of necessity somewhat slowly. In due time we hope to have a considerable number of animals in the cross-breeding experiments from which may be tested, by Mendelian methods, the way in which milk and butter fat production are inherited when a high producing and a low producing breed are crossed together.

Table 11 gives a conspectus of the animals which have so far been born in the Mendelian herd.

Calves which have been Produced in Cross-breeding Experiments to December 1, 1915. F_1 Generation.

Calf No.	Sex.	Dropped.	SIRE'S NAME AND REGISTRY NUMBER.	Breed of Sire.	DAM'S NAME AND REGISTRY NUMBER.	Breed of Dam.
0	♂	March 28, 1914	Lakeland's Poet (102603)	Jersey	Delva Johanna De Kol (146774)	Holstein-Friesian
1	♀	April 5, 1914	Lakeland's Poet (102603)	Jersey	Pauline Posch (81048)	Holstein-Friesian
2	♀	November 22, 1914	Delva's University De Kol	Holstein-Friesian	Canada's Creusa (44386)	Guernsey
3	♂	December 10, 1914	Johanna Lad Manor De Kol	Holstein-Friesian	Flora's Golden Poetess (264927)	Jersey
4	♂	January 20, 1915	Taurus Creamelle Hengerveld (98482)	Holstein-Friesian	Rosalie (4887)	Jersey
5	♂	January 24, 1915	Kayan (167617)	Aberdeen-Angus	Dot Alaska (29353)	Ayrshire
6	♂	February 8, 1915	Taurus Creamelle Hengerveld (98482)	Holstein-Friesian	Maple Grove Netta (29307)	Ayrshire
7	♂	February 13, 1915	Kayan (167617)	Aberdeen-Angus	Ruth 8th (4457)	Jersey (M. S. J. H. B.)
8	♂	March 23, 1915	Kayan (167617)	Aberdeen-Angus	College Creusa (25661)	Guernsey
9	♂	March 26, 1915	Kayan (167617)	Aberdeen-Angus	Pauline Posch (81048)	Holstein-Friesian
10	♂	April 7, 1915	Kayan (167617)	Aberdeen-Angus	Creusa of Orono 3d (34228)	Guernsey
11	♀	April 21, 1915	Lakeland's Poet (102603)	Jersey	Delva Johanna De Kol (146774)	Holstein-Friesian
12	♀	April 22, 1915	Taurus Creamelle Hengerveld (98482)	Holstein-Friesian	College Gem (40037)	Guernsey
13	♂	May 4, 1915	Columbia's Fox (126386)	Jersey	Eventime 4th (155526)	Aberdeen-Angus
14	♂	June 6, 1915	Taurus Creamelle Hengerveld (98482)	Holstein-Friesian	Flying Fox's Flora (274051)	Jersey
15	♀	October 23, 1915	Lakeland's Poet (102603)	Jersey	Hearthbloom (147141)	Aberdeen-Angus
16	♀	October 27, 1915	Kayan (167617)	Aberdeen-Angus	College Ruth (4895)	Jersey (M. S. J. H. B.)
17	♂	November 8, 1915	Kayan (167617)	Aberdeen-Angus	Rue Victoria (273096)	Jersey

The heifer No. 1 has been bred to the bull No. 0, to produce an F_2 calf. The other F_1 heifers will be bred as soon as they are old enough.