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1906

BEING THE

ANNUAL REPORTS

OF THE VARIOUS

Departments and Institutions

For the Year 1905.

VOLUME I.

AUGUSTA
KENNEBEC JOURNAL PRINT
1906

General View of Buildings, University of Maine, Orono.

AGRICULTURE OF MAINE.

FOURTH ANNUAL REPORT

OF THE

COMMISSIONER OF AGRICULTURE

OF THE

STATE OF MAINE.

1905.

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DEPARTMENT OF AGRICULTURE.

To the Honorable Governor and Executive Council of Maine:

In compliance with chapter 204 of the public laws of 1901, I herewith submit my fourth annual report as Commissioner of Agriculture of the State of Maine, for the year 1905.

A. W. GILMAN, *Commissioner.*

Augusta, January 1, 1906.

ANNUAL REPORT OF THE COMMISSIONER OF AGRICULTURE.

A report of the progress and welfare of the farmers of our State should be of general interest. If it be true that "the farmer feeds the world," then the interests of the farmer are closely related to those of every other class of our citizens, and it is a matter of importance to every one that he be encouraged to keep up the food supply in all its variety, increasing the quantity and improving the quality, at a minimum cost to himself and a reasonable price to the consumer.

We are gratified to be able to state that a good degree of success has attended the efforts of the farmers of Maine during the year 1905, and the work of this department in their behalf.

The United States Secretary of Agriculture, in his report for the past year, states: "Another year of unsurpassed prosperity to the farmers of this country has been added to the most remarkable series of similar years that has come to the farmers of any country in the annals of the world's agriculture. Production has been unequalled; its value has reached the highest figure yet attained. Farm crops have never before been harvested at such a high general level of production and value."

The farmers of Maine have enjoyed a fair share of this prosperity. Maine is undoubtedly destined to be the agricultural section of the East. Her soil and her climate are in her favor. The farmers are becoming awakened to the possibilities of our agriculture. There never has been a time in the history of the State when the agricultural people were so thoroughly alive to the development of our agricultural resources as at present.

Many factors are at work along the line of the development of agriculture in Maine. The Experiment Station, which stands ever ready to explain any new proposition along the line of the farmer's work which may be presented to it, and to assist the farmer in every way possible, has done and is doing a great work in the solving of these all important agricultural questions. That great organization, the Grange, whose leading purpose is and always has been the advancement of agriculture and the farmer's home, has done much to instruct and encourage the farmers of Maine. The press of the State has always been loyal to this great industry.

It is true that there are obstacles to be surmounted by the farmer in his pathway to success. The difficulty of obtaining farm labor and the high price necessary to secure it, the close competition and resulting small margins in many lines of production, the continuous labor and constant care required on the farm, are a source of discouragement to those who have but little interest in or taste for this line of work. But with a love for and a thorough knowledge of the business, a careful study of economy in production and close attention to details, we believe that the farmer in Maine may receive satisfactory returns for his labor, and that farm life in our rural communities, with its present advantages and its broad field of opportunities, offers many inducements.

The methods employed by the farmer are changing somewhat to suit the demands of the time. More extensive and intensive cultivation is being practiced. More land is under the plow than five years ago, and the farmers are tilling more intensively. The question of thorough cultivation has been presented by distinguished speakers who have been brought into the State for institute work and by our own men in such a manner that the seed has been sown broadcast over the State, and the famers are seeing more clearly than in former years that they can only get the best results by the most thorough cultivation. The work done by teams and by machinery is being increased. The problem of farm labor is such a serious one that the brightest men are devoting their attention to improving the present farm machinery and inventing new machines, to meet the new conditions placed upon the farmer. We trust that in this way this difficult problem will find a partial solution, and that farmers may be able to increase their operations with but a small increase of manual labor.

FARM CROPS.

The season of 1905 was favorable to the production of nearly all crops, and good prices for farm products have generally prevailed. On the whole, the tiller of the soil has been blessed and his labors have proved remunerative.

The hay crop of the State was above the average in quantity and of excellent quality in most sections. The grain crop was largely increased from 1904. While the average yield of potatoes per acre was not equal to that of the previous year, the drought affecting the crop quite seriously in some sections, yet with the large acreage and the comparative freedom from rust and rot, the number of bushels of potatoes raised in the State will not be greatly reduced from that of the preceding year. The phenomenal prices which prevailed during the spring of 1904 are not likely to be repeated; still, potatoes are selling at a fair price, and indications are that the farmers will receive good returns for this important crop.

The apple crop on the whole was light. This was undoubtedly due largely to the severity of the winter, many trees being winterkilled, and to the fact that the large crop of 1904 in orchards not sufficiently cultivated and fertilized to produce heavily every year greatly reduced the crop of the succeeding year. In some localities, however, quite large quantities were harvested, and the high prices at which they have sold will give a fair revenue from this crop.

The season was more favorable to the maturing of the corn crop than for several years past and the returns received by the farmers from the canning factories are largely in excess of those of the past two or three years.

Experiments in the raising of alfalfa have been carried on by some of our progressive farmers, in one or two instances with quite a marked degree of success. While we do not advise the farmers of Maine to engage in the culture of this crop to any great extent, yet we trust that experiments in this line will continue to be carried on, and that this valuable forage plant may find a place in our agriculture, especially on lands that are too dry for the profitable growing of our common grasses. Japanese millet is also receiving some attention, some of our farmers finding it a valuable crop for soiling and silage purposes.

DOMESTIC ANIMALS.

We believe our live stock industry is in a prosperous condition, notwithstanding the fact that the report of the State Board of Assessors shows a decrease in numbers in several classes of our farm animals. It is our opinion that this is due largely to temporary conditions, and that our farmers as a rule are not losing sight of the importance of stock husbandry in connection with their other farm operations.

We wish to strongly impress upon the farmers of Maine,—to write with indelible ink—the fact that stock husbandry must be continued and increased if we expect to reach the highest degree of agricultural success that this grand old State is capable of yielding.

It is an encouraging feature of the situation that the reports from the creameries show that there is an increase in the amount of production per cow. The United States Census Report for 1900 credits Maine with producing as much milk per cow as any state in the Union.

The impovement in the quality of our dairy products and in the methods employed by our dairymen, noted in our last report, has continued. The faithful, persistent efforts of the State Dairy Instructor, S. C. Thompson, are accomplishing much for this prominent branch of Maine farming. The high score received at the State Dairy Conference by the exhibitors of butter from the creameries and dairies was very gratifying.

Some new legislation was enacted at the last session of the legislature by which the duties and authority of the department in regard to the inspection of methods of manufacturing butter, the sampling of milk and cream at the creameries and the enforcement of laws relating to dairy products, were somewhat enlarged. The benefit from work in these lines is becoming apparent, as will be shown by the report of the Instructor.

We are pleased to note an increase in the number and value of horses in the State during the past year. We are still of the opinion that this industry offers opportunities to some of our farmers, in the raising of good family horses.

There is a still further decline in the number of sheep in the State, as reported by the local assessors to the State assessors. The present prices of wool and the meat products would indicate that the lowest mark must soon be reached in this industry, and that the attention of our farmers in the near future will be turned to this line of stock husbandry, which at present prices can undoubtedly be pursued to advantage on many of our farms.

Swine growing is not assuming the importance to which it is entitled. Swine in connection with the dairy, to utilize its waste products, is an industry which can be made to do much towards building up the farm, keeping up the fertility of the soil and increasing crop production; thus enabling the farmers to avoid largely the expense that most of them are taxing themselves with, in buying commercial fertilizers.

The poultry industry, in some sections of the State, has seemed to receive a new impulse. While poultry has in years past been one of the profitable branches of farming, in some localities there has recently been a marked increase in the interest manifested in this work. The exhibitions at some of our State Fairs were very encouraging, being large in numbers and representing all the improved breeds and the finest of individual birds. The exhibition held by the State Poultry and Pet Stock Association in Portland in December far exceeded in interest any which has been held in former years.

We have endeavored at the institutes to set forth the importance of this industry to the Maine farmer by furnishing lectures by some of the most successful poultry breeders in this country. As the total value of poultry and eggs produced in the State during the past year would approximate $2,500,000, we have felt justified in giving to an industry of this size considerable attention.

OUR FRUIT INTERESTS.

The fruit industry of the State is receiving more attention each year, and the extended report of the Pomological Society in this volume will be read with more interest than usual. Farmers are realizing that this crop requires as much care and cultivation as any of the farm crops; that the trees that bear the best crops and of the best quality are those that are thoroughly cultivated. Consequently we are raising better fruit and more of it. Maine is so well adapted to this branch of farming, her apples being surpassed in quality by those of no other state in the Union, that we believe the possibilities in fruit culture are not fully appreciated by many of our farmers. The same cultivation and fertilization given to our orchards as to any of our field crops will result in profits which will compare favorably with those derived from any other crop we produce. The orchardist, however, must be on the watch for insect and fungous enemies, and maintain a constant warfare against them. A serious menace to our fruit and shade trees which threatens to assume considerable proportions if we are not alive to the situation and prompt in our efforts to exterminate it, is the brown-tail moth. Early in the year it was found that this pest had spread over the southern portion of the State to an alarming extent. Through the efforts of the Pomological Society the matter was presented to the legislature and an act was passed appropriating $5,000 for the year 1905 and the same amount for 1906, for the protection of trees and shrubs from the introduction and ravages of dangerous insects and diseases. This fund was placed in the department of agriculture. Prof. E. F. Hitchings of Waterville was appointed State Entomologist and has devoted his whole time to the suppression of the brown-tail moth and other injurious insects, the inspection of nursery stock, and other work in this line. While that part of the appropriation which could be devoted to a warfare against the brown-tail moth was not sufficiently large to permit of actual work in the destruction of nests, every effort was made to arouse and instruct the people in relation to the danger threatening them, the necessity of immediate action in protecting their fruit and shade trees, and the best methods of exterminating this pest. Cities and towns were urged to make appropriations for the work. Some of the best men which could be secured were employed to carry on this campaign of education, and the interest manifested by the people throughout the infested district and the work accomplished have been very gratifying. The department in December published a bulletin giving a detailed account of this work and all items of expenditure.

The State Board of Trade early expressed a desire to co-operate with the department in suppressing this pest, and it has done much, through the local boards and individual members, to awaken an interest in the matter.

The destruction of such a vast number of nests must have a material effect in checking the inroads of this pest. But the work must still go on. Any relaxation of effort at this time will mean an influx with which we shall be unable to cope without vast expenditures. If the interest can be maintained, and every citizen will continue to look carefully after his own shade and fruit trees, we feel confident that it will be possible to keep under control this deadly foe to our fruit trees and forests. The experience of Massachusetts warns us that this must be a continuous warfare and that eternal vigilance must be the price of freedom from its ravages. Every fruit grower and every citizen of the State must feel the responsibility that rests upon him. The infestation is covering an increasing territory, and more attention will be needed in the year to come than in the year which has passed.

FARMERS' INSTITUTES.

The work of the farmers' institutes continues to show good results. During the past year the department has been especially fortunate in securing some very efficient institute workers. Fifty institutes have been held, divided among the different counties of the State. The same large attendance and good interest which have characterized these meetings during the past few years have continued. The farmers are becoming more alive to the advantages to be derived from these meetings, and there is a steady development in this line of work. A special effort is made to have the best scientific, as well as practical, agriculturists address the meetings and discuss all the practical farm questions with which the average farmer has to deal. This is a great school of instruction. The farmer can state his difficulties and failures directly to an expert, and listen to his explanation of the causes of the failure and his suggestion of remedies; and he is learning that he cannot afford to lose this instruction. The institutes have been held largely in connection with the granges in the places where they are located, and these have added much to their success. Requests for these meetings continue to be received at this office in increasing numbers.

The following speakers from out of the State have been employed: Prof. J. W. Sanborn, Gilmanton, N. H.; H. O. Hadley, Peterboro, N. H.; C. D. Richardson, West Brookfield, Mass.; H. E. Cook, Denmark, N. Y.; Forest Henry, Dover, Minn.; and Henry Van Dreser, Cobleskill, N. Y. We are also largely indebted for the success of these institutes to our Maine speakers.

Among the subjects which have been discussed are the following: Dairying, Poultry Culture, Crop Rotation, Extensive and Intensive Cultivation, Fertilizers, Swine Growing, Potato Culture, Diseases of Domestic Animals, Insect Pests, Clover as a Soil Renovator, Sanitary Barn Construction, Stock Breeding, Alfalfa Culture, the Development of our Agriculture.

We present in this report some of the addresses given at the farmers' institutes during the past year, which contain much that will be of interest and practical value to every farmer of the State.

AGRICULTURAL SOCIETIES.

The exhibitions held by the various agricultural societies of the State the past season were attended with more than usual success in most instances. The weather, an important feature in the financial success of a fair, was generally fine, and the attendance was large. The season having been a favorable one, the variety of farm crops which were displayed was great and the quality of the best. The number and character of farm stock exhibited were also gratifying. The fine specimens of the different breeds of live stock which were to be seen, especially at our State Fairs, were an object lesson of much value to the many farmers who attended them. The interest awakened in this way, and the education received by the farmer in comparing his stock with that of other exhibitors, the judging now being done largely by practical experts who are able to give accurate information as to the proper type and conformation of the animals, we believe is giving a new stimulus to the stock breeding industry of the State.

The managers of the fairs have shown a disposition to keep within the limits of the statutes, as a rule, and to emphasize the agricultural and educational features, thus making these exhibitions of more value to the farmer. We trust the farmers in the vicinity of the fairs will co-operate with the officers, bringing their stock and products for exhibition, and doing all in their power to the end that the greatest possible good may result.

The following figures show the business of these societies for 1905:

Number of horses and colts exhibited..........	1,652
Number of neat cattle exhibited................	6,008
Number of sheep exhibited.....................	1,093
Number of swine exhibited.....................	525
Number of poultry (coops) exhibited...........	3,118
Amount of premiums and gratuities awarded....	$24,402 25
Amount of trotting purses......................	20,716 73
Per cent of premiums and gratuities to total awards	55
Per cent of State stipend......................	36.37
Number of societies receiving stipend...........	44

THE WORK OF THE OFFICE.

The correspondence from the office has been very large during the past year. In addition to the usual lines, early in the season letters were sent to the officials of every town in the district infested by the brown-tail moth, calling attention to the great danger which threatened the State from this pest and the importance of immediate action; and urging them to present the matter to their towns and if possible secure appropriations for the work of extermination. A widespread interest in the matter of insect pests was awakened, and the number of specimens of insects which have been sent to the office and the letters of inquiry have been great.

In addition to the annual report and the quarterly bulletins, in which publications an increasing interest is manifested, various circulars and placards in relation to the brown-tail moth have been issued. These have been placed in the hands of town officials, school authorities, granges and other organizations, and have been distributed in the infested district.

AGRICULTURAL EDUCATION.

It gives us pleasure to be able to report a step in advance in the line of agricultural education. During the session of the last legislature the State Superintendent of Schools, at the request of the agricultural people, called together the president of the University of Maine and the principals of the state normal schools to discuss the feasibility of introducing the teaching of agriculture into our normal schools. The suggestions given at that meeting were received with a great deal of favor by the instructors in the normal schools, and in at least two of these institutions the teachers have entered heartily into the matter, and some of the sciences, as botany, geology and zoölogy, also bird study and nature study, are taught with special reference to agriculture; also, in the last term of the course agriculture is to be taught from a text book, even though this necessitates the setting aside of one branch which has formerly been taught. Something in this line is undoubtedly being done in all our normal schools, although detailed reports have been received from but two. We have every reason to believe that these schools will do more from year to year towards instructing the teachers of the State to teach agriculture more extensively. We trust this work will go steadily on until agriculture shall have a recognized place in every grade of our schools attended by rural pupils.

Agriculture is the noblest vocation of man, offering in its various branches more avenues to health, wealth and happiness than any other calling. The State furnishes money and schools to educate her sons and daughters and as many of them as desire it should certainly be educated along the line of this great industry, which is the basis of all others. A training in civil engineering or other mechanical arts is of much advantage, an education in some line of natural science is of great value, a classical education is grand, but agriculture is broader and more diversified, and to successfully follow this pursuit requires a wider intelligence, a more varied knowledge, than any other profession. It opens a field for the practical application of all of our natural sciences. It arouses the best that is in man, and brings him near to nature's heart.

A recent movement in some of the western states, in the forming of boys' agricultural clubs, is resulting in a general awakening of interest in agricultural lines, and seems to us worthy of note. In Illinois these clubs were first formed in connection with the farmers' institute, in an attempt to interest the people more largely in agriculture. Corn growing contests and similar competitions were instituted. At the St. Louis Exposition there was an exhibit of two large pyramids of pure bred corn, made up of 1,000 little pyramids, each of which contained twelve beautiful ears of white or yellow corn, grown by 8,000 farmers' boys of Illinois in contest. Through these agricultural clubs the boys have been made to observe more closely, and have met and solved some of the problems in the improvement of crops; they have also been encouraged to read good literature, their views have been broadened by contact with others, they have learned the value of organized effort, of coöperation and compromise, and the influence, not only upon them but upon the community, has been wholesome. This is one of the ways in which education in agriculture is being promoted in those western states. Agriculture can remain our leading industry only so long as we see to it that the children are educated in this all important branch.

LAWS RELATING TO AGRICULTURE.

There seems to be a general disposition on the part of the dealers to comply with the laws relating to agricultural products, which it is the duty of this department to enforce. Any violation which has been reported to us has received prompt and careful attention. The legislature of 1905 made some changes in existing laws and enacted some new legislation in these lines. We append the text of such of these laws as we think will be of special interest to the farmers of the State.

LAWS OF 1905.

An Act regulating the duties of the Commissioner of Agriculture relating to the manufacture and sale of Dairy Products and their imitations.

Be it enacted by the Senate and House of Representatives in Legislature assembled, as follows:

Section 1. Section nine of chapter sixty of the revised statutes is hereby amended by striking out the first paragraph of said section and inserting in the place thereof the following: 'The commissioner of agriculture shall inquire into the methods of making butter and cheese in creameries or cheese factories, together with the methods of taking, preserving and testing samples of milk and cream in the same, investigate all dairy products and the production thereof, and shall disseminate such information as will tend to produce a better quality thereof. He shall act for the state in the enforcement of the laws relating to the production, sale or manufacture of milk, oleomargarine or renovated butter;' so that said section as amended, shall read as follows:

'Section 9. The commissioner of agriculture shall inquire into the methods of making butter and cheese in creameries or cheese factories, together with the methods of taking, preserving and testing samples of milk and cream in the same, investigate all dairy products and the production thereof, and shall disseminate such information as will tend to produce a better quality thereof. He shall act for the state in the enforcement of the laws relating to the production, sale or manufacture of milk, oleomargarine or renovated butter; and for the above purposes he may employ chemists, agents and counsel, as may be necessary for the proper enforcement of such laws; and for such expenses there shall be appropriated a sum not exceeding five hundred dollars, to be allowed upon the approval of the governor and council upon the presentation of proper itemized vouchers.'

Section 2. He and his agents and assistants shall have access to all places of business, factories, buildings, carriages and cars used in the manufacture, transportation or sale of dairy products or imitations thereof, and to all vessels and cans used in the manufacture and sale of dairy products and their imitations. Whoever hinders, obstructs, or in any way interferes with the commissioner of agriculture, his agents, a milk inspector or other authorized officer in the performance of his duty shall be punished by a fine of one hundred dollars for the first offense and of two hundred dollars for each subsequent offense.

Section 3. This act shall take effect when approved.

An Act to regulate the sale of imitation Dairy Products.

Be it enacted by the Senate and House of Representatives in Legislature assembled, as follows:

Section 1. Section six of chapter one hundred and twenty-nine of the revised statutes is hereby amended by striking out the whole of said section and inserting in place thereof the following:

'Section 6. No person shall manufacture, sell, expose for sale or have in his possession with intent to sell, or take orders for the future delivery of any article, substance or compound made in imitation of yellow butter or cheese, and not made exclusively and wholly of cream or milk, or containing any fats, oil or grease not produced from milk or cream, whether said article, substance or compound be named oleomargarine, butterine, or otherwise named.'

Section 2. No person shall furnish oleomargarine in any hotel, restaurant or boarding-house, or at any lunch counter, to a guest or patron thereof, instead of butter, without notifying said guest or patron that the substance so furnished is not butter.

Section 3. No person shall sell or offer for sale to any person who asks, sends or inquires for butter or cheese, any substance or compound made in imitation of butter or cheese.

Section 4. No person shall sell, offer or expose for sale any renovated butter, unless the word 'renovated butter' shall be conspicuously and plainly stamped, labeled, or marked, so that said words cannot be easily defaced, upon the top and side of every tub, firkin, box or package containing said article or compound. The seller at retail of said article or compound, which is not in the original package, shall attach to each package so sold and deliver therewith to the purchaser a label or wrapper bearing in a conspicuous place upon the outside of the package the words 'renovated butter.'

Section 5. Any person who violates any provision of the four preceding sections shall be punished for the first offense by a fine not exceeding one hundred dollars and for the second offense by a fine not exceeding two hundred dollars.

Section 6. Section eight of chapter one hundred and twenty-nine of the revised statutes is hereby amended by striking out the words "the two preceding sections" in the first line thereof and inserting in place thereof the words 'this chapter,' so that said section as amended, shall read as follows:

'Section 8. For the purposes of this chapter, the terms 'butter' and 'cheese' mean the products usually known by those names, and which are manufactured exclusively from milk or cream, or both, with salt and rennet, and with or without coloring matter.'

Section 7. This act shall take effect when approved.

An Act to regulate the purchase of Milk or Cream by Creameries.

Be it enacted by the Senate and House of Representatives in Legislature assembled, as follows:

Section 1. On and after July first, in the year nineteen hundred and five, all milk or cream purchased by any person, firm or corporation, for use in or to be resold by any creamery in this state, shall be weighed and shall be tested by the Babcock test to ascertain the amount of butter fat per pound therein contained; and the value of the cream or milk thus purchased shall be determined by the amount of butter fat per pound as thus ascertained. The test herein provided shall be made by the owners or operators of the creamery purchasing as aforesaid, but upon petition in writing, signed by twenty-five per cent or more of the patrons of any creamery and addressed to the commissioner of agriculture, or upon petition in writing signed by the owner or operator of any creamery and addressed to said commissioner, one or more tests shall be made by, or under the direction of said commissioner, and the finding of said commissioner shall be conclusive upon all parties therein concerned. Provided, however, that when the total number of patrons of any one creamery exceeds one hundred then the number of petitioners herein required by patrons need not exceed thirty. All samples of cream treated by said test shall be weighed and the standard unit for testing shall be eighteen grams.

Section 2. Any person, firm or corporation, or the servant or agent of any person, firm or corporation, who shall violate the provisions of the preceding section shall be deemed guilty of a misdemeanor and upon conviction thereof shall be punished by fine not exceeding fifty dollars or by imprisonment not exceeding thirty days for every such violation.

An Act to regulate the sale of Milk and Cream.

Be it enacted by the Senate and House of Representatives in Legislature assembled, as follows:

Section 1. Section three of chapter one hundred and twenty-nine of the revised statutes is hereby amended by striking out the whole of said section and inserting in place thereof the following:

'Section 3. Whoever sells or offers for sale, milk or cream from cows known to be diseased, or from cows sick, or fed upon any substance deleterious to its quality, or kept in a filthy or unsanitary condition, or milk to which water or any foreign substance has been added, or sells or offers for sale as pure milk, any milk from which the cream has been taken, or milk in or from cans or other utensils that are not kept in a clean or sanitary condition, shall for a first offense be punished by a fine not exceeding fifty dollars, and for a second offense by a fine not exceeding one hundred dollars. When milk shall, by analysis, be found to contain over eighty-eight per cent of water or less than nine per cent of solids exclusive of fat, it shall be deemed prima facie evidence that said milk has been watered, and when milk, by analysis, shall be found to contain less than twelve per cent of solids and less than three per cent of fat, it shall be deemed prima facie milk from which cream has been taken, and any milk which, by analysis, shall be found to contain any foreign substance, shall be deemed milk to which a foreign substance has been added.'

Section 2. This act shall take effect when approved.

An Act in relation to the Protection of Trees and Shrubs from the Introduction and Ravages of Dangerous Insects and Diseases.

Be it enacted by the Senate and House of Representatives in Legislature assembled, as follows:

Section 1. All nurseries or places where trees, shrubs, vines and plants are grown or offered for sale, shall be inspected at least once a year by a competent entomologist to be employed by the commissioner of agriculture; and if no dangerous insects or diseases are found a certificate to that effect shall be issued by the said commissioner of agriculture; said certificate shall contain also the name of the entomologist and the date when said examination is made.

The entomologist employed for this purpose shall report in writing immediately the results of his examination.

Any proprietor or owner of nurseries or places where trees, shrubs, vines and plants are found to be infected with dangerous insects or diseases shall be notified of the same by the commissioner of agriculture at once; such proprietor, owner or his agents are hereby prohibited selling or offering for sale such trees, shrubs or plants unless the same have been fumigated or otherwise treated under the direction of the commissioner of agriculture, and such trees, shrubs or plants shall bear a certificate of the same. Any violation of this requirement shall be fined not more than fifty dollars for each and every offense.

Section 2. All nursery stock shipped into this state from any other state, country or province shall bear on each box or package a certificate that the contents of said box or package have been investigated by a duly authorized inspecting officer, and that said contents appear to be free from all dangerous insects or diseases. In case nursery stock is brought into the state without such a certificate the consignee shall return it to the consignor at the expense of the latter; provided, however, that any box or package bearing a certificate of fumigation, which shall be an affidavit made before a justice of the peace, that all stock sold by the consignor has been fumigated in a manner approved by the state nursery inspector of the state from which said nursery stock is shipped, the same may be accepted as though bearing a proper certificate of inspection.

Section 3. Any transportation company that shall bring into this state any nursery stock, such as trees, shrubs, vines, cuttings or buds, and any transportation company, owner or owners of nursery stock, or persons selling nursery stock as thus defined, who shall transport such stock or cause it to be transported within the state, the same not having attached to each box or package an unexpired official certificate of inspection or an affidavit of fumigation which shall meet the requirements specified in section one of this act, shall be guilty of a misdemeanor, and on conviction thereof be subject to a fine not exceeding one hundred dollars for each offense.

Section 4. It shall be the duty of the commissioner of agriculture to make full investigation of any locality when the presence of the brown-tail or gypsy moths or other injurious insects or plant diseases may be suspected. Should any person in the state suspect the presence of the brown-tail, the gypsy moth, the San José scale or other injurious insects or diseases preying upon trees, shrubs or vines in his possession or within his knowledge, he shall forthwith notify the commissioner of agriculture to that effect; and it shall be the duty of said commissioner of agriculture to cause the said trees, shrubs or vines to be inspected by a competent entomologist, who shall forthwith make a report of the results of his inspection. It shall be the duty of the commissioner of agriculture to disseminate information concerning the brown-tail moth, the gypsy moth and other injurious insects or plant diseases. Wherever such insects or diseases may be found it shall also be the duty of said commissioner to at once proceed to exterminate or control all such insects and plant diseases as may come to his knowledge within the limits of the means at his disposal.

Section 5. For the purpose of inspecting any trees, shrubs or plants supposed to be infected with dangerous insects or diseases, the authorized entomologist shall have the right to enter private or public grounds, and for the purpose of exterminating or controlling any dangerous insects or diseases that may be found infecting trees, shrubs, or plants, the commissioner of agriculture and his employees and municipal officers and their employees shall have the right to enter private and public grounds.

Section 6. For the purpose of carrying into effect the provisions of this act the sums of five thousand dollars for the year nineteen hundred and five and for the year nineteen hundred and six, or such part thereof as may be necessary, are hereby appropriated.

Section 7. In case of violation of this act it shall be the duty of the commissioner of agriculture to enforce the penalties set down in sections one and three of this act.

Section 8. The statute law entitled "An Act for the protection of trees and shrubs from injurious insects and diseases" is hereby repealed.

Section 9. This act shall take effect when approved.

(Approved February 28.)

INSTITUTE PAPERS.

THE CROP ROTATION OF AROOSTOOK.

By Prof. J. W. SANBORN, Gilmanton, N. H.

(Address delivered at farmers' institutes in Aroostook County.)

I congratulate you on the broad expanse of your fertile fields on low rolling hills. Their freedom from boulders and troublesome rocks and their natural fertility, make them easy competitors of the more remote farms of the billowy prairies of the trans-Mississippi Valley. The fame of your fair fields and colossal potato crops is abroad in the land, and no doubt is adverted to by all speakers from abroad who address you. It is the tendency of human nature, especially the human nature of guests, to say on occasions like this pleasing things. May it not be possible that you have acquired an exaggerated valuation to you of the bounty of nature as seen in your soils. This would be one of the great misfortunes that might befall you on the more material side of life. The character of the soil is not the determining factor in the life of an agricultural people. The accuracy of their information and of their estimate of their environing conditions, their ideals, their business breadth and vigor and their mental fertility of farmers are more potent factors than soil fertility. The richest soils known to the world, in time, and it requires but a short time, become reduced to a level of from twelve bushels of wheat to the acre down to a vanishing return. Such returns, those of nature, are not capable of sustaining a cultivated civilization, so that it is the man that determines the wealth of any agriculture. The poverty of the Russian peasant, on one of the richest spots of the world, the black soils of Russia, illustrates well the minor importance of the character of the soil, and the major importance of the man on the soil. If you are basing your farm processes, as in part you appear to be, upon the original stock of fertility of your soil, you are committing the error common to the agriculture of all new sections. The soils of the fat prairies of the West receded at the rate of a peck of wheat per acre per year, and corn and other crops in like ratio, until they reached a level of twelve bushels of wheat and twenty-six each of corn and oats per acre. Out there the hard lesson has been learned that nature will not feed man well without his aid, and the best farmers are building up painfully what they tore down lightly. Congratulations on your opportunities as farmers must be tendered with some hesitation or with the proviso that the true valuation of soil fertility to the permanent development of an agricultural wealth and of the social and mental growth of the farmer be clearly seen. Fortunately by a wise natural provision man cannot lean on nature alone for a manly support and development. Everywhere that the eye scans your agricultural horizon it views great potato fields and small barns, proclaiming the kingship of the potato crop in Aroostook and the obscurity of the steer, the cow and the pig. Your potato crop roots in the chemical fertilizer mines of Germany, Peru and Florida, and not in the cattle yards and barn cellars of Aroostook. Let me challenge you to find or to point to any great and permanent agriculture that does not rest or has not rested very heavily on stock husbandry. Probably no one in New England pursuing mixed farming and dependent upon it for his living uses chemical fertilizers more freely than myself, and none is a more zealous friend of them. I have been for many years their champion and would in no respect detract from their valuation by farmers. And yet I must in duty bound express the opinion that instead of chemicals occupying the major place and good manure the minor one in your system of fertilization, their positions should be reversed. It is granted that chemical fertilizers may for a long term of years maintain large crops in a good rotation in which cover or non-tillage crops are used liberally. Not so, however, if tillage crops follow each other. In this case the organic matter of the soil, as Snyder and many others have abundantly shown, is rapidly reduced by the very free and constant access of air. The rapid decomposition by bacterial action and by oxidation which follows faster in continuous tillage than crops can avail themselves of the products of these agencies, is a very wasteful one. It would not be wise here to use a system of rotation of frequent tillage crops in chemical fertilization, as these forms of plant food contain practically no organic matter and are expensive. On account of distance from its markets Aroostook County must pursue a system of farming for the best permanent results that sells crops requiring a minimum of plant food and which sell for maximum prices per dollar of plant food used in their growth. The following table will illustrate the point I seek to make:

	Nitrogen.	Potash.	Phosphoric acid.	Value of these.	Sale value of ton.	Sale value per dollar of plant food.
	lbs.	lbs.	lbs.			
Ton hay	25.2	18	10.6	$7 04	$8 00	$1 14
Ton oats	41.2	12.4	16.4	10 25	25 00	2 42
Ton clover	32.6	44.0	7.6	10 13	8 00	86
Ton potatoes	6.4	9.2	2.4	2 08	13 33	6 40
Ton wheat	47.2	7.8	14.0	10 97	41 66	3 79

In the above table the chemicals are rated at what they cost you in the fertilizers you are buying. The hay is rated at $8.00 net in the barn, oats 40 cents per bushel, wheat $1.25 per bushel and potatoes at $1.10 per barrel or 40 cents per bushel.

Potatoes bring more money to you per dollar of plant food than any other staple farm crop, as their sale is the sale of seventy-five pounds of water per one hundred pounds of potatoes. It is, if you must have a cash crop, the royal sale crop, and you do well to make much of it. I would encourage rather than discourage this sale crop. But it is associated with a crop system and a scheme of farm management that is as weak in other points as potato sales are strong. The common rotation with you is potatoes, oats, clover, timothy, timothy. The timothy is sold at its value as a plant food. As but about one-half to two-thirds of the added plant food returns in the first crop, and not all of it is ever recovered, the returns of hay sales do not equal the value of the fertility removed at the rate of its cost in fertilizers. While one end of your scheme of cropping makes you money, the other is losing it with approximately equal rapidity. In its final effects it would be difficult to inaugurate a worse system of cropping and crop disposal than that pursued by those without animals for crop consumption, who, depending upon purchased plant food or chemical fertilizers, sell—in addition to the one saving crop, potatoes—oats, waste the straw, and sell the hay at a net price of $8.00 per ton.

The results of careful inquiry and of observation make it appear that the splendid returns of your potato fields, of which we hear so much, are swallowed up somewhere in the total of the year's operations.

Let us examine the returns of your system of cropping and sales without the intervention of stock, and note the final results as I gather them from practical farmers in the audience.

A farm of one hundred acres is, on the five years' rotation so common here, divided in the acreage about as follows: In pastures, woods and waste, thirty acres; the balance, fourteen acres in potatoes, fourteen in oats, fourteen in clover and timothy, and twenty-eight in timothy. The returns, as an average of a ten-year period, for the average farmer, are stated by many of you to be as follows:

75 barrels potatoes per acre, at $1.00	$1,050 00
40 bushels oats per acre, at .50	280 00
28 tons hay, at $8.00	224 00
	$1,554 00

Your working stock eat and waste much of the clover and straw and little added revenue is derived from these crops. The big chemical bill, labor at high harvest wages, work teams, delivery of crops and unavoidable costs, reduce the total to a net that leaves you but little more than enough for the essentials of family life of the twentieth century. On pressing the inquiry closely I find that there is an agreement that your timothy crop is small and decreasing, that clover is not as certain as formerly, while it requires ever increasing amounts of purchased fertilizers to secure standard crops of potatoes. The 300 pounds of fertilizer formerly used has expanded to 500 pounds—to 800 pounds—to 1,000 pounds, and by some to 1,500 pounds per acre, and the end of your policy of farming is not yet achieved. The three years' rotation used by many of you when accompanied by stock feeding to consume the straw and clover, on one side of it is more promising than the five course system, but has the weakness of being at best but a temporary one as clover nowhere long can be grown in a short rotation. This is the world's history, and even now is becoming yours by visible degrees as seen by close observers.

A PROPOSED SYSTEM.

Is there not a better way than that common to all new lands, the sale of crops abroad on a large scale until the soil is depleted below the point of profit and then the slow, laborious and costly process of constructive farming again? Is the plea that the pioneer farmer, who is usually a man of great enterprise and energy, is necessarily constrained into this policy of soil depletion from the lack of capital wholly true? In part for a brief time it may be, but it is not necessarily true for the length of time that the system is extended. A constrained start becomes a habit that persists long after its necessity has ceased, in fact, continues until necessity compels a change. There is far more wealth in a system of farming that foresees the result of destructive tillage and crop sales, and not only holds soil fertility but even adds to it.

I offer the following upbuilding system of crop rotation and stock keeping as one that will, it is believed, add more wealth to the farmer while adding fertility to the soil. 1, potatoes; 2, oats and peas; 3, clover; 4, potatoes or wheat; 5, wheat, if potatoes are used the fourth year; 6, timothy; 7, timothy.

The general advantages of a rotation, and some of the advantages of the above rotation to Aroostook County are:

1. Rotation distributes labor of men and teams, if rightly arranged, over the year so as to keep both always busy at economic or remunerative work. As between a rotation that equalizes the work of teams and keeps them steadily at work

all of the year, the tillage cost, in teams, of an acre of ground may vary 100, even 200 per cent. By employing men the year round it incites the cottage home on the farm and the married man who becomes a fixed part of the farm life, and partly settles the farm labor problem.

2. It eventuates in a far greater use of capital, labor, machinery and factors that make farming more of a mechanical, capitalistic and intellectual enterprise, in which the farmer becomes more of an executive and less of a muscular laborer. This adds to the attractiveness of the business and to its social and intellectual status.

3. I have enumerated in a lecture elsewhere given in Maine and reported in a volume issued by the Commissioner of Agriculture the advantages of a scientific rotation, which must always be one adapted to the locality in which it is used, so that here I shall merely recapitulate some of them that are based upon scientific principles.

Plants vary in the root area they occupy, some being shallow, some medium and some deep rooted. They vary in breadth of root development and ease of gathering atmospheric materials of growth and in vaporization of water. This latter factor results in varying amounts of soil water even the succeeding spring, and affects the following crop growth, and aids in explaining in part what is called "a hard crop on the soil."

Insect and fungous enemies prey on root and stem, the enemies of one plant not being those of another. They have very unlike powers to gain from air and soil the varying materials of growth, some, like clover, gaining nitrogen easily, others potash and others phosphoric acid. Their roots and stubble vary greatly in weight. The clover crop, getting nitrogen easily, will in storing it up heavily in roots and stem, feed such crops as wheat, which have a low power to gain this material.

Plants also vary very decidedly in ratio of nitrogen, phosphoric acid, potash, lime, etc., taken up, potatoes taking over three pounds of potash for one of phosphoric acid. European and American experiments—the speaker's trials in two states being voluminous—show very decided gains in total yields from rotations as against non-rotations.

THE PROPOSED ROTATION.

The proposed rotation is only suggestive and illustrative, and one of many that might be suggested. It is especially used to show larger possibilities in a recuperative system of farming than in a destructive one; and further, that intensive, extensive farming widens our opportunities and makes farming more attractive, especially to youth and ambition. It makes provision for home consumption of crops and plant food making on the farm.

I may state in advance of the estimates below that potatoes are twice in the rotation as the tillage crop corn cannot start the rotation in this cold north country, and because the climate, soil, markets and tastes of the people call for the prominence of this crop.

I also invite attention to the fact that provision is made for annual manuring of each acre and crop, that is, in a seven years' rotation the crops are manured each year per each acre, with the possible exception of the first year of timothy. This annual manuring is pursued by the speaker and seems to him the logical method and one of more than passing importance. Those believing that the tabulated data that follow are fancy figures will bear closely in mind the fact of annual manuring and that the results are not expected until a second round of the rotation is well under way.

Attention is also invited to the fact that the system is one that is self-sustaining; that is, that the first year but one-seventh of the farm is placed under the rotation, and the next, two-sevenths, and so on until the full system is evolved. Profits are cumulative as well as costs, and capital and labor involved. Under your conditions here, where the soil is already fitted for the plow and not exhausted nor given over to bushes and nature, the full capital required should be earned for each successive step.

Our one hundred acre farm may be considered as thirty in woods, pastures and waste, leaving seventy acres for the rotation or ten acres per each crop.

10 acres in potatoes, 90 barrels..........		$1,000 00
10 acres in oats and peas...............	30 tons	
10 acres in clover, two crops............	40 tons	
10 acres in potatoes, 90 barrels..........		1,000 00
10 acres in wheat, 400 bushels..........	15 tons	500 00
10 acres in timothy....................	30 tons	
10 acres in timothy....................	30 tons	
	145 tons	$2,500 00
50 cows, 12,500 pounds butter at 22½ cents.......		2,812 00
50 cows, for skim-milk in pigs..................		500 00
		$5,812 00

It is not expected that the tabulated results can be attained literally in practice, but it is believed that they can be roughly approximated. In any event they serve their purpose of certainly and unmistakably showing that a far greater capacity exists in our agriculture than the present method which leans on potatoes and sacrifices other sources of farm income. The present is a system of rush periods for men and teams, but which narrows team use to brief periods and creates destructive team costs for the ten to twenty-acre fields around you. Interest, with depreciation of horses and harnesses, and cost of keeping, amounts roughly to $125 per year per horse. If three are used $375 are involved or a menacing amount to a farming that rests in the main on one crop. The same is in part true of men's labor. A system that obtains a very costly manure through far off shops in lieu of a far cheaper source in your own barns, one that diversifies your farming and enriches the soil.

IN RELATION TO THE CROPS.

The presence of the potato crop in the rotation needs no further discussion for my purpose, although it invites a chapter. The oat crop you understand is a northern clime crop and is there at its best. It requires early seeding, the time when clover should be sown, and although not the best nurse crop, on the whole serves well its purpose. Peas are sown with it, not alone because a greater crop is secured but because it is a legume or one of those plants that gain much of their nitrogen from the air through the nodular growths on their roots, and because it is what is known as a protein crop.

Protein crops, or those rich in protein, have a special value to feed with such carbonaceous crops as oat and wheat straw, timothy and corn meal. It serves a double purpose and should be sown with oats and both cut for fodder save such an amount as is required for grain for teams.

All that has been said of peas is doubly true of clover. A crop of clover, in its second year from seed may gather in roots and stubble 150 or more pounds of nitrogen, enough for more than two, or about three, good crops of potatoes. All of this is gained from air and subsoil. Its great root weight affects favorably for potatoes the physical character or lightness of the soil. On feeding it is found richer in protein than corn itself and is an invaluable accompaniment of the other coarse foods of the rotation. It diminishes the otherwise necessary grain bill.

With a soil and climate wonderfully adapted to wheat, and freight rates on flour almost prohibitive of western competition, wheat now being worth for flour in your markets $1.25 per bushel, it seems surprising that it does not occupy a prominent place in your farming. A yield of forty bushels or even fifty in a good rotation is one of the possibilities. By the first table it will be observed that less fertility is sold in a dollar's worth of wheat than in that of any other crop bringing the same money save potatoes.

In our rotation it has been sought to alternate tillage with half cover and full cover crops, to conserve soil fertility. Oats and peas and wheat, half tillage and cover crops, follow tillage crops, while clover, a cover crop, protects the soil and gathers up materials of decomposition formed under tillage crops. Save clover, timothy and redtop not only serve best this end but supply a pound of animal nutrients for less labor cost than any other crop. Cattle you must have, and timothy and redtop to feed them.

FEEDING THE CROPS.

From feeding a ton of cattle foods there will be derived two and one-half tons of manure. Allowing for shrinkage in the mow, and adding fifty tons for purchased concentrated feeds, we find that 450 tons of manure will be annually produced or over eleven tons per acre for four of the seven crops of the rotation. I would feed the crops as follows: Potatoes, ten tons yard manure, 1,000 pounds chemicals. Oats, ten tons yard manure. Clover, 150 pounds acid phosphate, 150 pounds plain phosphate and 200 pounds of muriate of potash, broadcasted the first fall after seeding. No nitrogen need be used. As the mineral fertilizers do not leach readily and diffuse in the soil slowly they should be applied in the fall or very early spring. They will be found very successful for the all important clover crop. After cutting the second crop of clover, apply ten tons, or six good, stout loads of manure. Applied in the fall it leaches into the soil and when turned under in the spring it will not materially affect the quality of the potato crop. After a clover crop and this manure, a fertilizer low in nitrogen may be added, and not in the quantity required on poor or not well fed soils.

The following wheat crop may now have fifteen tons of yard manure and 500 pounds of chemicals. This extra quantity of manure over that used for other crops is to avoid the necessity of chemical fertilizers for the following crop of timothy or timothy and redtop, with which wheat is seeded.

The second year's crop of timothy may be treated as the grass begins to grow in the spring with 500 pounds to 700 pounds of chemical fertilizers. Those desiring or needing the extra pasturage may extend the rotation one year more and pasture ten acres the eighth year. If this practice is followed, sow on 300 to 500 pounds of fertilizers fitted for pasture use.

I will not claim time to estimate the cost of this rotation. I find an eight years' rotation on my farm, though the rotation is dissimilar to the proposed one on account of dissimilar conditions, leaves a balance sheet on the right side, and feel confident that your net results or profits should or can be made to approximate the present gross receipts of such a course of farming as was considered common here at the opening of the discussion.

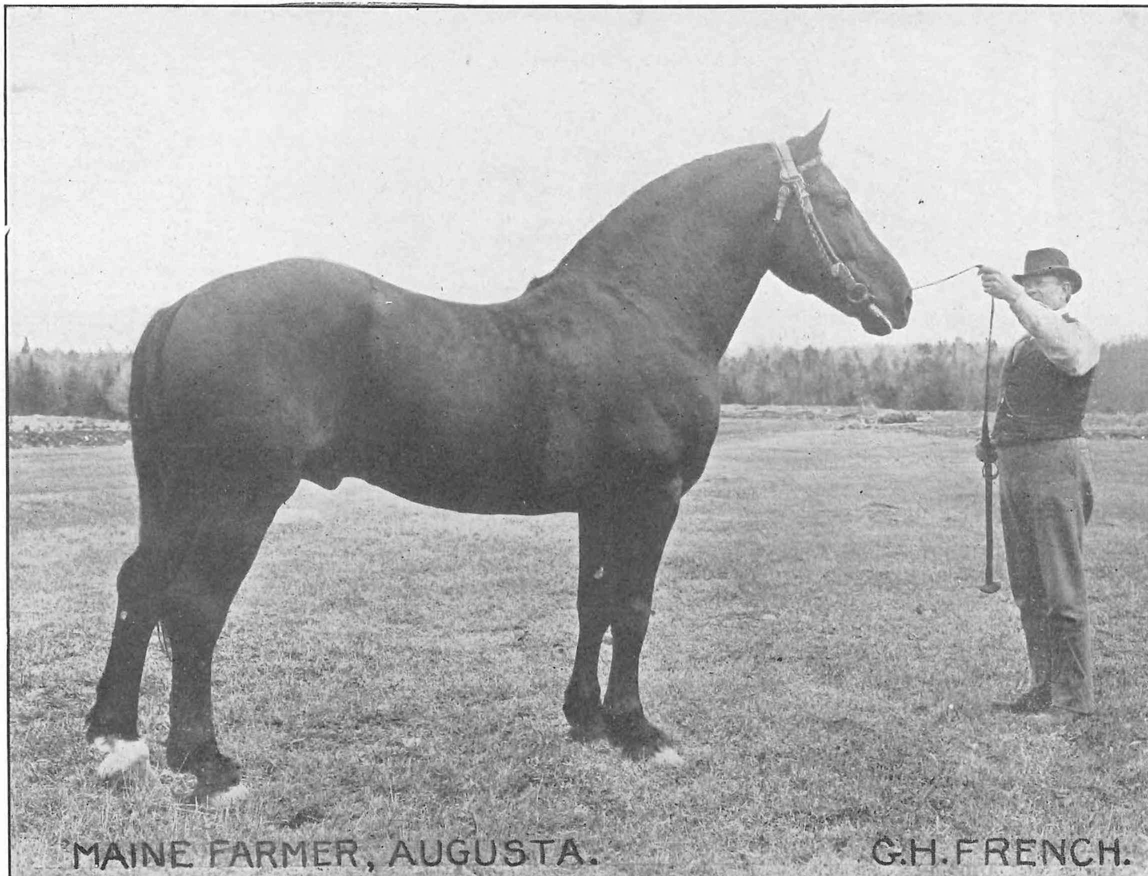
CATTLE VERSUS CHEMICAL FARMING.

The profit of stock husbandry or the wisdom of home production of manure on a larger scale appears to be in doubt with you, as I notice many farms handled without stock other than work animals, and also I notice small barns on fine estates. Let us investigate the matter. Without going into elaborate and time-using details, it will suffice to say, that the 450 tons of manure estimated as produced on the farm in question will contain per ton, as a rough statement, some twelve pounds nitrogen, ten pounds potash and six and one-half pounds phosphoric acid. While yard manure is not as active as chemicals, requiring years for its full exhaustion from a soil, yet on account of its large amount of organic matter whose absorptive power for moisture is several fold that of soil and on account of its influence on the physical condition of the soil and its chemical reactions incited in the soil, it is a question whether a dollar invested in chemicals by you at the rates you pay would not be justified at the same rates in good manure. This is a mooted question and held questionable, but an approximately equal value may be assigned each form of plant food. The comparison of the two in any event will afford a striking lesson of the value to you of good manure.

12 pounds nitrogen at 20 cents	$2 40
10 pounds potash at 7 cents	70
6½ pounds phosphoric acid at 7 cents	47
	$3 57

The chemical elements in a ton of manure then cost you at prices of the chemical fertilizer, $3.57, when derived from rich foods, such as you should feed. At two and one-half tons of manure from a ton of food, after deducting 20 per cent for growth or milk production, we shall still have left a chemical and theoretical value of $7.14 worth of manure from a ton of fodder. For the 450 tons made as rated above a valuation of $900 for manure is secured. As one man can feed and care for the stock that is to make it, he having no other work to do, it will be seen that the manure more than pays for the care of the stock and interest on the buildings. In fact, quite a balance is left to credit back to the fodder. In practice we do not have to get quite market rates for our crops to make stock feeding a judicious practice.

You are selling hay at a net of $8.00 per ton, clover as low or lower, and straw heavily wasted. Can you not get these values in full from stock? Most assuredly. I cannot demonstrate every proposition necessary to lay down and must content myself with stating that good horses, sheep, baby beef of the right type and cows, each will do it. As Maine is a dairy state, let us make a general dairy estimate. Any man bright enough to raise 100 barrels of potatoes to the acre can make readily 250 to 300 pounds of butter from a cow. At 22 cents per pound for the butter $55 will be derived from it. Ten dollars should be added for the skim-milk, making a total receipt of $65. The costs will be two tons of hay at $10, $20; grain, $18; pasturing, $6.00; milking, $8.00; depreciation of cow, $4.00; miscellaneous costs, $2.00. It is assumed that the butter will be made at a co-operative creamery and that 22 cents will be net. If estimate is too high for sale price of butter, as it should not be in good management, add $5.00 and the total cost is but $63, leaving a margin of profit of $2.00, hay being sold at $10 per ton. But as the cow consumes three tons of food and a profit exists on the manure production too, the operation will appear to have given the farmer a better market for his crops in his cows than at the stores. The method of farming proposed is altogether a more satisfactory one than the common type. The eggs are not all in one basket and some parts, the average parts of the scheme, are sure to go well, relieving the business of its extra hazards. As it equalizes the labor of the teams and is unattended by the strains of the rush periods of the single crop system, and as it provides for regular labor, it is held not only to be more satisfactory but more profitable. Its main claim to very careful consideration is deepening fertility and increasing revenues as against decreasing fertility and decreasing revenues. It is farming towards wealth and not from it.



Percheron Stallion, Valiant, 31,038. Weight, 1,720 pounds. By Marc, 9696. Dam Coralie 7473 (11,652).
Owned by D. E. Larrabee, Dover, Me. (Courtesy of Maine Farmer.)

CLOVER AS A SOIL RENOVATOR.

By Forest Henry, Dover, Minn.

There is nothing that should concern the farmer more than the fertility of his soil. The soil is the farmer's workshop. Practically all the value there is in the farm is the fertility that the soil contains. Therefore, any crop that can be grown on the farm that will assist in increasing the soil's fertility should be welcomed.

Of all the crops that are grown to any extent in the State of Maine there is only one that leaves the land it is grown upon richer after it is grown than before, and that is clover. If we were to grow a crop of clover that would cut three tons of hay to the acre, and even sell it off the farm, that field would be much richer than before the crop was grown. When the clover is grown and fed out and the manure returned, many dollars worth of plant food are put into the soil from each acre. When we grow grains of any kind or timothy hay, it means that the soil is that much poorer, but not so when we grow clover. Clover draws its nitrogen from the air above instead of the soil as most other crops. The air is the great source of all nitrogen. There are millions of dollars worth hanging over each acre of soil, and I cannot believe that the good Lord intended us to buy it of the fertilizer agent at from fifteen to twenty cents per pound when he gave us the clover plant that would get it for nothing for us.

On the roots of every well developed clover plant, you will notice little nodules or protuberances that are the home of what we may call a vegetable bacteria. In these little cells are millions of minute organisms (which would not be called insects strictly speaking) whose business it is to suck in the nitrogen from the air and work it over and over into plant food. The clover plant then takes it up and incorporates or uses it in its growth. The roots from a field of clover are nearly as heavy as the top growth, therefore, if the tops are removed there still remains in and above the soil about one half the plant food that the plant has used in its growth. Thus it is that in growing an acre of clover we have actually left in the soil over one hundred pounds of nitrogen more than the soil contained before the crop was grown.

The clover plant is also a deep feeder, feeding largely from the subsoil below, and by thus doing it pumps back the potash and phosphoric acid and leaves it nearer the surface where other less deep feeding plants can make use of it. It also liberates much plant food in the soil by the decaying of its roots. Oftimes there is much plant food in a soil that is in a locked up condition which can be unlocked slowly by nature, by the tilling of the soil or by the decay of vegetation.

There is another benefit that comes from clover growing that is equal in value to the plant food it leaves in the soil. We need vegetable matter in the Maine soils even more than plant food. Vegetable matter when decayed becomes humus, which not only puts the soil in a good mechanical condition, but also helps it to retain moisture in a dry season. It makes the soil more spongelike and holds the moisture in suspension near the surface where plants can make use of it in dry times. In wet seasons when we have an over-abundance of water the vegetable matter that clover puts into the soil helps to loosen it up, making it more porous or open, thus letting in sunlight and air that are just as essential to plant growth as plant food. In other words, clover growing tends to equalize the moisture in the soil by keeping it more moist in dry seasons, and by loosening up the soils and aerating them, thus keeping them from packing and getting salvy in wet seasons. While it has been doing so much for the soil it has also been growing one of the best hay crops that can be grown on the farm. Clover hay that has been cut on time and well cured has nearly double the value of timothy hay. Clover hay contains vastly more of the muscle and bone making material, the very same material that enables the dairy cow to give milk. The reason that farmers do not put more value on it is tnat they rarely ever feed clover *hay;* it is clover *sticks.* The great majority of clover that is grown is grown in the shape of mixed hay, which means only a small proportion of clover. The grass is left standing until the timothy is at its best. By this time the clover is dead and nearly worthless for hay. On the other hand if the clover is cut when just in bloom and left only to wilt, then raked, piled and left a day or two to cure in the pile, it is ideal hay for any stock on the farm.

There is a prejudice against it for horse feed, owing to the fact that horses will overgorge themselves on it when fed carelessly. The harm comes from the abuse and not the proper use of it, however. When horses overgorge themselves on clover hay their stomach presses against their lungs, thus shutting off the lung action. In this way their wind is injured and heaves brought on. This comes from carelessness, however, and should not be charged up against clover. I have fed it exclusively on my farm for more than twenty-five years with no bad results.

The quality of the hay is not only better but it will usually produce fully twice as much to each acre as the timothy. There seems to be great difficulty in growing clover in the State, which I think is largely due to the acidity of the soil. This no doubt comes from a lack of humus in the soil. This acid condition can be removed by the application of lime. From 1,000 pounds to a ton to the acre should be used, varying in amount with the strength of the lime. If air slacked lime is used, the amount must be increased. When your soils are once filled with vegetable matter you will hear less complaint of acid soils. A light application of stable manure will help wonderfully to get a good stand of clover.

The clover should be sown early in the spring to insure good germination. The stubble of the nurse crop should be cut high and no cattle should be allowed on the field. The clover will be in its glory the second season and should produce two good hay crops. It has then done its work and the field should be plowed up and used for other crops, such as corn or potatoes. Do not expect the clover to stand longer, as it is a biennial and only lives two seasons. If some lingers longer it comes from reseeding and not from what grew the first season. At least four quarts should be used to the acre and six would be much better.

To get the best results a regular rotation should be established with clover as its base. By growing clover every four years and following it with corn or potatoes, and then with the small grain, the best results will be attained, as the clover leaves the soil a little long on nitrogen, which would induce the small grains to lodge were they sown on clover sod. I would not recommend plowing under a growth of green clover as it would be apt to start soil acidity. Plow down late in the fall after the clover has got dryer or been killed down by the frost.

GRASS AND CLOVER PRODUCTION.

By Prof. W. D. HURD, Orono.

(Synopsis of address at farmers' institutes.)

Since grass and clover are both used as hay, and are usually closely associated in the minds of farmers, we can properly consider them together in our talk today. In some ways the production of grasses and the production of clovers are quite similar, and in others the conditions which will produce one are not proper for the production of the other. It is of some of the practices that I have noticed since coming to the State and of some of the methods we use in handling the hay crop that I wish to speak.

Maine is naturally a great hay producing state, the climatic conditions, the amount of moisture and proper temperature being perhaps as near perfect for these crops as in any other locality in the United States. Among the states of the Union, we stand, if I remember correctly, in fourteenth place as a hay producing state. Our yield is about an average one, being given by the last census at a little over one ton to the acre.

The desire to grow hay, on the part of the farmers of this State, has become so strong that this crop has crowded out the cultivated crops heretofore grown to quite an extent. No doubt the growing of so much hay, and the result that there is much less tillage practiced than before, accounts to quite a degree for the continued so-called "running out" of the land.

It is a common practice in the neighborhood where I live, and I suppose here too, to seed a piece of land to grass and then attempt to cut hay from this land for eight, ten, a dozen or more years, without much effort being made to keep up the fertility of the land and put back each year what is taken off in the shape of hay. Now such a practice as this, continued, cannot but result in one way, and that is, in a lessening of the fertility of the land. There are three things in the soil which go a long way toward producing a good crop of hay. They are, available plant food, moisture, and humus or organic matter, the chief function of the latter in this connection being to conserve and hold the necessary amount of moisture in the soil for the production of a good crop of hay. When land has lain in grass several years, the available plant food is nearly all removed, the humus is used up, thereby causing the land to be dry, and a small crop of hay results. Another very good reason why the practice of keeping land in grass so long without a change of crop is not a good one, is because after a plant has once produced seeds the life of that plant generally ends. This is particularly true in the case of the grasses. The grass crop is often allowed to occupy the ground until most of it has gone to seed, then when it is removed, the seeds are taken from the land with the hay, very little reseeding occurs, and the grass gradually "runs out" and weeds come in. I believe that you will agree with me when I say that most of the land which has been in grass eight or ten years yields only about three-quarters of a ton of cured hay to the acre, and this will be about one-half daisies and other weeds. Now one of the things which we in Maine, and the rest of New England as well, need to do is to practice a systematic rotation of crops, both with cultivated crops and with our grass growing. A good rotation would keep the land freer from weeds, the supply of plant food and humus would be kept up, the land would be better aerated, and in better condition generally. Then crops of from two to three tons of hay could be grown as easily as we now grow a ton or less.

Another consideration that we must not let slip by in our effort to grow grass is the fact that grass, and clover especially, will not thrive well in an acid or "sour" soil. It has seemed to me right along that this was one of the chief reasons why our grass crops were not heavier. Most of our cultivated plants use a large amount of lime in making their growth and in regions not of a natural limestone formation the soil after a time becomes deficient in this element. In an acid soil a heavy growth of grass cannot be expected.

There are two easy ways by which you can determine for yourselves whether or not your land will be benefited by the application of lime. The first is by taking note of the character of the vegetation which occupies the land. If sorrel, moss and other weeds grow in abundance, and the stand of cultivated plants and particularly clover is thin, it is a fairly reliable indication that that soil will respond to an application of lime. Another easy test which may follow this examination of the plant life is the use of the "Litmus paper" test. Procure from your druggist some blue litmus paper, cut this into strips three inches long and three-quarters of an inch wide. Take a teacup and a small pail of water into the field you wish to test, and gather small samples of soil from different sections of the field. Mix them together, with just enough water to moisten the soil, and then place a strip of the litmus paper down into the soil, pressing it firmly around the paper. Leave in this way for from three to five minutes, then remove the paper carefully and rinse in the water. If the contact of the soil with the paper has turned the paper red, it indicates an acid condition and in most cases lime may be applied with very profitable results. Now how shall this acid condition be overcome? The cheapest, quickest and best way known at the present time is to use lime. If wood ashes can be had in sufficient quantities they are even better, since good unleached hard wood ashes are about one-third lime, and also contain about six per cent potash. We are not far from the lime kilns of Rockland and Rockport and so can get lime at very reasonable rates. There are several grades offered. You can get that which is slaked and more or less lumpy for about three dollars a ton F. O. B. at the quarry, and the unslaked in casks for about six dollars a ton. One hundred pounds of fresh lime is equal to about one hundred and seventy-five pounds of air slaked lime. Considering this, and the extra freight and cost of handling the larger amount, I think you will find it cheapest and most economical to buy the fresh lime. In case you get the lump lime in casks the slaking can be done in several ways. The desired amount can be drawn to the field, a shallow trench can be dug, the lime put into this and covered up with moist earth. In two or three days it will be broken down to a fine powder. You can also use water in slaking the lime, being careful to use only enough to bring it down to a fine powder and not enough to make it sticky. At the college we use from fifteen hundred to two thousand pounds to the acre on our heavy land. From half a ton to fifteen hundred pounds is usually sufficient on lighter soil. We apply it after plowing and harrow it in. It can be spread broadcast with shovels from a wagon or cart, or in our case we have a Stevens lime, ashes and fertilizer distributor which does the work finely. The last lime we purchased was the ordinary lump lime ground up fine by the lime people and shipped to us in sacks. This cost us about one dollar a ton more, but it can be handled much easier and since it is all ready to be applied without slaking I consider it to be cheaper and better than the lump lime.

Now about the top dressing of grass land. While I know that there will apparently be good results obtained from top dressing with stable manure, yet I think there is a better way to use this material, and that as a top dressing we ought to depend on chemicals. Stable manure when applied as a top dressing decays on top of the ground and loses much ammonia into the air. In this loss of ammonia a great loss of nitrogen, the most costly element we have to supply, occurs. Besides this the strawy material which if plowed under would be valuable as humus is blown about and wasted. We practice plowing or harrowing all of the stable manure we have into the ground before some crop like corn or oats, and by so doing feel that we lose less than in any other way.

As a top dressing and stimulant to the grass crop we mix together

300 pounds nitrate soda (15%).
300 pounds muriate potash (50%).
600 pounds acid phosphate (14%).

1200 pounds.

Apply from 300 to 400 pounds of this to an acre of grass land as early in the spring as possible. The three materials used in this mixture are all quick in their action and the results from this practice are very satisfactory.

We seed to grass and clover at the time our oats are sown. As a fertilizer we use about 300 to 400 pounds to each acre of a good general fertilizer. Our seed mixture contains both grass and clover. That which is giving good results at present consists of

11 pounds timothy.
6 pounds red clover.
4 pounds alsike clover.
4 pounds redtop or Kentucky blue grass.

By using a mixture of this kind if the clover fails we are quite sure of getting a good grass crop, and so the use of the land is not lost for that season.

Another thing that I have noticed in the handling of the hay crop is that as a general thing the grass is allowed to become too ripe before it is cut. Nearly all of our grasses contain the most nutrients when they are just about in full bloom. In our neighborhood the general practice is to let the grass become perfectly ripe. In this condition it contains much woody fiber, which is almost worthless as feed. Animals never relish this as they do nice, bright, fresh looking hay.

I asked one man why he waited so long before cutting his hay and he said, "It cures quicker." I'll admit that his hay needed no curing at all, but it's not dead, dry feed that we are after. Another good reason for cutting when in bloom is that grasses when they have produced seeds have fulfilled their mission in the world and die. If cut before seeding time they again try to reproduce themselves and so the grass land does not "run out" so quickly.

Our plan in making hay is simple. We cut when the grass gets nicely into bloom. Hay mown in the morning is tedded out about noon and at once raked into windrows and bunched up in the afternoon. It is allowed to partially cure in these bunches rather than in the windrow or swath, because it goes into the mow in a brighter and better condition.

It is not necessary to dry all of the juices out of the grass. In fact the hay is much better when this is not done. A wisp of hay from which water cannot be wrung when twisted tightly in the hands is fit to go into the barn although it may seem rather green in color. Hay made in this way will be bright, palatable, free from much dust and greatly relished by all the animals.

The chairman of this meeting has asked me if I would describe the methods used in growing that fine crop of clover this year on the college farm. I am very glad to do this, as I believe clover to be the most important crop for Maine. By growing it we can avoid buying so much expensive feed rich in protein, and the power clover has of improving our soils is not half known.

Our methods were such as could be profitably followed by any farmer, and not beyond him, as is often the case in the production of extra large yields, and so are, perhaps, of more than ordinary value.

Our reasons for growing clover are the same that any New England farmer should have. We wish to raise a large quantity of feed rich in protein for feeding our dairy herd, while by no means of secondary importance is the place of clover in our rotation as a soil improver.

Before attempting to grow clover we recognize several conditions under which clover will best thrive and try to make these as favorable as possible. The first essential in the growing of clover is the selection of a well-drained soil. Clover is a deeply rooted crop. Soils in which the water stands nearer than three feet of the surface for any length of time are not suited to clover growing. Standing water in the soil prevents the roots going down deeply. The bacteria which take nitrogen from the air and store it up in the roots of the clover plant cannot live in a wet soil. Neither can the air which contains this nitrogen circulate through the soil and get down to the bacteria where the pore spaces are filled with water, as in the case of a "water-logged" soil. A second essential to successful clover production is the fact that clover is a lime-loving plant and will not thrive at its best in an acid or so-called "sour soil." Judging from the character of the vegetation, and also by use of the litmus paper test, we found that our soil was slightly acid. Probably ninety per cent of all New England soils which have been cropped for a considerable length of time and on which wood ashes or lime have not been used are "sour." To overcome this acidity we applied 1,500 pounds unslaked lime to the acre after plowing for the clover crop. Another essential is that the land must be well tilled and in a fairly rich state. Frequent cultivation aerates the soil, opening it up to the air, which feeds the bacterial life. Without encouraging the work of the bacteria no great gains in nitrogen can be made.

Now about soil inoculation. You have heard a great deal of late about this matter. Many agricultural papers have freely advised the farmer that all he needed to do was to inoculate his soil and he would be sure of getting good crops. Soil inoculation in itself is all right, and the process is successful when properly done, but there are certain conditions necessary before one can hope or expect to be successful with this inoculation. The clovers, alfalfa, peas, beans, and some other plants belonging to the same botanical family have the power of storing up nitrogen from the air, in their roots. They are aided in this process by certain forms of bacteria. Now any of these plants will grow without bacteria, but they will grow much better and there will be much greater soil improvement when they are present and working. People think after reading some of these papers that all that it is necessary for them to do is to get a culture of bacteria, and use it. Now in order that the bacteria shall work the soil must be warm, it must not be too wet, it must not be acid, and in order to obtain nitrogen from the air, the air must penetrate the soil where the bacteria are, and so good tillage is also necessary. All these things must be made right by the farmer, then he can hope to get benefits from bacteria. Red clover has grown in this State for years, and it would seem to me that there must be plenty of red clover bacteria in the soils of this State. The important thing for us to do is to make the conditions right for their growth, and then we will not have to think about inoculating the soil for this crop.

I have here a culture of bacteria such as has been sent out by the United States Department of Agriculture. [Here the speaker exhibited the culture and gave directions for preparing the same.] The soil may be inoculated in three ways. First, by sprinkling the seeds which are to be sown with the solution;

second, by gathering some soil, applying the solution to this and then sowing this soil over the land to be inoculated; and, third, by taking soil from a field which is growing the desired crop and sowing this on the land.

The cultures sent out by the government and most of the commercial concerns this year have failed in many cases. This failure I think is due largely to the fact that the cultures did not contain the proper kind of bacteria. Each of these crops has its certain kind of bacteria which work on it, and so far as is known at present on no other crop. The safest and surest way at present to inoculate the land is to secure soil from a field already growing the crop you wish to grow. In any case, either in using soil or seed, the inoculated material should be cultivated in immediately, as sunlight will destroy germ life. I would emphasize again the point of your doing everything you can to make the conditions right for the growth of the bacteria before you inoculate or attempt to inoculate your soil.

A systematic rotation helps greatly in clover production. We are practising the following system: (1) Potatoes. (2) Corn. (3) Oats, seeding to grass and clover at the time the oats are sown. The grass and clover is allowed to remain on the ground one but not more than two years, and is then plowed up and the rotation repeated. The stable manure is applied before plowing the land for the corn, and the potatoes are grown on commercial fertilizer.

The particular crop of clover grown this past season received the following treatment: The land had passed through the first two stages of the rotation, that is, potatoes and corn. In the spring of 1904 it was limed, as already described, and seeded to oats. With the oats the following grass seed mixture was used to the acre: Eleven pounds timothy, six pounds red clover, four pounds alsike, four pounds redtop. Three hundred and fifty pounds of a three per cent nitrogen, seven per cent phosphate acid, and four of potash fertilizer (of our own mixture) to the acre was applied at the time the oats were sown. When the oats ripened they were cut and threshed, yielding fifty bushels to the acre. After removing the oats the clover started up and made a good growth during the autumn of 1904. Nothing more was done to the crop until the latter part of June of the present year, when the clover was cut and cured in the cock. From this cutting forty-three tons of cured hay were taken from the twelve and one-half acres of land. Immediately after the crop was removed the land was top-dressed with a mixture of the following chemicals. To each acre seventy-five pounds nitrate soda (fifteen per cent), seventy-five pounds muriate potash (fifty per cent), 150 pounds acid phosphate (fourteen per cent), were applied.

These materials being all soluble stimulated the second crop, and on August 20, last, thirteen tons were taken from the same land, making fifty-six tons in all. Both crops were weighed, 2,240 pounds being allowed to the ton.

At the present time there is an excellent stand of grass on the land and everything points toward a heavy crop of hay next year. Early next spring we repeat the top-dressing of chemicals as used for producing the second crop. Of course, we do not expect to have as heavy a crop of clover next year as we had this, because it is biennial in its growth. This is the best argument that can be given for not keeping clover sod down more than one year.

Too many make the mistake of not cutting their clover early enough, but let it become dry and woody. When a plant has produced seeds it has fulfilled its mission, so we cut our clover when it is nicely in blossom, but before any of the heads ripen. The plant will then make another effort to reproduce itself, a second crop will be obtained, and the feed will be richer and more palatable.

I think you will agree that no unusual amounts of grass seed or fertilizer were used in the production of this crop. Our soil is no better than thousands of acres all over New England. We have not used methods or practices beyond the average farmer. By observing the wants of the plant, and supplying the conditions under which it will grow best, the same as we have tried to do, there is no reason why any one cannot succeed equally as well.

QUESTION: "What do you think of alfalfa for Maine?"

ANSWER: If alfalfa could be grown in this State successfully it would be the salvation of the dairymen. So far as I know no one has yet been successful with it on a large scale.

Chester White Boar, Jim of Hillside. Property of Lyman Blair, Greenville.

A few people have small patches that have survived the winter. We have not yet been successful in our attempts to grow it at the college. The Experiment Station sent out this year about eighty packages of seed, with full directions for growing the crop, and the reports show that more than one half are failures. Vermont has reported about the same thing. The conditions I have spoken of as being absolutely essential to successful clover growing must be present in a more marked degree in order to have alfalfa succeed. I do not know of any one real reason why alfalfa does not survive our winters. It grows well in some states where the winters are as severe as ours are here. I do know that water standing on the surface and freezing around the crowns of the plants is sure death. Perhaps in a few years alfalfa will become acclimated the same as we know some other plants have. My best advice to you would be to go into alfalfa only in a small experimental way at present. My feeling is that if the farmers of this State would put as much thought and energy into the growing of clover as they are putting on the alfalfa question the results with clover would be perfectly satisfactory. There is a great question about alfalfa for Maine. There is no question whatever about being able to produce fine crops of clover if the conditions are only made right.

THE DEVELOPMENT OF THE DAIRY COW BY FEED.

By H. E. Cook, Denmark, N. Y.

The science and practice of dairy cow feeding has reached almost perfection so far as maximum production is concerned. Our efforts in the future, in my judgment, must be along lines of disseminating the best information and making clear to those who work animals under pressure, or more correctly speaking give full rations every day in the year, that the greatest efficiency will come when they are brought to full capacity slowly, or rather from birth; that good blood constitutes primarily the true requisite for large and profitable production. But only when that possibility is made more than potential will it avail the owner. To secure these results, therefore, the full growth and development of the young must take place. The calf should be fed milk from the mother until it can use skim-milk, or if substitutes must be used, then a longer time. The individuality of the calf alone can decide. If it is not worth raising in such a manner that the digestion is kept strong and vigorous, better kill it. More otherwise good cows are permanently injured in the early life when digestion is weak than perhaps at any other period. Food ill fitted to the stomach of a young calf is forced upon it, and the poor thing is forever reduced in value to the owner. I do not know how long a calf should have milk, it may be four weeks and it may be three months. Keep her thrifty and growing during this earlv period, and later when she takes her place in the dairy you will be surprised at the production from small quantities of feed.

The age for first calving will depend upon the individual. With the smaller Jerseys, in my judgment, no greater breed error has been made than the encouragement given to the young things to carry out their natural propensity for early motherhood. The vitality and size are reduced, and consequently the usefulness.

Here is less danger with the Holsteins because of the tendency to grow and mature before taking the place in the dairy. My experience says—Feed the young animal to development, and then don't hurry. Often the better cow does not calve until in the three-year-old form.

There is a prevalent opinion that danger is lurking whenever concentrated feed is fed prior to parturition. My experience is exactly the reverse. More trouble comes from lack of complete nourishment. If there is any time in the year that full strength is needed, it is surely for this trying ordeal of giving birth to the calf, and a preparation at the same time for being commercialized. If the only requirement was to feed the young, sufficient reserve force would be accumulated in the system. This notion of danger is the result of a tradition coming down from a time when effects of feeds were not understood. Starchy feeds were fed which of all things the cow did not want because of her tendency to lay on fat from protein feeds. She wanted blood and bone and nerve making feeds, such as good hay, some silage if at hand, and from three to five pounds of either oats or bran daily. There is acutally less danger from udder troubles, or retention of after-birth, the two constant troubles attending this period. Muscles are strong, passages are free and the owner need not worry. Then the cow is ready to begin full, active service at the pail and bring to the owner returns for this feed and time.

If this condition does not prevail, I know of no way of making the animal profitable for the year to come. Less feed will be required for a given production during the year, if such quantities as mentioned are fed when she is dry.

Ease of digestibility is a very important part of the study and practice of animal nutrition. We generally understand that fresh, early growing grasses are of all single feeds perhaps the best, not, of course, including milk. The cause is, first, its nearly perfect balance of nutritive elements. It also contains very little fiber, and hence its nearly complete digestibility. Everyone knows the generous milk flow from this grass, while the same field allowed to ripen and cut two months later will need about ten pounds of grain daily in addition to give the same results.

It is a safe rule that the per cent of fiber largely determines the value of a feed. In the hay crop, which constitutes the

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bulk of coarse fodder in Maine, there could be, I am sure, some gain made in net digestive matter through early cuttings. I realize the difficulty of curing hay at that period in its growth when most suitable for milk making. But it can, most years, be more nearly approximated than at present practiced. With early cut hay containing at least one-half clover, and corn silage in those sections where corn thrives, we shall have the basis of a good ration. My experience warrants me in saying that the fullest profits are not obtained without a daily ration of concentrated feed. Experiments are repeated over and over again concerning the amount of grain that can be profitably fed.

Many of these are to me worthless, for this reason—the data is secured from comparatively short periods. If the cow has been previously fed upon full nourishment and then she is placed upon so-called light grain rations, she can, for a somewhat protracted period, draw upon her previously stored vitality and give an apparent profit. On the other hand, a cow upon light feed and perhaps of immature growth may be placed upon so-called high feed and give a very poor return. The animal will begin a systematic storing of energy, and the profits in the milk pail will not compare at all favorably with the former experiment. Take this same cow again after she has been built up anew and she will give comparatively greater profits upon the lighter ration. That there is a limit to the amount of grain fed, there is no doubt. I am confident that that limit cannot be arbitrarily fixed by any single experiment or in fact a series of results. It must be determined by the individuality of the cow and her owner. To illustrate: I have a heifer that has been properly developed and produced the first year 10,553 pounds of milk. She has now with her second calf averaged fifty pounds of milk daily for the first 125 days. Her grain ration has been from ten to twelve pounds daily. Would any one for a moment say that this high feed as usually measured is, when compared to her output, high? Had I fed this to a twenty-five-pound cow, it would have been truly high and been a losing game from the outset. This case fairly well, in a few words, gives my idea. Cows should be educated from birth and then fed up to the limit of their digestion and milk elaboration. It may be three pounds of grain daily, it may be fifteen pounds daily. Either may be profitable and either may bring a corresponding loss.

These grain feeds should be selected for the cost of digestible protein. The starches and gums should be and are grown at home.

Fortunately, the manufacture of proprietary foods for the human family has placed upon the market feeds having no other value than for milk production with a consequent cheapening of protein over its cost in the cereal grains. These feeds, the glutens, distillers' grains, cottonseed meal, linseed meal and often malt sprouts, together with the wheat feeds, constitute a sufficient list from which to draw. With the exception of cottonseed, these all have a tendency to soften the butter and will have to be fed with that in mind. A combination with cottonseed can often be made with economy. If there is necessity for adding carbonaceous feeds, corn will usually be the cheapest. Individuality will demand varying amounts of protein as well as more or less of gross weight of feed.

The cow should not be permitted to acquire undue fat to such an extent that it will detract from her milk force. With the strong dairy type, however, there is seldom any danger with a ration having a nutritive ratio of 1 to 5½ or 1 to 6. I would advise keeping clear of the proprietary feeds that, as a rule, have more or less oat hulls. They are too costly.

The chief factor in successful feeding for milk is the individual who manages the cow. If he is infused with the true dairy spirit as his cow should be bred with it, all of the details of combination of feeds and the time of feeding, whether it be twice or three times a day, in smaller or larger quantities, will easily work out. I might add in conclusion that winter feeding will not be profitable in these northern latitudes unless water is provided in the barn, and the stables are warm, dry and ventilated.

POULTRY CULTURE.

By HENRY VAN DRESER, Cobleskill, N. Y.

I am to talk upon a very small thing this morning—something as small as a hen—usually beneath the dignity of the farmers at large in the different states. I wonder if we realize the fact that there is more money in poultry, for the amount invested, than in any other business along the line of agriculture. Yet it is the most neglected.

I want to tell you how I became interested in poultry. I became very much interested in a little boy who lived about three miles from my place. He was not related to me, but the better I knew him the more I loved him. That boy had grand prospects. He was earnest in purpose and honest in heart. We became so much interested in each other that he came to our house every day, and he finally concluded that he did not want to go home at all. So I saw his father and told him that I wanted the boy with me and he told me to take him and do as I pleased with him. I gave him a course at Cornell University, and during his absence I purchased the interest that my brother had in the home farm and my brother purchased another farm and moved five miles away.

My wife and I, having no children, were lonely; and I want to say to the people here today there is no household complete without children, music and flowers. That has been thoroughly demonstrated at my own home. My wife and I talked the matter over, and we wrote and told the boy we would like to have him come and stay with us. He left the university and I drove down to the station to meet him, and on the way home I saw at once he was very enthusiastic in regard to poultry.

We talked the matter over, the subject seemed feasible, and at once we went into the poultry business.

The first thing we did was to purchase a Prairie State incubator, of two hundred-egg capacity. We thought it was necessary for us to start with thoroughbred stock, because the chickens that we had on hand were of all ages, all colors, all denominations; they were not to be depended upon; they were scrubs. So we sent away for two hundred such eggs, for which we paid $20. When they arrived we put them on the table to give them a rest. Whenever you send away for a sitting of eggs, when they arrive you should give them a rest of twenty-four or thirty-six hours. It will bring them together and you will have a better hatch.

When the eggs were ready he opened up the incubator. It is very easily adjusted. He put those eggs into the tray, closed the incubator, and at the end of the fourth day examined the eggs; he took a tester and just took the eggs off the tray and held them up to the light. If they are fertile there will be a pronounced zone of very fine blood vessels. He put those eggs back into the tray, and the eggs that were not fertile he laid aside to feed to the little chicks after they were hatched.

The eggs were turned twice a day, and then on the morning of the nineteenth day, there was a beautiful sight; those little chicks just threw off their shells and opened up into new life. There was a wonderful transformation.

That was the first hatch I ever saw by an incubator, and it was one of the best hatches we have ever had. Ninety-seven per cent of the fertile eggs hatched. The next thing we did was to leave those chickens in the incubator thirty-six hours.

Now, when we took the little chicks away from the incubator we tried to have the brooder from 97 to 100 degrees heat. We took those chicks out of the incubator and put them carefully into a basket lined with cloth, so as not to have a circulation of air, lest they should catch cold. You want to be very particular about that. If you take the chicks out of the incubator and put them into the brooder, and that brooder is a little bit cold, and they catch cold, it will cause indigestion and cholera, and that means death every time.

Now, the first thing he fed those chicks was the shells they came out of. He put them into the oven, and when they were perfectly dry rubbed them together in his hands, and sprinkled them in front of the chicks. That is just what is required to promote digestion.

On the brooders he sprinkled some sand and gravel, and that puts the system into action, gives them a good appetite and power to digest their food. Then stale bread, moistened with skimmed milk, was sprinkled in front of the chicks.

In a few days he gave them plenty of clean water. It is necessary to be very careful about the water. If the water is distasteful and insipid, and the vessels become slimy and nauseous, that causes indigestion, and makes a great difference in regard to the death-rate. What they want every hour of the day is clean, pure water.

We give them granulated charcoal, put into a small box, so they can help themselves. That, also, is a great bowel regulator—it cleanses the system.

After a short time, we began to feed golden millet, and that is the most growthy food and the best bowel regulator that we know of, and every farmer can raise it. You can raise a good many bushels to the acre, but if you purchase it, it will cost you from $1.50 to $1.60 a bushel. We always raise it for our own use.

When the chicks get a little larger, we begin to feed cracked wheat and cracked corn and johnny cake. The first few years we made the johnny cake the same as we would make it for our own family, with the exception of working those infertile eggs into the mixture and stirring it up with a spoon. We put it in the oven and baked it. We could feed the inside of that johnny cake, but the crust was hard and we had to put it through a grater, which made additional work. Now, we mix up the batter and put in the soda and eggs and then put it right into a large jacket in the cooker and steam it. And there is no crust to contend with; it is more digestible; every bit of it is eaten and there is no loss connected with it.

We give them, for succulent food, beets cut up. Just as soon as they get large enough so we can distinguish the sex, we put the cockerels in one department and the pullets in the other. We put all the cockerels in a brood-house; the pullets we put out in a fourteen-acre orchard and allow them free range.

The cockerels we fed with a little more of the johnny cake, and a little cottonseed meal with the corn meal, for the purpose of giving color to the flesh, which makes the chickens look so much more attractive, because we wanted to put them on the market for broilers; and it gives a beautiful tinge to the meat.

And we fed them with a rush, but were very careful and watched their digestion. We fed them plenty of buckwheat, as it is very fattening.

I want to say to you that a White Leghorn will make the first pound as soon as any breed of chickens I have ever had anything to do with. Just as soon as ours weighed a pound to a pound and a half, we dry-picked them and sent them to New York.

Now we are sending them away alive when they weigh a pound, and chickens never bring a better price than they do when they weigh one pound, because, as they go up in weight they go down in price, usually.

Some years we send to New York early in the season, and then when the season opens at Saratoga we ship there. Now they want us to ship them in a crate alive, when they weigh a pound or a pound and a quarter. We have gotten from thirty-five to fifty and fifty-two cents apiece, and I think that is a very good price. As they want them without picking, we are willing to get rid of all the work we can.

The pullets were fed on meat scrap with the johnny cake, and some oats ground, with the chaff sifted out; that was put in with the corn meal. We gave them buckwheat, also, and a variety of food. They had free range, which gave them plenty of muscle; and they were very healthy, and we were very much elated over the results.

While this busness is very attractive, I don't want you to go into it without consideration, and I don't want to mislead you, but I want you to do as we did; go into business in a small way, and as you increase your knowledge of the business enlarge your plant.

With the mighty increase in population there is a greater call for eggs constantly; and when you realize the fact that upon the average only sixty eggs per hen are laid in the United States, that is a very small record. Why, the farmers of the state of New York do not produce eggs enough to feed Greater New York.

Eggs are being imported into the United States—millions of dozens a year. With the price that exists today, and which is constantly going up, don't you see that we are victims of lost opportunities, and we should be benefited by the mistakes we have made. I am so sorry that my attention was not called to this business earlier in life.

Now, don't you see, poultry and dairying go hand in hand. One is an adjunct of the other, and you can realize on this as a side industry, a dollar on a hen, above all expenses, at the present price of eggs as you sell them to the grocery store; and I know whereof I speak. If you have plenty of confidence in this business, and look after all the little details, you are sure of success.

Our old poultry house was unfit for use, so we took out the interior and burned it. Then we refitted the house by running tarred paper along the studding, then began ceiling and stuffed between the ceiling with soft meadow hay, to make the room dry—and I am going to tell you that moisture in the hen house means death every time. The great secret of success in poultry is a dry room.

When our house was finished we had a room fifteen feet square, with a southern exposure, two windows in it, and made frost proof by filling in between ceilings; with a wallowing box and a nest box, a roosting device and a watering device, making the home very attractive and pleasant. But we didn't dare to put those old hens back into the new department—we did not even introduce them to the pullets. Those old hens had something on them besides feathers. So we let them roost in the old orchard, out of doors, and the pullets we kept in the young orchard, away from the old hens, until fall, and then they were taken into the new department.

When those pullets were four months and nine days old we got the first egg! And I will never forget how delighted the boy was. He was interested in the business and he watched it closely. A man must look after the details of the business if he would succeed.

Those chickens did pretty well; they began to lay and they did not decrease in their laying at all, but went on all through the winter. We got more eggs that winter than we had before in twenty years, during the winter months, all put together.

Then a serious question arose, as to what we should do with those nearly 300 old hens and roosters. So we talked the matter over. I always like to have a boy in the game, because he thinks more quickly than a man that is past the meridian—I know that by experience. He suggested that just before Thanksgiving we dress those hens and put them up nicely in attractive packages and ship them to New York. So just before Thanksgiving we killed them and picked them very carefully—every pin feather was picked off cautiously. After we finished picking we dipped them into a kettle of hot water long enough to count four slowly,and then, reversing the order, put them into water with ice in it for the same length of time.

Why did we do that? Well, you see, putting them into the hot water drew the secretions to the surface, and then putting them into the cold water with ice in it checked and held the fat over the surface of their bodies, and it puffed them right up. They looked fine—just like pullets—tender, mellow and fat. Then the boy went to the village and got a roll of blue ribbon an inch and a half wide, and after drawing their legs close up to their sides, tied it around their bodies, with a nice, double bow-knot across the breast, and laid them on their backs, so they would not get out of shape during the night.

The next morning we got some nice, clean barrels and packed them with a little straw. Then we took them to Cobleskill and shipped them to New York by express. In a few days we got a check which astonished me. It was much larger than I had expected to receive.

So, you see, we had disposed of the scrubs, and then we were in better company. We are now taking care of thoroughbreds. I will tell you how we are feeding now: We put straw on the floor, about four inches thick, and in the morning we feed some peas, oats and wheat. These are the best all-round foods for laying hens I know of. We raise Canada peas and oats together; the Canada peas, you know, are small, and the hens can eat them whole. The peas are rich in protein and the oats have got the "gimp" in them. Oats will make a horse trot, a hen cackle or a rooster crow.

Next we feed the mash. Take seventy-five pounds of wheat bran, one hundred pounds of wheat middlings, one hundred pounds of corn meal and twenty-five pounds of meat scrap or meat meal, and mix them together. We cut up some alfalfa hay, put that into the cooker and pour some skimmed milk on it and bring it to a boil, then stir in enough of above mixture to make the whole crumbly, and feed just what they will eat up in about fifteen or twenty minutes, in V-shaped troughs. You have to use your own judgment in feeding; after you have fed them a few times you can do it without the least bit of waste.

Then, in the evening, if the weather is cold, we feed them corn, wheat or buckwheat, providing nice, clean, pure water to drink constantly. In the wallowing box we put South Carolina rock for them to wallow in. That is a lice exterminator, as it contains phosphoric acid from 14 to 16 per cent, and no lice can live on a hen when she gets into that wallowing box and takes her bath.

You see we are very particular in regard to the care; we study their nature and make them comfortable and contented.

A question which has been frequently asked in the institutes I have attended is, What is a good ration for a laying hen?

That question answers itself, if you give it a thought. We will ask ourselves this question—What is an egg composed of? Seventy-four per cent of the egg is water. Now, how necessary it is that a hen should have water every hour of the day—nice, clean water. Because it is impossible for a hen to lay many eggs without water.

When the housewife opens an egg in a saucer and examines it, and the egg is not so nice as she would like to see it, the white of the egg is watery and the yolk is pale, she thinks the hen is sick, but that is not so.

When the white of an egg is watery, it shows that we are not feeding a good, well balanced ration. The lack of protein in feeding causes it. Fourteen and a half per cent of the egg is protein. That is the white of the egg.

We must find a ration rich in protein. That we can do by feeding plenty of clover and wheat bran and wheat middlings. What is the result? The white of the egg is thick and attractive.

Ten and a half per cent of the egg is fat; that is the yellow. If the yellow is pale we can color it by feeding.

If you feed too much buckwheat the yellow of the egg will be pale. We feed yellow corn and wheat, two glutens, and in that way we give a beautiful hue to the yellow. We also feed quite a good deal of corn, to produce fat.

How often do we pick up an egg in the winter with a shell so brittle that it won't stand shipping! Sometimes you find an egg with nothing but tissue—no shell at all. What is the matter with that hen?

The shell is composed of lime, and it is a great drain on the hen's system, to produce the shell. They must have lime enough to cover the egg with a shell.

Clover is rich in protein and it is rich in lime, but, in addition to this, we slack a little lime and put it into the shell-box, and the hens will go there if they require it; and you will be surprised, if you try it, at the difference in the results.

What is the result of this kind of food? We will break an egg in a saucer and see. The white of the egg is thick, heavy; it is attractive, nutritious; the yellow of the egg is the golden hue that was desired, and the shell is firm and strong and will stand shipment. There is the perfect egg, just brought about by thinking the matter over carefully and feeding intelligently.

In this way, you see, the business becomes more profitable to us. Furthermore, it is just as essential for us to breed hens of the laying type, if we are going into the business, as it is for the dairyman to have a cow of the milk type if he wants her for milk purposes.

Now, as to the laying powers of the hen. I visited Professor Gowell, who told me that it took him fourteen years to develop the laying functions of the hen so that he produced 241 eggs per hen. He has hens right there of the same breed that laid only forty eggs per hen during the same year, and some hens were barren.

I there studied the type of the hens; I noticed their characteristics. They were very perceptible. You could see it at once in their general make-up.

The best investment that we ever made in the poultry business was when we purchased our foundation stock. We bought thirty hens and three cockerels from Mr. Wyckoff.

It took him about twelve years to develop the laying functions so that he got 197 eggs per hen from 600 hens. I have already passed the meridian of life, age is crawling on, and life is so short that I wanted to begin where Mr. Wyckoff left off, and I was willing to pay him for the knowledge he had in the business. So our foundation stock was all right. They are very intelligent as well as very strong; they are the fashionable styles, up to date in every respect. I brought them home, and for more than ten years we have been further developing the laying functions of that stock.

You should select a hen something of a wedge shape, a little long over the back, and deep through the heart; that gives plenty of room for the ovaries, and that insures heavy egg production.

We are studying it very closely, and a few years ago we had 950 hens in one house that produced us 201 eggs per hen. We are not satisfied with that. We want to increase the egg production still further. But just as soon as the hen puts on fat it dwarfs her egg production. When a dairy cow puts on fat it dwarfs her milk production, just upon the same plan. There is the difference between success and failure in the business.

I will tell you our practice. About the middle of August we shut our hens up in order to reduce their flesh. We have one house 367 feet long and 15 feet wide, with two windows in each department; we put those hens into those rooms, which are fifteen feet square. One window has wire netting in front of it; this we open to give plenty of circulation of air. We give them a scant ration and plenty of water, and it takes about two weeks. At the end of the two weeks we open up the windows of the house and let them out, so they can range out into the sunlight in a fourteen-acre lot, and they look like so many balls of snow. It is a very attractive sight.

Then we begin to feed richer food and more of it, but we want to use some caution and watch their digestion. We give them sunflower seed, peas, oats, wheat and corn, a variety. We raise the sunflowers ourselves, and this seed works upon the feathers, and that will make them begin to shed, and they will throw off their old plumage until almost in a state of nudity. They will then go to work and replume early in the season. They don't suffer any inconvenience, as the weather at that season is mild and they do not get chilled. You don't see them standing around shivering and looking sick, forlorn and disheartened, for they are happy.

They will soon put on their new plumage, and as the feathers begin to come out, their eyes will begin to sparkle, their combs will turn red and they will begin to cackle. That is the time to gather the eggs.

You want to keep your hen-house dry, and avoid disease in that way. We clean our roosts every Saturday.

After the droppings are taken off we put on South Carolina rock, which we buy by the carload, and it absorbs the moisture, and this gives us a fertilizer that is astonishing. A hen will produce a bushel of manure a year. This means a better farm and better crops.

Just as soon as the roosts are cleared we paint them with a mixture, made as follows: Take a pound of carbolic acid crystals (and you can get that for forty cents), put it in a crock and set it in a pan of warm water and let it melt; then pour the contents into a gallon jug and fill it up with kerosene; then take another gallon of kerosene and put about four tablespoons of that combination into that gallon of kerosene. And I want to say to you that, with that South Carolina rock and wallowing box, with just a little care every Saturday, you will never see a louse nor a mite on your premises. We are very particular. We fight the lice before they are born; that is the best time to fight them.

There is no more valuable fertilizer than hen manure mixed with a little South Carolina rock, and the crops we raise with it would astonish you.

So, you see, it is not just the eggs that are profitable; but, also, the manurial value of the poultry. If you have a little farm of your own you can enrich your soil; you can have the eggs and the broilers, the birds for breeding and everything along that line, and there is something in the enterprise.

We began with only 200 eggs, and then as we grew in the knowledge of the business we increased our plant, so that we now have over $8,000 invested in buildings and appliances, and the hens have paid every cent of that amount and more, too.

I say to you people here—and I want to speak within safe bounds—you can just as well, at present prices of eggs, bring in a dollar a hen, after paying all expenses, and you can do it with your other work, and it makes a great deal of difference with regard to our finances.

CARE OF THE FARM AND DAIRY.

By C. D. Richardson, West Brookfield, Mass.

Under ideal conditions each person would follow his tastes in selecting his farm and his specialty in agriculture. One can get more comfort and financial profit from an occupation and surroundings which are congenial to him. In taking up a life of farming, however, one is compelled sometimes to submit to conditions beyond his control. He may have inherited his farm, or family affairs may have much to do with where he locates. When such considerations may have influenced his location, in studying the market where he is to make his farm home, he may find circumstances which make it financially advisable to take up a line of agriculture different from that which he likes best.

The decision in regard to a breed of cattle will depend on the specialty in dairying one undertakes, whether it be sale milk, cream or butter. But having decided on the blood best adapted to your specialty, then the more of it the better. Exercise good care in the selection of the male. Pedigree is of value; but be sure that there are ancestors of large production as well as of herd book registration. Breeding from such a sire and selecting the best of the calves is sure to result in a profitable herd in a few years. Breeding is better than buying, for in the former case you can control more of the conditions and be more certain of good results.

In building up a dairy herd by breeding you should not sell your best cows unless at a big price. If you are getting a herd by purchase, the other fellow will dispose only of his inferior animals, unless a high price is asked and paid him.

In deciding what farm crops to raise you will be governed by the nature of the land and the specialty you follow. In my own case I have a natural grass farm and I pay especial attention to the grass crop, both in pastures and to be cut as hay. I do not give much attention to cultivated crops or to soiling, under my condition.

Cattle should be grained in summer, as well as in winter, and when land is not too valuable turning the cows into the pasture at night will tend to maintain its fertility and even to bring it up. The hay fields should be put into such condition and made of such size that the most improved labor saving machinery can be used.

Take good care of all tools and machinery. One of the great leaks on the farm is caused by neglect of machines, and not having them ready for use when wanted. The natural New England grasses cut early and well *cured*—not dried—make the best of cow feed. I supplement this by a mixture of cottonseed meal and coarse bran, in equal quantities by weight, about two to one by bulk. Each cow is fed as much as experience shows she can digest with beneficial results. This amount will vary from four to eight quarts per day per animal. When the cows are at pasture in the summer see that they have an ample supply of pure spring water. I prefer to have a trough in the pasture for them to drink from.

When the cows are in the barn in winter, give them plenty of light and air. I prefer to board carefully the sides of the barn back of the cattle to prevent any uncontrolled draughts of air back of and over them. In front of the cows is a large space in which the air is constantly changing without draughts, from the free circulation induced by windows in the lower part of the barn and near the gables.

I water the cows in the cellar, where there is a supply of running water. I regard the mild exercise of going to this and returning to the tie-up as beneficial and an offset to the extra time consumed by this system. I have a barn-yard facing the south and through the middle of the day in pleasant weather the cows are allowed to exercise there.

The barn and cows should be kept clean and this can be promoted by liberal use of bedding. Milkers should also be clean themselves and in their habits. Cows should be handled and treated in a kindly, careful manner. This will give better results at the milk pail than when they are poorly treated or abused. When cattle and stables are cared for in this manner the milk will be clean and free from an excessive number of bacteria. It should be removed from the barn at once, and promptly cooled, in order to prevent the increase of the number of bacteria. This is important whether the milk is to be sold whole, or cream is to be sold, or butter is to be made, at home or at the creamery.

But important as is all this, the question of marketing is equally important. Indeed, it is the vital question. What shall I produce? How shall I produce it? are necessary questions. But, How shall I get the most out of what I have produced? must be answered if there is to be any profitable returns from all the labor and expense of production.

The answering of this question depends even more on the individual than does the matter of production. Certain universal general principles govern production, but often in the sale of a product each person's circumstances and business instincts are governing factors in the case. A few general principles, however, are of importance in the sale of dairy products. They must be clean, they must be put up in a tasty manner, and the packages must be clean, attractive and convenient. It is very desirable that one should have a market which will appreciate—and pay for—an article of extra quality. If one has not such a market he should try to create it.

THE SUPPRESSION OF BOVINE TUBERCULOSIS.

By H. O. Hadley, Peterborough, N. H.

(Extracts from address given at farmers' institutes.)

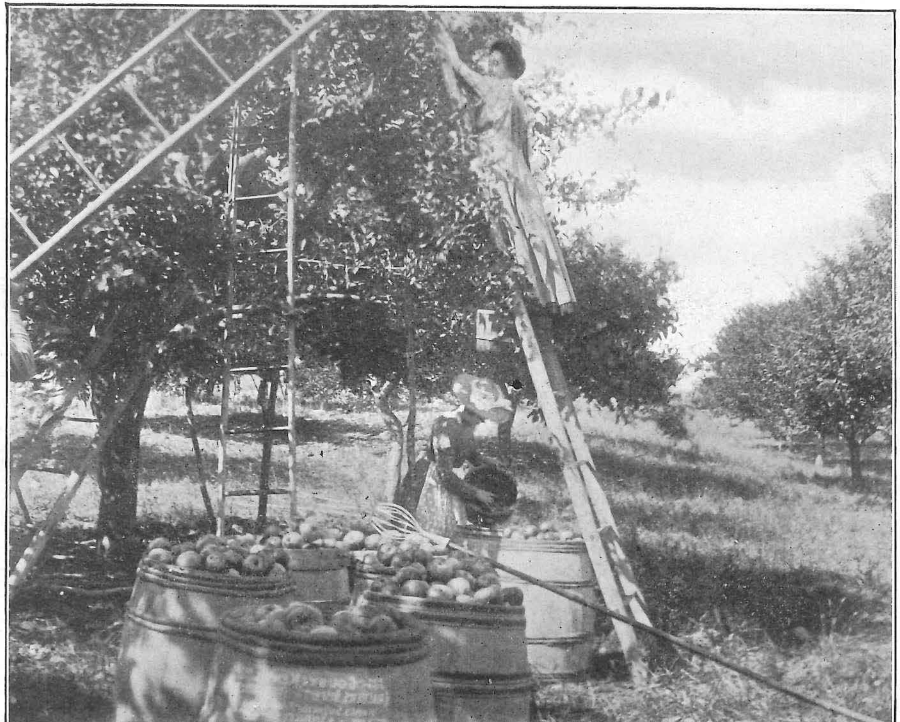
Bovine tuberculosis is one of the oldest diseases of animals of which we have knowledge. It was known to the Egyptians in the days of their captivity, and from then until now it has been a subject of much thought and investigation. Tuberculosis is caused by a microbe or micro-organism better known as tubercle bacillus. This is a small, rod-shaped micro-organism, so small that it would take ten thousand of them placed end to end to cover the distance of an inch in length. This organism has a peculiar way of retaining the stain used for coloring it, so it is possible to distinguish it from other bacteria by a microscopic examination. The tubercle bacilli escape from the diseased animal in the saliva and mucus from the mouth when the lungs or certain glands are discharging into the respiratory tract. They also escape in the pus from tubercular abscesses that open through the skin, and in the milk.

Symptoms: The beginning of the disease usually passes unnoticed, inasmuch as it is very slow and insidious and rarely accompanied by fever. When the lungs are involved a dull, short cough is noticed which may later on become prolonged, convulsive and very troublesome to the animal. The cough is more frequent in the morning after movement and drinking. The breathing varies. Only when much of the lung tissue is diseased is it labored and accompanied by active movements of the chest and nostrils. Discharge from the nose is very rare. At times, however, when the tubercles have broken down and cavities containing cheesy masses have formed in the lung tissue, or when the air tubes have become filled with cheesy and mucous masses, coughing will dislodge these and cause their discharge. In advanced stages the breath may have a disagreeable odor. Pressure on the chest wall may give rise to pain. Another symptom, and sometimes the first one noticed, will be stiffness when coming out of the barn, something like a horse that is sore forward. This is caused by the movement of the shoulders over the diseased lungs, which causes the animal pain, and makes her movements slow and stiff. A failure to breed is also one of the first symptoms noticed in many cases. The general effect on the body is at first slight, in fact animals may remain in good flesh for a considerable time. Invariably as the disease progresses loss of flesh and appetite and paleness of the mucous membranes become manifest, and these are accompanied by a gradual diminution of the milk secretions. The debilitated condition of the animal is also manifested by a staring coat and a tough, dry, harsh skin. Digestive disturbances are indicated by a distention of the stomach by gas, colic and diarrhœa, alternating with constipation. The animal generally dies from exhaustion after a perod of sickness which may last months or even years.

The method of infection: Animals become infected with tubercle bacilli largely by eating with or from the same crib from which some infected animal has eaten or by feeding from an open floor beside some diseased animal. One thing is certain, and that is, if there is no germ of the disease present in a stable of a healthy herd they will continue healthy until some diseased animal is taken into the herd and develops the disease, and then trouble begins. The most common way in which the disease is introduced into a herd is by bringing in some animal that looks perfectly healthy, but has the disease about it, which later on develops so slowly that it is not noticed until the animal is so bad that the disease germs are already scattered and perhaps have taken root in some of the other cattle that appear perfectly healthy. The best way to avoid contracting the disease is to buy from herds known to be free from disease and those only which will pass the tuberculin test; then by keeping the cows in a stable where there is plenty of sunlight and pure air may we expect a healthy herd.

Our experience of eight years in doing some of the field work of the State Board of Cattle Commissioners of New Hampshire has taught us that we may never expect to entirely eradicate the disease, but that it may be greatly reduced and brought to a minimum under careful sanitary conditions is certainly our opinion. As the most efficient means of preventing the spread of tuberculosis the conclusion has been forced upon us that sanitation must rank first.

Whenever we have found tuberculosis to exist extensively in a herd of considerable proportions we have invariably found one of two conditions in connection therewith,—that the animals were stabled in close quarters, with an entire absence of proper ventilation and cleanliness, thereby maintaining an atmosphere so warm that the temperature rarely reached the freezing point in mid-winter, moist and charged with the effete stable products, thus creating the very best possible conditions for the tubercle bacillus and its diffusion among the animals. Or, second, a degree of inbreeding among some of the thoroughbred herds that in all possibility impaired the powers of resistance and rendered these animals particularly susceptible to infection. It is a very common occurrence to find stables constructed with a deliberate purpose to retain the animal heat without any attention to ventilation or other sanitary conditions. Under such circumstances once infection is introduced into the herd, even though the diseased animals are destroyed as soon as discovered, disinfection of the stables sufficient to destroy the germs is next to, if not quite, impossible. The remedy lies, therefore, as far as this phase of the question is concerned, in educating the farmer and stock raiser along these lines, and to show him that the best protection that he can give his herd, not only against tuberculosis, but against other diseases from which cattle occasionally suffer, lies in sanitation. When an animal is found to be diseased she should at once be destroyed, and the



View in Orchard of C. S. Phinney, Standish.

stable thoroughly disinfected. This can be done by washing the stable, especially the crib or eating place, with a strong solution of carbolic acid and water, having the water boiling hot. The stables should be whitewashed at least twice a year, thus making them clean and sweet, as well as much lighter and neater to look at.

The custom of boarding up in front of the cows, thus shutting off their supply of fresh air, is one of the worst things a farmer can do. We believe when the farmer realizes the great need of pure air, sunlight, and exercise, for his cattle in order that they may be healthy, he will give these things more attention, and as a result there will be less tuberculosis in our dairy herds.

ORCHARD RENOVATION.

By D. H. Knowlton, Famington.

The apple crop in Maine for 1905 will bring to the farmers of Maine nearly or quite a million and a half dollars. Under these conditions there will be a great boom on for setting trees and making new orchards. This is all very well, for it declares in language plainer than words can express that there is money in Maine orcharding. At the same time there is more to it than the setting of trees, since it is a lamentable fact that a large part of the trees that have been set the last twenty years have had to struggle along the best they could—the victims of neglect. That so many of these trees are producing excellent fruit is only another proof of the favorable conditions for fruit growing in the State. As I go about over the State I find many things along the line of fruit growing to which it is my purpose to call attention in this paper.

THE OLD TREES AND WHAT TO DO WITH THEM.

Scattered here and there over the State there are a great many old orchards. The trees have been where they now stand a great many years. Some of them have been producing excellent fruit for years, but a larger part of them have long been neglected and their tops are filled with decayed limbs and innumerable shoots and spurs. Many of them are bearing only natural fruit. Last year I was interested in harvesting the apples from one of these orchards, and I verily believe the apples were worth little more than the cost of gathering; besides, a man's life was in almost constant peril in worming his way among the tangled, half-decayed branches. These trees have long outlived their usefulness, for most of them, so far as they produce fruit, bear only that of inferior quality. So we may say that as producers of fruit they are well nigh worthless.

The trees have been long neglected and they certainly detract much from the beauty of the farm and hillside. In a way, every man who owns a farm owes it to himself and his neighbors to keep his premises neat and to make them as attractive as possible. An old lady found herself among the passengers on a fisherman's craft, en route for Nantucket, in the War of 1812, when English war vessels were prowlng around Massachusetts Bay. When discovered the craft was run down by an English frigate and boarded by the British and the crew declared prisoners of war. The passengers were wringing their hands and the crew were just about as much alarmed as the women. But Aunt Martha, wiser than the others, was in the cabin, arranging her front curls, putting her cap in order and preparing to meet the British officer who was left in charge of the captured boat. Not long after the British tender had pulled off she made her appearance on deck. She made a low bow to the British officer in charge and to the sailor as she passed him. She was a fine looking woman and a model of courtesy and refinement. The officer was charmed by her manners and conversation. While she thus engaged his attention the skipper took the hint and gave the signal for his men to seize the captors. Thus it was, thrown off their guard by Aunt Martha's fine appearance, they were easily overcome and made safe. Soon after all sail was put on and the skipper brought his craft to a place of safety with prisoners of war on board. Aunt Martha was thanked over and over again for the part she had played in the escape, but she simply remarked that it was always best to make a good appearance. Her good appearance saved the craft from capture, and the good appearance of the farm has drawn many a purchaser near, and the better we can make our farms look the more attractive our

State is going to be to those who want homes or visit us for recreation.

There is another thing about these old trees: they are the worst places on the farm for breeding all sorts of insects and fungous diseases. Out on the old apple tree there is a nest of caterpillars. The farmer sees it, but he is in a hurry and says to himself, "The old apple tree isn't good for anything any way and it won't pay to take them off." So the caterpillars have it their own way, and the poor tree struggles along the best it can. But the day of reckoning comes later. There were few caterpillars on the old tree at first, but they had their own way and now hundreds, yes, thousands of caterpillars are foraging down in the orchard and the farmer realizes that there is only one way in which to save the orchard and that is by putting up a fight against them. Had he seen a single nest in one of his younger trees he would have stopped his team and wiped the caterpillars out of existence before they had time to do much injury.

Thus it is these old trees are unsightly objects on the farm or about the farm, and the proper thing to do is to use the axe and saw until they are removed. In doing this I would not advise leaving the limbs in piles about the orchard or farm. I would rather burn them up and get them thus root and branch out of the way.

TROUBLESOME TREES ON THE FARM.

On every hand we find evidences of the favorable conditions for fruit culture in Maine. The hillsides and pastures are everywhere dotted with seedling trees that have sprung up almost spontaneously, and, notwithstanding they are browsed by the cattle and sheep and have to struggle with other trees and shrubs for food, they keep on growing just the same. Dwarfed, distorted, and ugly to behold, they are proving a great menace to the orchardist. I know hundreds of farms where these trees abound and they are the breeding places of insects and the homes of fungous diseases. I saw one of these trees in Kittery last spring that had in its branches over fifty nests of brown-tail moths in the caterpillar state. This is only an illustration of what may happen anywhere in Maine, especially if every precautionary measure is not promptly applied. A few years ago the gypsy and brown-tail moths made their appearance in Massachusetts. The state made appropriation for their destruction, but it was not done until the pests had gained a foothold. It took lots of money and the politicians got mixed up in it and concluded to withdraw further appropriations. The insects had their way for a year or two, until the old commonwealth became alarmed over the situation, and now they are trying to save the trees and shrubbery of the state. In doing this, or rather in their neglect to fight them off at first, the insects have become disseminated over a large part of the state as well as scattered over a large part of New England, and there is the greatest solicitude for the future as well as the present. Under these circumstances there are special reasons why the progress of these and of all other forms of insect life should be held in check. The removal of worthless apple trees whether they be large or small will be a great help in this direction, and such trees should no longer be allowed to grow. Cut them out and burn them up. I might add to this that I would also cut down wild cherry trees, alders, and other shrubs that have no value, either present or prospective.

UTILIZING VOLUNTEER TREES.

During the harvest season I was riding across the country one day when I met a team loaded with natural fruit. I asked the driver what he was going to do with it and he said he had sold it to the canning factory for 75 cents per barrel. To be sure this was as much as many apples sold for the year before, but a mile or two beyond a man and his two sons were picking Baldwins from a lot of roadside trees. The man was a Canadian who a few years before had bought the run-out farm for a song. "What are you going to do with those?" I asked. "I shall sell them to Lowell for $2.50 a barrel," was his reply. There were several barrels of them in sight and they were fine looking Baldwins.

These trees, every one of them, were growing by the roadside. They came up from seed, scattered no one knows how, and the thrifty Canadian had pruned them up and set in the scions. Only a short distance from this roadside is a volunteer orchard of Baldwins growing in a pasture. The owner saw the trees growing there and he went to work and grafted them over. These trees are producing fine apples, and they cost the owner hardly enough for him to realize that they are worth anything to him. Wherever we go in the State we find these volunteer trees, well established, hardy, thrifty trees. They are just waiting for the farmer to go out and work them over into profitable market varieties of fruit. A few dollars spent here will be far more profitable than spent in planting new trees. There are thousands of such trees that in five years could be converted into productive trees. Such work, it seems to me, may well be considered as a part of the renovation of the orchard. In this connection I am glad to notice that there is an effort in some places to have the public parks and streets decorated with more or less fruit trees. The plan is a good one.

PRUNING THE TREES.

While it is not my purpose to tell just how or when to prune the trees, I wish to call attention to its importance. One of the largest orchards in the State has suffered much from lack of pruning. In earlier days it was one of the most productive. The owner was rather averse to "mutilating" his trees when they were young, and as they increased in size it was altogether too much work when help was high and scarce. I have been told that the fruit now grown in this orchard is not as large as it was a dozen years ago; that it is colored less, and that a much larger per cent of the fruit is imperfect for one cause or another. In this case it would be vastly better for the owner to prune his old orchard rather than to set more trees, and yet there are many people in the State who have orchards in just this condition who are buying and setting more trees. Certainly for the present it would pay vastly better to get the fruit trees on the farm in good condition before setting out others. Such work will increase the quantity and quality of fruit—two most important matters in the business.

CULTURE AND FERTILIZING.

There has been a great improvement in the culture of orchards in the State during the past dozen years, but there are many, we fear the majority of orchards, that are still sadly neglected. There is need of a general awakening along this line. Our orchards that are in grass land are likely to suffer materially from dry weather, causing the fruit to drop prematurely, and whatever may be left is quite likely to be undersized, caused by the dry weather. Cultivation of the soil to a very large extent will overcome these conditions. It is noticeable everywhere that orchards cultivated are in better condition than those uncultivated. Visit orchards and observe these conditions for yourselves and the lesson will be confirmed.

There are thousands of neglected trees that are starving to death for the want of some nitrogenous food. They have lived on from year to year with little growth. Some have died in consequence, and those that have borne fruit are doing it at a sickly rate. I was in a situation not long since where I could look over a broad valley in Kennebec county. On every hand there were orchards spread out before me. In one of these orchards some interestng fertilizer experiments were being conducted by the State Experiment Station. These experiments were so arranged that there were more or less trees that were left for comparing results. I do not know exactly what the results were, but I do know that one could see even at a distance the difference in the condition of the trees. Those receiving the fertilizing were a deeper green, and compared with other orchards within view the difference was very marked. Some of these were treated with home-made fertilizers, some with chemical fertilizers, and others were enriched by the hogs that to a large degree lived upon what they got by rooting among the trees. A closer inspection showed that the effect of the fertilizers was not all in the foliage, for the trees receiving the treatment showed much larger and better fruit than the check rows. They stood the winter much better and bore more fruit this year, thus showing that the fertilizer lasted more than one year. The work of others in the State fully confirms the results reached in this orchard. Feed the trees and they will return fruit in abundance. It matters not from what source the fertility may come if only it reaches the hungry roots of the trees. Some are obtaining it by keeping hogs, some by pasturing sheep among the trees, some by keeping poultry in the orchard, and others by the use of chemical fertilizers. Get it somehow and give your hungry trees a fair chance.

Several excellent formulas for chemical fertilizers for orchards may be found in the Pomological department of this volume. They are all good and the cost of each is somewhere around 25 cents per tree and one may choose for himself, though the writer thinks there is especial need at this time of those rich in the nitrogenous elements.

THE GROWING OF ALFALFA.

By FOREST HENRY, Dover, Minn.

The semi-arid sections of the west were at one time considered about the only place in America where alfalfa could be grown successfully. The plant has been gradually pushing its way eastward across the Mississippi river, and, in fact, into nearly every state in the Union. Many sections are now growing profitable crops of alfalfa that were at one time thought to be altogether unfit for its production. By the proper study of the plant and its requirements I believe it can be grown in many sections of the State of Maine. One of the requirements of alfalfa is a dry or well-drained soil. It would be useless to sow it unless these requirements could be met. Like red clover it draws its nitrogen through its bacteria on its roots. If the soil is acid these bacteria will not multiply. This acidity must be corrected before alfalfa can be successfully grown. This can be done by the application of lime the same as recommended for red clover.

Alfalfa to do its best must make a quick, vigorous start. This will call for a soil well supplied with plant food. I much prefer a liberal use of stable manure to any commercial fertilizer to supply this demand. The stable manure, besides furnishing the plant food, also furnishes a medium in which the alfalfa bacteria thrive best.

I should prefer the soil to be plowed the fall previous to the sowing. A sod field would not be desirable. A field that had previously grown a crop of corn would answer the purpose admirably. Top dress this during the fall or winter, if possible. Thoroughly cultivate this dressing during the early spring. Keep on cultivating the field at intervals until all danger of frost is passed. This will put the field in good mechanical condition and at the same time liberate plant food and, last but not least, kill innumerable weeds that have sprouted that would be injurious to the alfalfa if allowed to grow.

One step more before the alfalfa is sown. The soil should be inoculated. The alfalfa bacteria is different from the bacteria that grows on the ordinary red clover roots. The alfalfa being new to the State it would be much safer to inoculate the soil by sowing about 200 to 300 pounds to the acre of soil taken from an old alfalfa field. This should be sown evenly over the plat during a cloudy day or after the sun has gone down and immediately cultivated in. If sown during bright sunshine much injury would be done to the bacteria. Nitro-cultures have been used with varying success for the purpose of inoculation. Nearly all authorities agree that soil from an old alfalfa field is much more sure to bring the desired end than the nitro-cultures.

After all danger of frost is passed, sow about twenty pounds of northern grown seed to the acre. Care should be taken to sow the seed at a time when there is sufficient moisture to insure an immediate growth, or the weeds will get the start of the alfalfa. The seed should be sown alone and not with a nurse crop, as clover is usually sown. If everything works well the alfalfa should soon cover the ground.

As soon as the alfalfa gets from eight to twelve inches high, if it takes on a yellow color, as it is very apt to do, mow it off as closely as possible and leave the clippings on the ground for mulch. This will strengthen the root growth and discourage the rust that causes it to look yellow. In a very short time the alfalfa will press up again through the clippings, and soon cover the ground. It should be clipped back in this manner about three times the first season, each time leaving the clippings on the ground for mulch. The last clipping should not be later than the first of September. What grows after this time should be left standing to protect the plants through winter. At no time should the alfalfa be left to blossom during the first season, as that would weaken the vitality of the plant. If the plants winter well they will start early and make a very rapid growth the second season. About the first of June they will begin to blossom. This is the time that the first cutting for hay should be made. It should not be allowed to come to full blossom. It should be cut as soon as the first blossoms appear. Care should be taken that it does not get too dry before it is raked and piled. It should be mainly cured in the pile.

The value of alfalfa hay is never questioned. It is worth nearly as much pound for pound as wheat bran for feeding young animals and milch cows if properly cured. About three crops in a season should be expected in this section. One thing bear in mind,—always cut in time, if there be more or less. If the cutting is delayed the vitality of the plant is impaired. The stand should grow better year by year for, at least, the first three seasons.

Alfalfa is usually intended as a permanent meadow crop and not a rotation crop as red clover. An occasional top dressing will benefit it but is not absolutely necessary. If for any cause you fail to get a stand the first time trying, plow up the same piece of land and begin over, following the same plan. You will be very much more liable to succeed than if you were to select another field. Don't forget that you must have a field *thoroughly well drained* if you are to meet with success. I fully believe that there are many fields that are now only producing a light crop of poor quality hay that might be made to produce good crops of alfalfa if the proper course were pursued.

REPORT OF PROCEEDINGS

OF THE

State Dairy Conference

AND

EIGHTH ANNUAL MEETING

OF THE

Maine Dairymen's Association,

DECEMBER 5, 6, 7, 1905.

The annual State Dairy Conference, under the control of the Maine State Dairymen's Association and Department of Agriculture, was held at Pittsfield, December 5, 6 and 7, 1905. This was one of the most successful meetings of this nature ever held in the State. A large and interested audience assembled in Union Hall, and in Grange Hall the display of dairy products and dairy machinery and appliances was exceptionally fine. Tuesday, December 6, was devoted to the arranging of exhibits and entering and scoring of dairy products.

WEDNESDAY, DECEMBER 6.

ADDRESS OF WELCOME.

By E. A. PORTER, M. D.

Mr. President, Ladies and Gentlemen of the Maine State Dairymen's Association:

In behalf of the Board of Trade and the good people of Pittsfield and vicinity, I bid you a most cordial welcome.

While we only have a small village of about three thousand inhabitants and lack many of the advantages and accommodations of the city, yet we are firm believers in being wide awake, full of energy and up to date. Our churches and schools are models of excellence and our scholars may have the advantages of a good education and even fit for college, tuition free. We have a fine library building and a very good library.

The water works system is of the best and owned by the town, and it affords fine protection from fire. We also have a good sewerage system. The town is well lighted by electricity, having both day and all night current furnished by the Sebasticook Power Company, composed of local capital. It has plenty of electromotive power to sell for manufacturing purposes and the town is always ready to offer terms which make it an inducement for manufacturers to locate here. Our railroad facilities are of the best. There is a good water power which is fully utilized by the three woolen industries of this place. There are lumber and wood-working mills, a good corn canning factory and a creamery which are a great help to the growth of the farming industry of this place and vicinity. And, in fact, we have a hustling and prosperous farming community, one that is taking pride in the calling, and is maintaining in our village a live and prosperous grange of over three hundred members. With all, we think it is a bright, wide awake and hospitable town to live in. And we bid you welcome, not only because we hope to make your stay with us one of pleasure and profit to you, but also for a selfish motive, that we may receive from you valuable knowledge of the best and most approved methods of performing the various duties, thereby giving us a stimulus to do better work.

This is a period of great progress in manufacturing, in agriculture, in medicine and surgery, in means of travel and conveyance and, in fact, in every vocation, and he who would keep abreast of the times, must attend the meetings of his profession or calling and have the best and most up to date books that are written on these topics and closely follow the best papers and periodicals of the day. If you drop out but one day, the other fellow, who has kept on, is one day ahead of you. And if you would have the aid of others you must be ever ready to give to them some of the good and valuable things you have learned.

Have the boys and girls attend these meetings that they may receive this stimulus and develop a love for, and a practical knowledge of the rapid progress that is being made in the calling which they are about to follow. If the boys attended these meetings more and made agriculture more of a study, then so many of them would not consider farming a drudgery and long to leave it for the confined life in the mill, the work-shop, the store and the professions.

But because a boy is born on a farm do not think he must become a farmer, or that a doctor's son should become a doctor, or a merchant's son a merchant. Find out his talent and what he loves to do. Educate him for it and the chances are he will make a success of life. Work will not hurt any one. It is the worry, the dislike, the being ill-fitted to follow the chosen vocation that wears out the body and soul of a man, shortens his life and often makes it a failure.

Perhaps if I should say that I was born on a farm and there worked until I was twenty-one, which is a fact, and should now try to display some of my interest in farming, you might say by me as the old farmer in the legislature said by the lawyer who was making a very eloquent speech and trying to win the favor of the farmers in that body to his side of the question when he said, "Why, I was born between two rows of corn." One old farmer in the back of the house sang out, "Pumpkin, by thunder."

The most of the wealth produced in this world is the product of agriculture and mining, although mining is but a small part compared with agriculture. The roots of a tree are equal in size to its top. The roots will live and grow forth another tree if the old one is cut down, but the old tree that is cut down must die, it cannot live without the roots. So it is with our commonwealth. Those who till the soil are the roots and the foundation and can live without the people of commerce, manu-facturing and the professions who represent the top of the tree and who, when severed from their foundation or roots, must surely die.

If I remember correctly, more than one-half of the people of this world are agriculturists, and, as I have before said, they are the producers of our wealth. The rest of us are but hire-lings, living upon them as manufacturers, merchants and those of the professions.

Now, lest I weary you and take up too much of your valu-able time, I will come to a close, again bidding you welcome

Island Sheep.

and wishing you a meeting largely attended and with papers full of instruction so that when you depart for your various homes you may go with your heads filled with much useful knowledge, your stomachs with the good things of Pittsfield and your memories so full of the pleasant and profitable hours spent here that you will want to come again.

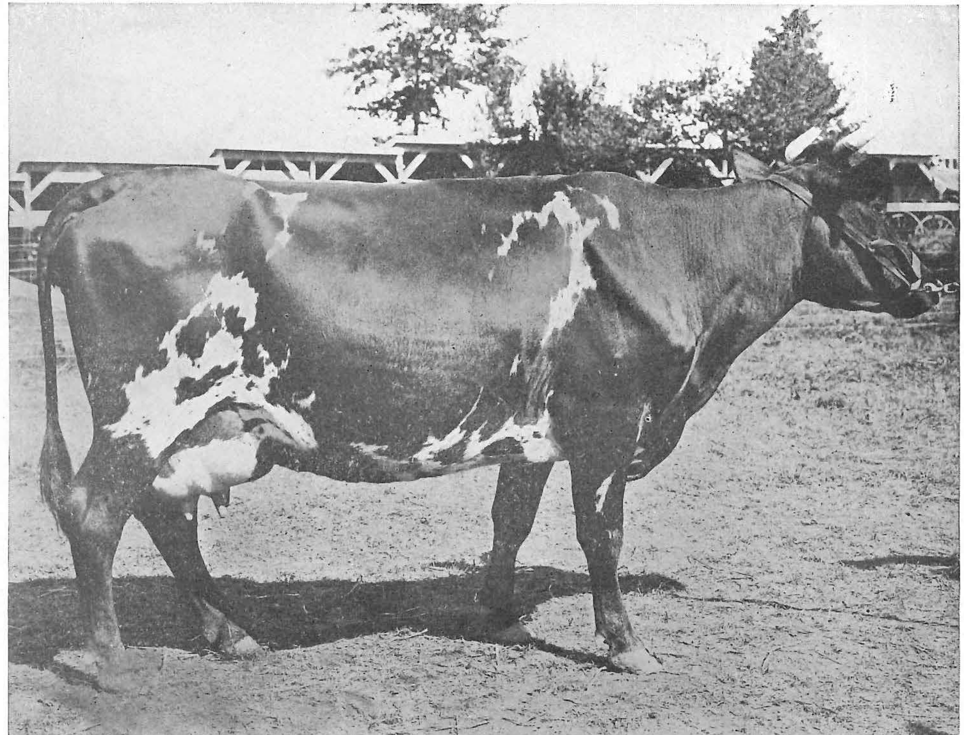
RESPONSE,

By A. W. Gilman, Commissioner of Agriculture.

It gives me joy and pleasure to receive such a greeting as this. When we were invited to hold our annual conference here in Pittsfield, with its busy, hustling, generous people, we knew that we should receive this very cordial welcome that has been extended to us this morning. Every citizen of this State is either directly or indirectly interested in the Maine Dairymen's Association, an organization composed, as it is, of some of the best, most progressive and energetic men of Maine, for the sole purpose of increasing, advancing and stimulating the dairy interests of the State. The efforts of the association have not been in vain during the past decade. We have been making some progress, enlarging the cow population and increasing their product, both in quality and quantity. Some of the dairymen have raised the standard of their herds to a very desirable position. These great dairy herds that some of our farmers possess were not obtained by haphazard or chance. They are the result of careful selection, wise breeding, judicious care and intelligent handling. Every dairyman should strive, as much as in him lies, to build up and breed up his herd, so that his cows in each succeeding generation shall advance in quality, and increase in strength and vigor. The dairy cow, to perform the work that is expected of her in these times and resist the diseases that are so prevalent, must be strong and vigorous. This is no easy task. It is a slow process. It requires the best efforts in man. Study the individual characteristics of your herd; watch developments; attend dairy conferences; hear the wise and great men discuss the important topics of breeding, of feeding and caring for the dairy cow. Then it will become a personal matter for you and me to apply it to our own conditions as far as practicable. Our progress in the past may have been slow and at times discouraging. My brothers, be of good cheer! What others have done we can do. Eternal vigilance, judgment, perseverance and patience are the price paid for success. The world is moving and we must advance with it. We cannot remain stationary.

Brother farmers, are we keeping pace with this moving procession whose watchword is Onward? Are we putting as much study and thought into our chosen work as those in other occupations? Let us see to it that we, the tillers of the soil, are not behind the flag in this race. Set your standard high and strive to attain it. Life is a constant battle, let us fight it manfully.

Mr. President, we have met here for a purpose and I trust we shall accomplish it. Bound together by the association, we are I hope united as one man with only one object in view, and that is the advancement of the Maine Dairymen's Association and the dairy industry of the State. Agriculture is the foundation of all industries and no department of it is of so much importance as dairying. By advancing the dairy we advance every interest in the State. There is no industry, there is no State industry existing today which is equal to the dairy. If the farmer succeeds the country prospers, peace and plenty reign and the world rejoices. We expect that much encouragement will be derived from this conference. The program is rich and full of good subjects to be discussed by Maine's progressive dairy workers aided by men from other states whose reputation is national.



Ayrshire cow Zulu, 14,468. Owned by Rev. E. F. Pember, Highland
Bangor, Me.

THE COW.

By Prof. G. M. Gowell, Orono.

The cow stands out superior to all other animals in her relations to man. She came across the ocean with our fathers when they sought refuge in the American wilderness.

Few of those men could boast of coats of arms and most of them were barely able to spell and write their names correctly.

The cows had no pedigrees—they were brought just because they could help in the struggles for homes. Somebody has written for us the histories of the struggles and hardships of the pioneers to New England, but nobody has written the history of the early New England cows.

The men and women of those days had few comforts themselves, and saw but little in their own lives which they thought worth writing down for those who were to follow them. But they chopped down the trees and made their clearings, built their cabins, fought Indians, built roads, schoolhouses, churches, villages, cities and colleges, and when they had harnessed steam and electricity, and made them do their bidding, they unyoked their oxen, and unharnessed and abandoned their horses—but the cow, that had given milk for the sustenance of their starving children, when our State was a wilderness, could not be supplanted by any machine that the minds and hands of ingenious man could devise and construct. And so she staid with us,—and is with us now, not as a tolerant, but as a contributor to the welfare of the world, superior to all other animals, save man.

Her milk, cream, butter and cheese are on the tables of every family in the land, three times a day, if they are able to buy or beg them. As she gives her milk for the sustenance of our children, so she also gives of her flesh, her son, the beef steer, as food for the support of man. Other classes of domestic animals have risen and fallen in public popularity, for varying periods of time, but not so the cow. Quiet and unpretentious, she plodded on, yielding her little, day after day, year after year, generation after generation, until the scales fell from the dull eyes of men and they were able to see in her and hers, the instruments which were to enable them to change the position of New England agriculture from a depressed and profitless vocation to the most helpful, prosperous industry in our country. Through her agency the green is being brought back to the brown fields again, the bushes are being cleaned from the pastures, and the going back to Nature is being checked. Clover and corn are being grown as foods especially for her, and better farm homes are keeping our boys and girls with us, and calling back from the cities the ones that wandered away, before she set in operation this newer system of agriculture. In her helpfulness to man, she has reached out over and beyond the hills and valleys of New England, until she occupies all of the northern country, and hundreds of thousands of men are constantly at work, caring for her and her products, and carrying her milk, cream, butter and cheese to the great markets, by trainloads. Ingenious men have devised and constructed dairy machinery, and we have many great manufactories devoted exclusively to their making, to the extent of millions of dollars worth of machines and implements each year. So generally is the cow being recognized as the great benefactress of our time, that the people of every northern state are holding meetings and conventions, as we are doing here today, to plan and provide for the welfare of the greatest of all industries, of which she is the central figure. Great pressure is being brought to bear on the industry in every section, to make it more profitable. Every succeeding year more men are engaging in dairying, and more acres are receiving better tillage, until those old-fashioned plants of our boyhood days, Indian corn and red clover, yield sufficiently for the generous support of a cow on every acre, in numerous instances. While this is true of corn and clover, who shall find the limits of the possibilities of grass—the one plant that outclasses all others in value and adaptation to the cool, moist climate of Maine?

Do you recall the tribute paid to grass by that great Kansan, John J. Ingalls, whose monument was unveiled in Washington a few months ago? "Grass is the forgiveness of Nature, her constant benediction. Fields trampled with battle, saturated with blood, torn with the ruts of cannon, grow green again with grass, and carnage is forgotten. Forests decay, harvests perish, flowers vanish, but grass is immortal. Sown by the winds, by wandering birds, it softens the rude outlines of the world. It invades the solitudes of deserts, climbs the inaccessible slopes of mountains, modifies climates, and determines the history, the character and destiny of nations. It yields no fruit in earth, or air, and yet, should its harvest fail for a single year, famine would depopulate the earth."

And so, gentlemen, I stand for grass! Among men, the world has those that boast of their histories, and those that have none; those that boast of pedigrees and coats of arms, because they can trace back to some fellows in their family histories, who were either great saints or scoundrels; but the bulk of this country's work is being performed by men whose pedigrees are not traceable beyond the Atlantic.

So this great dairy industry is being made what it is by the united work of the millions of American bred cows; cows without pedigrees; cows without histories; cows that are not known beyond the borders of the farms on which they were raised. They came from breeding cows of that hardy old New England stock to special dairy-bred bulls, that were imported from Jersey, Guernsey, England, Scotland and Holland, and continuing the breeding with the succeeding generations, until we are fast approaching a general basal stock, which is better in its hardihood, and better in its performance, than like numbers of pure bred cows of any or all breeds.

Not for one instant would I be understood as undervaluing the many herds of pure bred dairy cattle we have, for it was through the influence of the better bulls of the pure breeds that our common cows derived their dairy functions. While we have *many, very many,* beautiful, great milk and butter producing cows in the pure bred herds, it is lamentable that among them are so many inferior creatures, that would be tolerated in no breeder's herd except under lax registration laws. In our common grade dairy stock we have the best of foundations on which to build the dairy workers of the future. The breeders of pure bloods will vie with each other in breeding bulls good enough for the needs of practical dairymen, and this should be the highest purpose of their work—because of its greater field of usefulness. We need no longer go to foreign countries for new and better blood, for the great number and high quality of American breeding establishments give ample scope for the avoidance of the pernicious influence of inbreeding. Why do we expect to find better stock on the island of Jersey, an area not greater than this little town of Pittsfield? Or on Guernsey, which is but one-third as large? Why should we go to Scotland for better Ayrshires, or to Holland for Holsteins simply because the breeds originated in those countries?

We have taken all of these breeds, and Americanized them, and adapted them to our purposes.

Are the people of Jersey, Guernsey, England, Scotland or Holland possessed of more skill in the art of breeding than the men who bred the winners at the St. Louis Exposition last year? It almost seems as though our people are daft over everything that is imported. A few weeks ago a foreign prince landed in this country, and our newspapers were at once full of him, and his movements every day, and we left our plows and cows and rushed off to the city to get a glimpse of this man, who had done nothing with brain or hand to distinguish him from other men.

I have no patience with our foolish girls who go off to foreign countries to find husbands, with titles and pedigrees; but never once—praised be their good sense—with the thought of marrying blood with which to improve the American race.

We are driving the American show cow at a terrible rate of speed. At some of our great contests we have experts in charge, who with watch and thermometer in one hand, and an open bag of grain in the other, crowd their animals with rich foods, and then determine the approach of the danger line by the thermometer and their movements.

The matter for wonder is not that the cow produces three or four pounds of fat or from seventy to a hundred pounds of milk per day, but that she manages to eat from thirty to fifty pounds of grain, for days in succession, and lives to enjoy the honors. I do not think that the business cows of our State are overfed, but I do think that a great majority of them are overworked. Stimulated by generous feeding, they are induced to yield milk late, and are barely dry when the new calf is born.

Milking stripper cows is the most pernicious practice I know of. It yields no profit, for strippers' milk is generally poor in fat, off in flavor, and damaging to other milk, with which it may be mixed. The stripper tries to make milk for her master, and food for her unborn calf, at the same time, and her endeavors result in dismal failure, for she is tired and thin from incessant work and her calf is born a starveling. I am very sure cows will yield as much milk and butter, through life, if allowed to go dry ten weeks each year as they would were they milked to within four weeks of every calving. Think of the common sense of the proposition, and then think back to the time when by mistake in your reckoning you milked a cow clear up to the day on which her calf was born, and you will remember that she did not freshen as usual, and at no time during the succeeding year did she yield as she formerly had done. As reckless men and women, who fill their lives with overwork or debauchery, pay the penalty to Nature, so does the overworked cow fall in the harness of toil, because the load laid upon her by her avaricious owner is too great for her to carry.

The cow that goes on a vacation from everlasting work for ten weeks stores on, and in, herself, a lot of muscle, fat and nerve force, which, when fresh again, she calls in and works over into milk, when stimulated by the demands of nature and love for the man who feeds and milks her. Succulent foods, the year around, is the watchword of the successful dairymen. Their free use not only results in greater profit but enables their animals to utilize greater quantities of other foods, with least danger. Inestimable are the values of silage and roots to the cow and the dairyman, and yet, the large majority of cow owners in this State grow neither silage nor roots. Tell me! Tell me! Why this is so? There is no room to doubt that very many of the cows of New England are being seriously injured by being kept all winter in close barns that they warm by their own body heat, until they lose nerve force and health. We have demonstrated beyond dispute that hens lay as many eggs and have better health when kept in the open air all day, and with nothing more than two thicknesses of cotton cloth between them and all out-of-doors, day and night, all winter. And yet, of all animals, the laying hen is the one generally regarded as needing hothouse conditions.

Somebody, in the near future, is to work out a plan for the winter housing of cows that will revolutionize present methods. Is it to be the flat-roofed yard, with close walls on the exposed sides, and with great openings above the bulkhead on the south and east sides, through which the sun may shine and make cozy this sheltered nook, with its deep straw bed, where the cows and heifers, in groups, may spend a part of every day in the open air, from November to May?

Do we go out to our work in winter, bare-headed, bare-handed, and in only the same coat and shoes we wear in the house? Then, why should not the cows have strong, warm, inexpensive blankets, strapped closely around them when they go into the winter air in this sheltered yard? I hope my friend, Secretary Aitken, who is to speak to you tomorrow, will tell how he raised his Jersey heifers in Vermont. That Scotch boy, remembering how the Ayrshires were raised on his native hills, transferred his attention, if not his affections, to the Jerseys, when he came to America, and keeps them in yards and open sheds, in a sheltered valley, day and night, throughout the Vermont winters. The modern dairy cow is not a machine, but a creature of flesh and blood, as sensitive to many conditions and surroundings as are human beings. Do cows think? We have the son of one of them—a magnificent eight-year-old Jersey—who guards our barns every night, with the keenness of a watchdog. No one except the herdsman can step foot inside the building after nightfall without being greeted by his low mutterings. If the intruder advances, his protests are louder, ending in roars that terrify the neighborhood.

Do cows love home? One of the meanest acts of my life, the one that I would give most to forget, was the selling of an old cow that I had raised from calfhood. Every time she could break away from her new home she would come back to us, sometimes through the rough storms of winter, because she was homesick. Were you ever homesick?

I bought a Holstein cow of Will Hunton, that he had raised, and when he came to visit us, two years later, she fairly cried out in her joy at meeting him.

Do cows love each other? We have a four-year-old Shorthorn, bred in Ontario, a great, luscious, handsome roan; and another, one of the most beautiful five-year-old Guernseys that I know of, that was bred in York county. They were brought home at different times. These two animals, that are so much unlike in everything except beauty, express strong friendship for each other, and whenever in the loose herd with forty others, in yard or pasture, they are constantly together, frequently expressing themselves in exchanging laps of love, true cow language. Do you recall the words of that old Roman father, Virginius, as he fondled his daughter before plunging a knife in her heart, to save her from the lust of a despot: "I remember well the day when but a babe, your mother placed you first in these arms. She wept a bit and said she wished it had been a man. But I answered 'Ah, better still, she shall be the mother of a race of men.'" So again, gentlemen,—I stand for the Maine-bred cow, for she shall become the mother of a race of cows possessed of such functions and powers of endurance as will enable them to change the products of these brown soils into finer and more valuable farms, and to reclothe these hills and valleys with a verdure which once was theirs, and make the lives of the generation of men and women who are to follow us, rich, and round, and full of God's blessings.

HISTORY OF STOCK HUSBANDRY OF MAINE AND THE OUTLOOK FOR THE FUTURE.

By John M. Deering, Saco.

I hardly know where to commence upon so broad a subject as your President has requested me to speak upon today, and it will be impossible for me to cover all of the different points embracing this most important industry. The live stock industry consists of all the different breeds and all of the different products produced from them. But, fortunately, there are many things fairly well settled, and which do not need to be discussed at this time. Therefore I shall only touch upon a few points that in my opinion need our attention. The cattle husbandry of the State is an agricultural industry, and like all other industries must take its chance with the changes and conditions as they take place from time to time.

A radical change has taken place in our cattle husbandry within the last twenty-five years. During the years from 1884 to 1890 I had the honor of representing York county as a member of the Board of Agriculture, and being engaged at that time both in dairying and in the beef business, it caused me to be somewhat familiar with the cattle husbandry of the State. Reports show that the cattle population changes in numbers, and that no two years will agree. In 1884 there were three hundred thousand cattle in the State with one hundred and fifty thousand oxen and steers and one hundred and fifty thousand cows and heifers, the breeds consisting of the Durhams, Herefords, Devons and natives, with a few Jerseys. There were no butter factories at this time, and the farmers were carrying on what was called private dairying with such breeds as they had, depending principally upon selling yearly their oxen and steers to pay their taxes and other expenses. Previous to this time the cattle industry had been fairly prosperous, and at this starting point we find the cattle husbandry of the State equally divided between what we will call the beef growing interest and the dairy interest. About the years of 1886 to 1890 a depression struck the beef side of the industry by coming in contact with Western competition, and in the year 1889 there were eight hundred cattle to every one thousand persons in the country, the largest number in proportion to the population ever recorded in the history of the country before or since, and no foreign markets to take up the surplus.

During the depressed times in the beef products the farmers commenced to look around to see how they could improve their condition, and with beef at five cents per pound and butter at twenty-five cents, there seemed to be sufficient inducement to change the beef breeds to dairy herds. The Board of Agriculture was called upon by the farmers to investigate the matter and report, at the farmers' institutes and otherwise, the best policy to pursue in order to bring the farmers out of their dilemma.

When I first went upon the Board my duties were assigned to me by Secretary Gilbert by placing me upon the beef end of the program, which ran along quite smoothly for two or three years, but the Secretary commenced to see that it was up-hill business to try to bolster up the beef interests, and he very politely informed me one day that my services were no longer required in that line of work. "Why," he said to me, "it is no more use to talk beef to the farmers of Maine than to try to throw a cow over the moon by the tail," and at this time the dairy interest began to take root, and in 1889 there were one hundred and thirty thousand milch cows in the State.

For the next ten years the dairy interests prospered, the number of cows increasing some years and decreasing in others. Butter factories increased in numbers. Modern butter making machinery was introduced, and fine dairy herds were built up, and in all sections where dairying was carried on farms were improved, buildings were in better condition, and the farmers were prosperous. And this brings us up to 1899 with two hundred thousand cows in the State.

Well, what next? About this time there seemed to be a growing sentiment among some of the leading dairymen that we were not receiving quite enough per pound for our dairy products when we took into consideration our fine herds and good facilities for doing the business, and while, in its wisdom or otherwise, the Legislature saw fit to cut down our Board of Agriculture from sixteen to one, the dairymen saw the necessity for a dairy association. And the record for the last five years, between 1899 and 1904, two years of persistent labor and effort to bring into existence this strong and influential organization, and three years of actual work in bringing the dairy interests up to a higher standard, should be fairly satisfactory to its members, when we could report on January 1, 1904, three hundred thousand milch cows in the State, with twenty-seven butter factories and nearly one-half million dollars worth of first-class machinery. The history of the live stock industry shows that we started in 1884 with about one hundred thousand milch cows and in 1904, twenty years after, we had increased in numbers to three hundred thousand. I see by the State Assessors' report that we lost somewhat this last year, but that is no evidence that the dairy interests are on the wane, for there are no two years on record that the number of cows are reported alike. Conditions make changes in our live stock the same as different conditions change other agricultural lines of industry. For instance, once in every few years our hay crop is cut short, obliging many farmers to dispose of a portion of their stock. Then again, the market for milch cows in other New England states is much better some years than in others. In 1901 there were over thirteen thousand cows shipped out of Maine for milking purposes, and in 1903 eleven thousand five hundred. So we see that a few cows less in a certain year does not prove that we are losing, if the heifers are coming to fill their places.

The State of Maine has become a dairy State, with its high-bred, heavy-producing dairy herds, and in my opinion we have as good a line of dairy stock as any state in the Union. But in obtaining this stock, we have changed our breeds, the feed and the habitation of our cattle, and there is a vast difference between handling a fine cut cream or milk producing cow and the old-fashioned, hardy, common-purpose cow which we used to deal with. And we should bear in mind that we have been for the last twenty-five years breeding up our herds, endeavoring all the while to obtain a higher type of dairy cow, and it seems to be a fact that as we breed up the producing qualities we breed down the constitution—or, put it another way, if you please, the higher the type the larger the producer, and the more strain upon the constitution; and the more delicate the animal, the more susceptible to diseases. Either way you accept this proposition, Mr. Breeder, it is certainly an important matter in the art of breeding, and should receive your most careful consideration, because the common dairyman by law holds you responsible for strong and healthy animals which they purchase from you for the purpose of building up their herds.

Then again, the law that was passed by the last Legislature through the influence of the Dairy Association holds you down to the tuberculin test, and obliges you to deliver only healthy animals when purchased from you. At first this seemed to be a little hard on the breeders who were breeding cattle for sale, and some complained that it was a discrimination between the pure blood breeds and the common breeds of cattle, but that sentiment seems to be passing away, and the majority of the breeders are living up to the law in good faith, and are doing all in their power to satisfy their customers. The success of the dairy interest in the future will depend largely upon the health and condition of our herds, and no dairy herd can be profitable unless healthy.

I remember of being present at a farmers' institute some years ago when the Board of Agriculture was doing mission work among the farmers in the interest of dairying, and I heard a speaker say that in order to make cows pay well at the pail they must be kept warm and quiet, and he advised the farmers to close up their open barns and tieups, and as the farmers commenced to do dairying they at once saw that winter dairying would not pay if the cows were cold and shivering, and they began to board up their tieups in front of the cattle, and with the common barns there was no other way to do.

They did the best they could under the circumstances and conditions, and thought that they were doing right. And why not? There had never been any disease among our herds to speak of before dairying was established. Now, I don't want to be understood that a warm tieup will cause disease if properly ventilated, because I do not think it will, but if your tieup is close and warm, and poorly ventilated, and filled with cattle, and if there are any disease germs lurking around, such conditions will cause diseases to develop more quickly than under well ventilated conditions.

There is no necessity of my laying down any specific rules. In ventilating our stables many devices are practical, and the question must be worked out from an economical standpoint by taking into consideration the different construction of our barns, and other conditions. But let us for a moment take one of these close tieups sixty feet long, twelve feet deep and seven feet high, and we have 5,040 feet of air space. Such a tieup will tie twenty cows; this gives each cow 250 cubic feet of air. Now, if your tieup is close and no air can get out, and no fresh air get in, this is certainly a bad condition of things, simply because a cow will breathe this amount of air over at least five times during a long winter night. My experience leads me to believe that we must give more attention to the ventilation of our stables. There is one case I wish to mention, and if time would permit I would call your attention to a number of cases, which would seem to be sufficient proof that too close tieups are injurious to the health of our herds. A certain dairyman lost a number of his cows—the disease being tuberculosis. The barn was constructed with the floor running through the centre crosswise, and there was a tieup at each end—one was a close one, and the other an open one, the cattle standing with their faces to the open floor. The cattle in the close tieup were found to be all diseased, and those in the open one were all sound.

It is not my intention to discuss tuberculosis at this time, but to try to impress upon the dairymen the necessity for having better sanitary conditions around our stables, for all kinds of diseases which are liable to affect our herds. While I consider tuberculosis the most dangerous, and abortion next, there are many things that come in not as dangerous, but very important, and while we are guarding against one, we are guarding against the whole.

Water in front of the cattle is another luxury, and something which I never happened to have, though I have had all of the rest. Now, I don't think anyone ever thought that the water would be any better or that the cattle would be better cared for by having water in front of them. It was put in for the sole purpose of saving labor, and by saving this labor we deprive our cattle of the proper exercise they really need. I have taken particular notice how this system of watering cattle worked, with the idea of using it myself, but generally I found that the cribs were wet and impure underneath the troughs, and that the water was mixed with hay and chaff and in an impure condition. I know several farmers who have discarded theirs altogether, and in my opinion it would be better for our cattle if they were all removed.

High pressure of feeding plays an important part in causing trouble with our herds, yet I am aware that there are more cows underfed than there are overfed. There is one redeeming thing, however, about an animal that is underfed. When she goes to pasture in the spring, if she gets good feed she will recover and generally do well, but the animal that is overfed seldom recovers or gets back to her normal and natural condition. Under a moderate system of feeding we can feed our cows all alike without injury, but under a high pressure it requires an expert. The weight, the age, and the assimilative powers of each animal should be carefully studied and considered. My attention was called to a case of overfeeding a few days ago. A man was trying to see how much butter he could make from a three-year-old heifer. She stood the feed for a few weeks and then collapsed. He told me how he fed her and how much butter she made in one week. "Well," I said, "she did well, but you have spoiled your heifer." It is my opinion that by endeavoring to feed our dairy herds up to a higher standard, we go a point beyond the natural laws of our animals, in some cases at least, without realizing what we are doing, working upon the theory that a cow can stand anything. We must always bear in mind that a high-bred, heavy-producing dairy cow is a delicate animal. She cannot help it. She was bred that way, and born that way, and unless the owner of such an animal conforms to these conditions he must expect trouble.

When we stop to look back twenty-five years, and think of our tough, hardy breeds of cattle, with no close tieups, no water in front, and few barn cellars, and our cattle with plenty of exercise and fresh air, and with a moderate system of feeding and breeding for strength and muscle only, it was altogether a different condition of things than what we find today. Breeding for production only, in close tieups, water in front of the cattle, depriving them of their proper exercise, and with a high pressure of feeding, barn cellars and many other things that come in, who wonders that it requires more thought and care to successfully handle our herds than it did before dairying was established. But do not understand me that I would do away with any of these things. Oh, no! We cannot go back, but must go ahead. We are using them every day in our business, and they are all practical in a way, and we cannot get along without them. They have all been in the line of progress, and in harmony with the progress made in other lines of industry, but to my mind the time has come for us to take another step forward along this line, and the conditions emphasize the importance of this. We must open up a new page in the history of our live stock, and make a new and better record in the future by improving the facilities which we already have in handling and caring for our dairy stock.

Yes, tuberculosis is a very sensitive subject to speak upon; not so much so, however, as it was a few years ago. Dairymen have become better educated in regard to its danger to their herds. We will drop it here and leave it for the scientific men to discuss. There are men in this country, and Von Behring in Denmark and Prof. Koch of Germany, who are giving their lives in experimenting and studying upon this disease, and through all of these years of experimenting and persistent efforts in investigating they are still unable to offer to us a ray of hope, or a remedy, or even a kind of medicine that will cure this infectious disease, and from a scientific standpoint we are just where we were ten years ago. Older and wiser only by our experience, and in order to protect our herds and ourselves, we must depend upon our own intelligence, and thought and common sense.

The dairymen are the interested parties. They are the owners of the dairy interest of the State, with nearly twelve million dollars invested in their herds, and are responsible for the future welfare of the industry. And it will require a careful administration of affairs in order to build it larger and stronger, and it must be done through the influence of this association, and as time goes on and conditions change, we must be able to meet every emergency by putting into operation every safeguard consistent with practical economy, for history will prove to us that as the country grows older the harder will be the task to protect animal and vegetable life from pests and diseases.

There are many dairymen in our State who are not present today, and, whether large or small, their interests should be represented by the members of this organization, and every member should do all in his power to create a sentiment among his fellow dairymen that better sanitary conditions are necessary in order to guard against all diseases which are liable to affect our herds in the future.

Yes, we changed our breeds. And 75 per cent of the cattle in Maine have dairy blood in their veins, either pure blood or grades. The other 25 per cent is made up of the several beef breeds, and while both the dairy breeds and the beef breeds bear different names, they can be used only for two purposes. However, there are more good dairy cows among the beef breeds in proportion to number than good beef animals among the dairy herds. I have no choice in breeds only for myself, and with my experience in owning and handling cattle from all of the popular breeds of the State, I could not advise any one which breed would be the best for him to carry. Yet the dairy breeds predominate, and why should they not? The dairy business is the young farmers' friend and also the friend of the man with moderate means. It is practically a cash business, with an even market, and an income every day in the year; while at the present time it requires a man with means to grow beef; he is generally obliged to wait for his market or sell at a sacrifice, and his returns come only once or twice in a year. In some sections of the State, however, the growing of beef is quite popular among the farmers, and there are more white-faced steers in the State today than there were five years ago, and it is safe to say that the raising of steers is on the increase.

Upon the prosperity of our live stock depends the prosperity of all other agricultural lines of industry, and I believe that the prosperity of our herds will depend in the future largely upon the manner in which we treat, handle and breed them. It will be no one thing that will trouble us to any great extent, but a combination of things, and, while I am aware that the eye of every breeder is upon me, I must again emphasize the fact that the system of breeding must be carefully considered and unless we breed more for strength and constitution in connection with production, I fear that our dairy herds have struck their limit in profit to the dairymen of our State. This is a strong statement, and one to which some one may take exception, but my experience with quite a large number of dairy herds leads me to believe that something must be done along the line of breeding. The foundation of our herds will depend upon the manner in which they are bred.

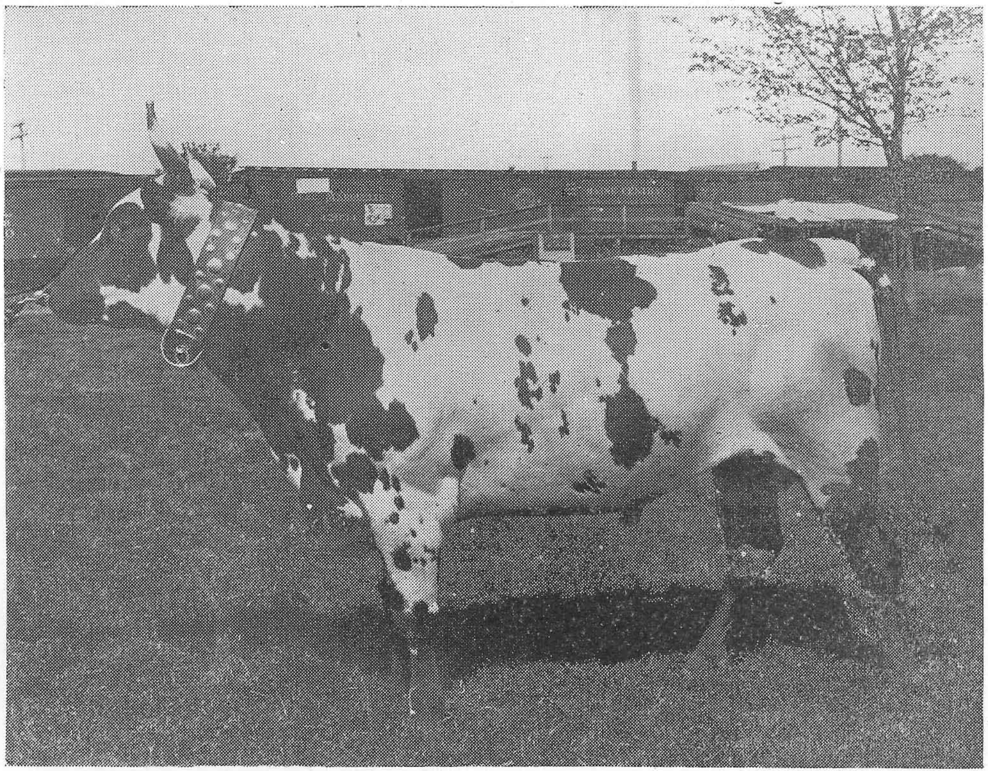
Now, my friends, I come here today as a dairyman and a citizen of the State, claiming no wisdom above others, and with no other object in view than to do what I can in the interest of this important industry by giving to you my ideas as they appear to me by my own observation and experience. Whether I am right or wrong, I will leave for you to say, but I earnestly appeal to the members of this association to carefully consider these few points to which I have drawn your attention, and whether you agree with me or not, to exercise your best thought and influence in order to raise our dairy interests to a higher standard by creating a stronger sentiment among our dairymen that more attention must be given to the health and welfare of our dairy herd in order for them to advance and prosper, and with a few improvements made along this line, and the good start we have made in the business in the past, in connection with the prosperous condition of other lines of industry in the State, our dairy industry is bound to prosper, and be a blessing to our people in the future.

DISCUSSION.

R. W. Ellis, Embden: I am pleased to have a chance to say a little something on the dairy industry and the stock industry of the State of Maine. I have been engaged in this business for quite a long time. For fifty-three years I have been trying to find out the best method of making a little money out of the cow. I have tried to learn something every year, to do a little better each year. I started in with the native cows and an open barn and everything against the cow, against the interest of the farmer in the cow. I was the first one in all eastern Maine to go into the dairy business as a business,—to try to make a living out of the dairy cow. I was the first one to furnish customers directly from the dairy. I commenced in Penobscot county, carrying butter to Bangor, eighteen miles, and furnishing customers the year around for one shilling a pound. We had no western feed at that time. We had only what we raised here in our own State. I knew that if I made any money out of the dairy business I would have to feed differently from what had been the custom. No man had thought of making any money out of cows. He kept them for his own use and for raising stock. No one thought of feeding grain during the winter season. We made what we could out of our cows during the summer and then fed our coarse fodder and let them dry up and come in again in the spring. We used to raise at that time a great many oats and peas. We raise those now because they make one of the best feeds that can be raised on the farm for dairy cows. That was our only feed except what we got from the mill in the grinding of the flour, shorts and middlings.

I kept along in that way for quite a number of years, but as the western feed began to come in I began to use that, and have been experimenting all the way along with the best feeds and the best methods of taking care of the dairy cow. Thirty-six years ago I went to Winthrop and bought the first Jersey cow ever brought into Waldo county, and tried to improve the breed. My endeavor was to raise the standard of quality; that I thought was the main thing. I bred for a great many years for quality and got a herd of very rich cows. The milk averaged over six per cent for the entire herd. But in breeding in that direction I made a mistake. My cows deteriorated in size and stamina. I tried to get the richest strains that I could and oftentimes I got small animals to breed from.

We used to have our cows tied in pretty cold, rough barns; but I found early in my experience that in order for a cow to do her best she must be kept warm, her conditions must be as pleasant and agreeable as possible. About fifteen or twenty years ago we built over our barn and tried to have a model tieup for that time. I made a mistake in making it too tight.



Ayrshire Bull, Gold Fox, 8,400. Owned by Rev. E. F. Pember, Highland Farm, Bangor, Me.

It was too tight in front. I had good ventilation in the rear, but that is not the place for ventilation. There is a great deal said about the King system and other systems of ventilation. These are all expensive, and it costs but little to ventilate a tieup all that is necessary, which is to give plenty of air in front. That is where every tieup has to be opened to feed the animals, and that is where they must have the fresh air. We closed our tieups up so that when we shut them up at night they were nearly air tight. The warm air rises and the cold air falls; it could not get out and they breathed it over and over again. All the expense of ventilation is a strip over the door that lets down where you feed and a few holes in that so you can regulate the ventilation. In ordinary weather let it stay right down, and let them have the whole air space, their breath going out into the barn and out of the ventilators at the top, and the fresh air coming in to take its place. After you shut that up you may have all the ventilating pipes you please in the rear and you cannot get good, fresh air for your cattle to breathe. With those pipes in the rear that went up into the roof of the barn, when the wind was blowing in a certain direction it would blow down there enough to blow out a lantern; but it was not ventilating the tieup to any extent where it was necessary. At other times there would be no current of air going through the pipes. They were of but little use in furnishing fresh air for the animals to breathe. We made our tieup tight and shut it up every night, so that ice would be thawed in the morning. The animals were comfortable, as far as that is concerned, but the foul air was breathed over and over again, and I believe it bred trouble. Tubeculosis got in and we lost almost our entire herd. We had been breeding them for thirty-five years and I had animals there that I thought almost as much of as I did of our own family.

I want to emphasize what I have said about the necessity for ventilation in front, and also breeding for stamina. I tell you the Jersey breeders in particular have bred for fine points until they have a lot of animals that are small and with weak constitutions. There are many good, strong animals, but there are also many that are lacking in this respect. When I started in the second time, after I lost my herd, I made use of the experience that I had had, and I bought such animals as have strength and stamina to stand against disease or anything else. I believe that one great mistake that has been made is breeding from too young sires. I believe the older the sire the better until he gets to be eight or ten years old. The great mistake is to get a young sire and use him a couple of years and then dispose of him before we know what he is. We made change after change before we knew what we had. Every man who gets a new sire should keep him until his progeny comes to cowhood and he knows whether he has an animal that he wants to keep.

This breeding up process is a slow, discouraging process. Sometimes the breeder gets his herd up to a good standard and then gets a setback. We got ours at one time up to 318 pounds of butter per cow, five of them two-year-olds, and I got what I supposed was a very fine animal for a sire. I thought he would set us ahead twenty-five pounds to a cow, perhaps, but he set us back nearly fifty pounds to a cow. What are you going to do? You have done the best you could and you have to make the best of it, and hope to do better next time. I do not believe there is a dairyman in this State who is trying to breed up his herd who is not getting the best sires he can, patronizing the best sires all over the State endeavoring to bring up the herd, and as a rule probably he is building up, but it is slow and discouraging. We must do the best we can with what we have and breed from the best and breed up as fast as we can, and be sure to breed for size and stamina.

REV. E. F. PEMBER, Bangor: I am very glad to stand here this morning for a moment as one of the many friends of the State of Maine cow. We have reasons, most of us, for being friends with the dear old lady who graces our barn. I was reading an article the other day in some paper, which stated that there are three things necessary to success in dairying: first, the man, second, the cow, and third, the feed; and the emphasis was laid—rightly, I believe—on the man. It depends very largely upon the man who is at the head of the enterprise as to whether dairying pays or does not pay. With a wise, kind, faithful man at the head, like the good gentleman who has just blessed us with his words, I believe that dairying can be made a success in Maine or anywhere else. It makes a great deal of difference who takes hold of the business, and whether it is wisely, carefully and intelligently managed. Let each man select the kind of cow he likes best and stick to it and make that a success. Breed up all the while, as has been said.

There is a single point I want to make, and that is in connection with what was said by Brother Ellis a few moments ago in regard to breeding for stamina and size. A cow that has not these qualities might as well go to the butcher first as last. She is not worth keeping. Brother Deering in his paper emphasized this. And I want to add just a word to what has been said in regard to breeding from young sires. I believe that one chief fault today is breeding from too young heifers, getting in too much of a hurry to make them cows. At the last State Fair at Lewiston when the yearling class was called two or three of those led out in that class were giving milk. Of course you understand the rules of the fair; they could be 23 or 23½ months old, but they were cows to all intents and purposes. Any man knows if he has tried it that this means the weakening of his stock, the hindering of the growth of the heifer and cow and later on he will suffer in his herd more than enough to pay for the amount he receives in winning the first prize at the State Fair or anything of that sort. I notice that in all the accounts of fairs and like exhibitions in Canada and in the old country, in many cases when yearlings and even two-year-olds are exhibited they are shown only as dry heifers, they are not cows. They are not made cows until they are at least three years old, and in that first two years of growth they get the size, they get the strength, they get the stamina with which to serve their lord later on. Now in our desire to breed for fine points, and to hurry the process, we simply weaken the stock and in that way produce a lot of cattle that we ought to be ashamed of. To improve the herd, this is a splendid mission, the work of the farm today of presenting before us a lot of cattle that are of high standard in excellence and that stand before us as things of beauty. Some people think there is not very much beauty in a cow, but I cannot help feeling that there is if she is rightly treated, and if she is kindly treated it will go a long way in helping out the feed. In this connection I want to emphasize the point I started with, that the man is the part that counts. If he is kind and gentle in his treatment it is better than an extra quart of feed. If a cow is treated decently I think in most cases she has brains enough to appreciate it, and it is our business to learn that to begin with. I suppose I cannot claim to be a farmer; I am an agriculturist. I have to hire my farming done for me, but if I found a man misusing an animal that I owned, I think he would lose his job about as quickly on that as anything. I would rather he would feed less hay or less grain than to pound any animal that I own. If we treat the animals kindly, if we do wisely and well in these matters, we shall go a long way towards producing the very results we are aiming at.

I congratulate the State Dairymen's Association upon the attendance here today, the opening day. The men who are interested in these matters are giving their best thought and best time to comparing ideas and bringing out of this meeting what must be the grandest and best results.

DAVID CAMPBELL, Cherryfield: I am to speak to you this morning as a representative of the Maine State Agricultural Society, and my acquaintance as superintendent of the stock department of course has been with breeders of all kinds of stock, but more especially the breeders of dairy stock, because they constitute about three-fifths of the whole number on exhibition. We had an aggregate number of about 500 head of cattle on the Lewiston fair grounds this fall. All of those breeders and exhibitors of stock are pretty well informed about the rules of our society, but there are some points which ought to be touched on briefly, in particular the care of the stock before it is brought there. Of course after it gets there, the barns and stables being new and new straw being furnished, it is possible to keep them in nice condition. The condition the stock is in when it appears before the judges must necessarily score to an important degree, because we recognize that our exhibition is not only for the instruction but also for the entertainment of the large number of people who come to our fairs who are not breeders, and we try to make that department attractive in order to interest all the people in the State in this beautiful exhibition of fine stock that we have before us. So I think everything should be brought there in good condition, fat and sleek and especially clean. Exhibitors should also study the rules of the association in regard to entering and exhibiting.

Another department which does not come directly under my supervision but which perhaps interests me more than any other of the trustees is our exhibition of dairy products. These have been a disgrace to our society and in a measure to the dairymen of the State, who should take advantage of our exhibition to forward their interests. This is a great industry of the State, and I will say to you this morning, something which has been spoken of previously through officers of the society, that we come here from a meeting of the trustees of the Maine State Society at Oakland as representatives to take up with you, as a strong, powerful organization, the matter of a better exhibition of dairy products at our fair next year, something that will be as good as your exhibition here, which will compare, of course, with any exhibition in New England. We are ready to unite with you in anything which will be for the mutual benefit of our societies.

R. ALDEN, Winthrop: I have taken a good deal of interest in the papers which have been presented this morning, and more especially, perhaps, in the paper that was presented by Hon. John M. Deering, who has been an active member of this association ever since its organization. You will remember that you chose a legislative committee at the annual meeting last year. I think Brother Adams, Brother Dyer and myself were on that committee, and we tried to attend to our duties. I speak of this because of my connection with the legislature, having been on the committee on agriculture while a member of the Senate for two terms and having attempted to make laws for our benefit. The cattle commissioners came to us and asked for appropriations to pay for the destruction of herds from tuberculosis. The increased amount that was asked for from year to year was almost beyond anything that we could expect. I think invariably we granted everything they asked for, but they found the demand was so great that Brother Adams, Mr. Deering and myself started to investigate as thoroughly as we could to see what the cause of tuberculosis was. We felt that something ought to be incorporated in the laws that would cause the cattle commissioners to look after the ventilation of our tieups. What has been brought up here in relation to the herd one-half of which was destroyed and the other half not affected, was a very convincing argument to us that something should be done. I wish every dairyman in the State of Maine could have been here to hear the paper presented by Brother Deering. I believe that paper will do more good than a hundred times the cost of this meeting if the dairymen will listen to it and profit by it. I have been observing the work of tuberculosis in the different herds. There is no question in my mind that tight tieups without proper ventilation have been the cause of the spread of the disease to an alarming extent. Brother Ellis has given you some thoughts that are worth taking home with you. As a legislative committee we were successful in having laws enacted which I believe will be of lasting benefit to the association; and I want to say here that this association is indebted to the committee on agriculture and members of the legislature for passing all the laws that we asked for. They listened to us with the greatest attention and respect, and I believe that we should give them our hearty thanks for their support.

GRASS AS A MONEY MAKER.

By GEO. M. CLARK, Higganum, Conn.

Ladies and Gentlemen:

I am here to talk about grass culture; not that I can tell you much that I have not told to you or others heretofore, except that I can confirm my previous theory about the cultivation of grass as a money-maker without the aid of yard or coarse manures, for one more year. I am here to talk about some of the things that we feel sure of, also some facts that have been found through scientific research. It is an age of progress. There are many conditions that we have to accept as facts which we know little of. In fact, life is so short that it is impossible for us to learn very much.

WHAT SCIENTIFIC MEN SAY.

Scientific men tell us that when the earth was formed its original surface was rock, that with time and the action of the elements the surface has softened, that vegetation has sprung up and with it came the animal creation, one of which is mankind.

Now, ladies and gentlemen, we know that some of this is true. We also know that many facts have been found through the aid of these scientific gentlemen. I can well remember the first telegraph line run. I thought it a humbug, but soon found it a fact. Sixty years later we find the earth a network of wires, and a wireless telegraphy system, also electric railways and a host of other improvements, all of which have been brought about by the aid of science.

But I am not here to talk about all creation. I am simply here to tell you a few facts that a farmer boy has learned in grass culture, while working upon an abandoned New England farm.

PRACTICAL EXPERIENCE.

One of the important things found is, we can make money on the farm. Sixty years ago this spring I sowed a field to oats and timothy—used three bushels of oats to the acre and three pecks of timothy, and when the oats were cut the timothy all died. In September I seeded it again to timothy and rye. The rye was all right; twenty-two months later, I cut a poor stand of timothy—now I get a good stand of grass in ten months. My next experience was in turning sod over flat September 1st, then harrowing and seeding to timothy; tried that several times, found the new grass came up all right, but in the spring old grass came up and killed all the new grass; also found that old sod caused a premature drought.

HOW TO MAKE MONEY.

I will now tell you how to make money in grass culture and also how to make money on the farm. Higher cultivation is the watchword. For eighteen years or more I have been experimenting on many different kinds of grasses. My first fear was that no commercial compound that was in the market could produce the favorable continuous results of our yard or coarse manures, that no commercial fertilizers would continue to produce a continuously large crop. My fear had been strengthened by the use of Peruvian guano and other fish compounds in years gone by. While that kind of fertilizer may be of service, my experiments in our soil have proved it to be a failure, with the old style of cultivation, as well as all other compounds that I had then tried. But later I found by the use of bone, potash and nitrate of soda, or their equivalent, with the new method, or by the aid of intense cultivation, I could maintain a continuous high crop standard, and I am here to tell you of another year of my continued success.

POOR LAND CULTIVATED.

This year's crop is fully up to any previous year, and you must bear in mind my field, to start with, was one of the poorest of the poor. The surface was half covered with rocks, with a filling composed of ferns, white birch bushes, hardhack, juniper bushes, sumac and a large variety of other foul vegetation. Then to complete the compound, all was covered with a dense covering of moss. It can be truly said of that sixteen-acre field that it was a rock-bound, moss-bound, brush-bound, abandoned New England farm. I have a section now left to show. I know of no poorer farm. When the rocks were removed, the surface, in sections, was composed of clay gravel hard-pan, gravel hard-pan with a slight amount of loam, and gravel with a little loam.

The clay gravel hard-pan and clay hard-pan hold water well. On the balance, about two-thirds of the field, the water supply is poor. I refer to the subsoil water which, on that and all similar land, cannot be supplied except by intense cultivation.

To commence with, I had to remove at least a thousand tons of rocks to the acre before I could commence to plow. The cost to remove these rocks and bushes from the sixteen-acre field was $4,750.00. One corner of this field is 125 feet higher than the other. This sixteen-acre poor, hillside, rocky and bushy farm did not produce, to start with, two hundred pounds of vegetable substance of every kind to the acre per year.

THIS YEAR'S YIELD.

This year, 1905, my 11⅛ acres of the same field produced 116,121 pounds of well-dried hay. The first crop was over fifty-eight tons, and second crop on seven acres of this field, 35,010 pounds. This hay cost me in the barn less than $5.00 per ton, making a net profit, with the hay figuring at $15.00, which is below the present market value, of $68.00 per acre. My seven-eighths acre field, now seeded sixteen years, cut this year 20,560 pounds, over ten tons. Total in sixteen years, two crops, of over 135 tons.

I think this yield most remarkable, sixteenth year after seeding, over ten tons of well-dried hay in two crops. The relative stand of timothy and redtop is substantially the same as when first seeded. The first cost of cleaning this sixteen-acre field, as before stated, was $4,750. That money has all been paid back with large interest. What I wish is to spread this information as far and wide as possible, for I am sure, with intense cultivation and care, that we can double the product of the soil, whether with the cultivation of grass or otherwse, and that we can make money on a farm.

HOW TO HARVEST THE CROP.

One word on the matter of drying my hay. The first crop this year had an average of three full days' good sunshine. The second crop had eight days without rain, five of them bright sunshine. Both crops were well tedded and spread, and heaped up every night. This is my method of drying hay.

DIFFICULTIES IN EXPERIMENTING.

In regard to my experiments, I would say that if I were to talk to you a week about my experimental work concerning grass culture and the tools to assist in its production, the story would only begin to be told. You may think that all of these experiments have been attended with success, but I want to tell you that very few of them have. It has been a rough and rugged pathway, filled with breakers all along the line.

BEST KINDS OF GRASS.

I have tried all the different kinds of grass that I could find, singly and combined, with many of the different kinds together, and have finally adopted two kinds, timothy and redtop, as I have found that they work best together and would produce about a ton and a half more hay to the acre. The results have been heretofore given.

SUCCESSFUL MACHINES.

As to the machines to produce the results, I have kept a large force of pattern makers at work for more than thirty years making improved earth-stirring machines. The circular which I have just given you shows the final results. Just a few machines of the thousands that I have perfected have been adopted. I have thus far found only a few machines that I could adapt to produce intense cultivation cheaply. Please bear in mind that must be obtained to get the largest results.

HIGHER CULTIVATION.

Thus far I have only described my own conditions, for the reason that my field to start with was about as poverty-stricken as any. It cost $300.00 per acre to commence. That is not the case with the average farm.

There is something in this intense cultivation—in my method. With it many a farmer can start with his first crop and commence to make money. Why not get out of the old rut? Take a small section of land, give it the higher cultivation and care, and commence making the farm pay. Why not?

HOW TO PRODUCE A CROP OF ALFALFA.

I promised my friends to tell them what I know about the production of alfalfa. The scientific men say that to prepare and sow a field to alfalfa, twenty quarts of seed should be sown to the acre, in the spring, and when the plants are about six inches high they should be clipped. This clipping is necessary to check the growth and strengthen the plants. Clipping makes the plant branch out with new vigor. This treatment should be repeated several times during the summer. Every clipping, they say, will strengthen the growth and should in no case be neglected. The neglect may mean failure. This clipping of the field the first season is not expected to be saved for hay.

After the first season alfalfa when cut for hay should be cut when one-tenth of the heads are in bloom. After each cutting, if the ground is dry, it usually will be well to go over the field with the disk harrow. This, they say, is practised by some of the best growers with excellent results. The disking splits the crowns and strengthens the growth. The disk must be set at a small angle so as not to cut off and tear out the plants. By some this disking is done in two directions, across each other at right angles. They further say that the alfalfa when cut for hay should be cut when one-tenth of the blossoms have opened, as when it gets old the leaves deteriorate very rapidly in feeding value.

The analysis made by the Experiment Station shows that to get the best result from alfalfa, it must be cut at an earlier stage of development than red clover. A late cutting not only means poor quality of hay but it also is detrimental to the development of the next cutting; so early cutting should be practised regardless of the weather. They also say the curing process must be carefully handled because the leaves soon dry and are easily broken off. The leaves are of more value, pound by pound, than good wheat bran.

PERSONAL EXPERIENCE.

I have been using cutaway harrows for resetting alfalfa along the west coast for a great many years. Those best acquainted with the production of that crop have decided it should be reset at least every third year, and the best method is to sow about ten pounds of new seed to the acre, then go over it with the cutaway harrow set at a light angle, in both directions, and split the heads of the old plants and reset with the new seed. By that means the crop can be produced continuously for a long term of years. My experience, of course, is not confined to my this year's experiments.

I am now going to tell you just what I have done. I took three and one-half acres of the very highest, dryest and poorest section of my field, 100 feet above the water line, and intensely cultivated it with my double action cutaway harrow to the depth of six inches or more, then I sowed twenty-five pounds of alfalfa seed to the acre the third day of June, also sowed 800 pounds of high grade fertilizer to each acre. On the twenty-fourth day of July, fifty-two days after seeding, I cut and cured 10,760 pounds of well-dried hay, and on September 13th I cut and cured 10,850 pounds of well-dried hay—or 21,610 pounds, almost eleven tons, in 103 days from time of seeding. I can safely call it three tons to the acre of well-dried alfalfa hay after all of the outs are deducted. While I would not advise others to go into the cultivation of alfalfa very extensively at first, yet I think that there are many high and dry fields in New England that could be utilized to good advantage in the production of alfalfa.

The first thing to be done is to intensely cultivate the field and kill out all kinds of vegetation, then sow the seed, giving the alfalfa the first, best, and only chance. With my present knowledge I should say a good dressing of thoroughly decomposed vegetable manure, with a few hundred pounds of slaked lime, to the acre, added, would be best, except in sections where there is plenty of lime in the soil. I had no lime, but a portion of the field had a little thoroughly decomposed yard manure and that section was the best. I think the success I have obtained was due, first to intense cultivation, and second to the nitrates which were in the fertilizer sown, but it would be well to remember that high grade fertilizer containing nitrates cannot be used after the plants come up. If I had sown my alfalfa the middle of April I think I would have easily gotten five tons of well-dried hay to the acre this year and that would have been much better than one would expect to get, according to the scientific men, and yet I think with the ordinary cultivation they are right. I would only like to add that I was unable to obtain the views of scientific men which are herewith set forth, until after I had sown my seed.

I will repeat: First, intensely cultivate your land, then sow your alfalfa seed as early as convenient in the spring, giving the land a thorough coating of decomposed vegetable manure with a little slaked lime, as before stated. If you can afford it, put on three or four hundred pounds to the acre of nitrate of soda, before seeding, and cut it when one-tenth of the blossoms are in bloom. One word more. Perhaps I ought to say that when I cut my first crop I immediately removed it to another field, then I sowed ten pounds more of seed to the acre and took my double action harrow and set it at a light angle and went over the field in two directions. The final result is as above stated. It is now sixteen days since the second crop was cut. We have had very heavy frost since the cutting and yet the alfalfa is still growing. It has made a further growth of at least four inches.

The best way to dry alfalfa is to put it upon racks, three feet square and one foot high, putting enough on each rack to make a hundred pounds of dry hay, and let it remain there until dry. That keeps the ground free so that the plants can keep growing without interruption.

This is all I care to say in relation to this subject at present. You may think of many other things that you would like to inquire about. For that reason, if you desire to ask any questions, I am now ready to give you the fullest information possible in relation to this subject.

DISCUSSION.

QUES. What would be the result of topdressing a good, fair field with barnyard manure?

ANS. You would get a very good crop. You could not get five or six tons, but you could get two and one-half or possibly three tons. What you want to do is to cut out everything in the way of vegetation. I do not go over the land very much with a plow, perhaps once or twice, and the rest of the cultivation is done with a double action harrow, using a smoothing harrow to keep it true all the time. Giving it thorough, intensive cultivation and then using the proper fertilizer will keep the crop going for a long period of time.

QUES. What do you call intensive cultivation?

ANS. That would mean going over the land with a tool like the double action harrow many times.

QUES. How often would you cultivate?

ANS. About once in two or three days.

QUES. Do you think light, sandy soil would require as much cultivation as your soil?

ANS. I do not think it would.

QUES. If you had a heavy, witch grass sod, how long would you cultivate it, with a four-horse team?

ANS. I would cultivate it until I was sure that the witch grass was killed out. It would take longer on some soils than others. Intense cultivation for a long time will kill witch grass.

QUES. What would be the effect of intensive cultivation on stony land,—ledgy land with two to six inches of sod above the ledge?

ANS. That would be all right if you got down on to the ledge.

QUES. Would you advise putting grass on a soil not over six inches deep?

ANS. I think so. I think you could get moisture enough to run one crop every year, you might not be able to get the second crop.

QUES. Do you think it possible to cultivate any kind of land with any kind of tool too much?

ANS. I do not think so. They say that down South cotton will not grow unless it reaches some solid bottom. I went down with a cutaway harrow and got a good crop. My alfalfa field was just as dry as ashes down six inches deep when I sowed the seed and rolled it. Pretty soon the moisture came, and it sprouted right away.

QUES. Would you advise drainage on any land?

ANS. I would in some cases, but never until I had found out what was wanted. My best field of grass is the seven-eighths acre flat field. Drainage was made by my grading harrow. With that I made a grade. Then I dug a ditch along the side and made ditches the other way, not steep enough to interfere with the growing grass but enough to run the water off. I found that it did not require any underdraining, though it had been called a wet, soggy place. On one other secton which was wet I put in some tile, but I spoiled the land to a certain extent in so doing. First have the land graded properly, then if it needs underdraining to prevent the crop from killing out on account of the water, put in the drain. But very few fields need that drainage, as far as my experience goes. I am very sorry there is an underdrain on my land at all. I have never had one rod of grass winterkilled from any cause; but many people say that it is all right to drain.

QUES. You have frequently mentioned the raising of alfalfa on your farm. Would you advise it for the farmers of Maine? We have usually understood that alfalfa is a grass that naturally belongs to a high altitude, such as western Nebraska, Dakota, Montana and Wyoming, and that it requires an altitude as high as two to four thousand feet. In the majority of instances in the State of Maine it has been pronounced a failure, and I would like to have your opinion on the advisability of trying to raise it here.

ANS. I do not understand alfalfa to be a crop for which high altitudes are necessary. It does best in arid regions, where it is dry. The dry fields are better for alfalfa because it is so hard to dry. But I think almost any land where water is near the surface would produce alfalfa in New England. I have been making a study of this point, and while I do not want to make any statement that will not prove true, because I do not want to lead any man astray, I think you can raise alfalfa anywhere ten feet above the water line, ten feet above the margin of your rivers, and get a good crop. But you must have some method of drying better than you have had heretofore. You can make a small rack and put in the field and put alfalfa enough on it to make 100 pounds of hay, and it will be kept up from the ground. You can keep it there a month if you want to and it will not interfere with the growing crop. The only thing I know of that will interfere with our making alfalfa raising a success is the drying part.

QUES. Can you use alfalfa in the silo to good advantage?

ANS. I have been told by a gentleman here today, a man of experience, that clover had been a success in the silo; but I do not think there is any chance at all with alfalfa except by drying it on a rack. That is done successfully in Germany.

QUES. Leaving out of the question the trouble in curing it, is it an advantage over timothy and redtop?

ANS. It is not, when you have good land for timothy and redtop. But if you have dry land that will not produce timothy and redtop, you can put on alfalfa and it will grow. I have seen the roots of alfalfa, in the West, go down sixteen feet or more for water.

QUES. If you should commence immediately after haying and thoroughly pulverize the sod before plowing do you think it would increase a crop of potatoes over plowing in November?

ANS. I think so, surely. The more you harrow the better crop you will get. You must cultivate enough to kill out all the foul vegetation. Land ought to have two or three months' cultivation to get it entirely clear. Also, in harrowing the ground the air goes down into it, and it gets the benefit of whatever the air contains. I would rather take a piece of ground in the fall, break it up and cultivate thoroughly, and then in the spring cultivate again more thoroughly, and then sow it to oats and cut the oats for market, and then cultivate again and seed it down. Bear in mind that you should never undertake to raise two crops at one time on the same piece of ground, when grass is one of them. When you want to raise a crop of grain, raise it, and then take the grain off and seed it down. You will get the grass just as soon and get a full stand, and you cannot get a full stand when seeded with grain.

QUES. Would you advocate the raising of alfalfa to feed to cows green, as a forage crop?

ANS. I have not had enough experience in that line to be able to advise. Alfalfa is said to be a good crop for grazing. It will stand the grazing and go right on, if you do not graze it off too much. Alfalfa will do more things in the way of pasturing than any other crop. It is a good crop for hogs.

PROF. GOWELL: In your remarkable experiments, I understand that you insist on three conditions,—first, thorough cultivation of the soil; taking an old field and plowing and cultivating it until it is as fine as a garden and you have killed every weed seed. You have then a fallow field. The second condition is liberal fertilization with chemicals, heavy fertilization, and the third is seeding with grass seed only. Your yields are certainly remarkable. We have grown and weighed in four and one-half tons to the acre on four acres, but that is the best we have ever done.

MR. CLARK: I have raised as high as eight tons in one crop; ordinarily the yield is about four or four and one-half tons the first crop, and the next crop, when it is fairly moist, will give a couple of tons more.

QUES. You say you use a different class of fertilizers for top dressing than in seeding down. Will you describe the quality and quantity used in the two methods?

ANS. I use mostly bone and potash to seed down with, a mixture of 1,000 pounds of bone, 800 pounds of potash and 200 pounds of nitrate of soda. I use 500 pounds of that compound per acre. Then in the spring I use a mixture of one-third bone, one-third muriate of potash, and one-third nitrate of soda, 600 pounds. You cannot make the grass stand up unless you have a large amount of potash. For top dressing I never use any more than I do to start with, 600 pounds to the acre each year of the last named mixture.

HON. GEO. AITKEN, WOODSTOCK, VT.

The question of alfalfa seems to be a bony one here, and it might not be a bad idea for me to give some of my experience. Four years ago the Department of Agriculture at Washington sent me up some alfalfa seed that they got from Turkestan to try if it would grow in Vermont. I was anxious to make it grow and did all that I possibly could to give it a chance. I think I rather outdid our friend Clark in intense cultivation. I cultivated and recultivated until the land was thoroughly mellow and then I put on as much rotten sheep manure as I could bury with the plow. I then harrowed it with a smoothing harrow until the surface was fine, and sowed the seed, twenty pounds to the acre. I should never advise sowing less than thirty-five pounds, but the department sent me forty pounds for two acres, and advised me to sow it in rows so that I could cultivate it and if it was a success get the seed. They were anxious to have some home-grown seed. I gave it all this cultivation and all that I could possibly bury of the very strongest kind of manure, and sowed it with a seed drill. The result was that I got eight tons to the acre the first season, with the two crops, of dry alfalfa, as near as I could estimate it. I cut it all green. That was very encouraging, of course. By the way, I bought forty pounds of the common, native seed, and planted two acres and gave it the same conditions, with almost exactly the same results the first year. The second year it happened to be a spring when the ground froze after the first thaw and the water had been standing in hollows and froze over again, and that killed it out in spots. But it killed our clovers and grasses also. With the exception of those spots that were winter-killed I got a larger crop the second year than I did the first. I cut it all green again, I did not try to dry it, because I wanted to use it for green food. The second year I cut one-third more per acre from the Turkestan seed than from the native, but to offset that in the field of the native seed I had the prettiest stand of poppies I ever saw. Since then, while there are some poppies appearing, the alfalfa has done first rate. I have seventeen different kinds of alfalfa growing on the farm today. The government was so pleased with this experiment that they sent me seventeen different varieties of seed, from seventeen different places; seed from the Euphrates valley, and all over the world. It is in half-acre plots, and as far as I can see it is pretty nearly all alike. I began to sow it in the early spring, as early as I could, then two weeks later sowed another plot, and so kept on during the summer until I had all those fields sowed. I wanted to find out whether there was any difference in its growth in different seasons of the year.

So I have been experimenting with it for four years, and so far as I am able to judge we are going to be able to grow alfalfa here in New England; not everywhere, not on land that will grow those large crops of hay per acre, because that must be moist land, and we do not want alfalfa on moist land. But the best results I have had as yet have been on land four feet from the water level. Where I planted the first four acres the water level is only four feet down, and it has given no indication of winter-killing as yet.

I did not try to save seed from the first crop of Turkestan, because alfalfa blossoms so early in the spring that the insects are not plenty enough to fertilize the flowers. It is always best to take the second cutting. I left the second cutting and just before it blossomed the rust struck it, and I immediately cut it. I was discouraged, but when the department sent up their agent he told me that during that year there was hardly an ounce of alfalfa seed grown east of the Rocky Mountains. That encouraged me again. This year I left the second crop to seed and I have got quite a good deal of seed from that second cutting. It is in the chaff yet, but I think there are probably twenty bushels of this seed. I do not know whether it will germinate or not. I am going to try it in a greenhouse before I plant it. While I do not advocate every farmer's sowing his whole farm to alfalfa, I wish every farmer in the State of Maine would try a little piece of it, under the proper conditions, and see if it will not grow.

Another thing, alfalfa is coming into New England as a voluntary plant. We have in Vermont in the last few years had a great many plants sent to us, and also the Experiment Station has received a great many, voluntary plants that come up amongst the clover. We are advocating saving the seed from those voluntary plants and raising a particular seed of our own that will be acclimated, and I think we will make a success in growing alfalfa where the conditions are anyway right.

HON. Z. A. GILBERT, North Greene.

In the few minutes that I will claim your attention I will simply lay down a few aphorisms in connection with grass, and leave the discussion of the several sections out entirely for want of time. I will say in this connection—and I presume it is the reason that I am on the program in the place assigned me—I, too, stand for grass, and the first aphorism that I would lay down is that grass is the nearest to a perfect stock food of any plant known to our agriculture, a fact which places it in an important position in connection with farming in Maine, and especially so in connection with a subject involving our stock husbandry.

The second aphorism is that grass is especially adapted to our northern climate, an advantage which we never can overestimate in the consideration of any product or any crop that we may attempt to raise. We never must lose sight of the fact that we are living away up here in this northern corner of the United States, and the central portion and the western portion can never make our literature or make our knowledge for us. Our agriculture, as our people, is a matter of itself, and a matter that must be studied from our standpoint in order to draw sound and reliable conclusions to give to the farmers of our State. Nowhere on this continent do you find this humble grass forming itself in such a compact and beautiful sod as you will find on the fields of Maine. Travel south down our coast and as you reach the warmer latitudes this grass sod thins out until you get down to the Gulf States, where on the establishment of the Experiment Station one of the first problems that was undertaken was to show whether or not grass could be grown as a crop in that locality. I say this never should be lost sight of. Grass is especially adapted to our northern climate, and it is one of the compensations that is given to the north. Every locality has its special compensation, and this is ours, and it is an important fact to hold under consideration.

Third, grass will produce more stock food to a given measure of cultivation and of manure than any other stock food known. I am not going to discuss that problem, or that aphorism. I leave it for you to take home with you and think about.

Fourth, another important consideration in connection with it is that it can be harvested at less cost per ton than any other fodder crop. Such are the methods that are in vogue and can be used in connection with the crop that it brings out this result,—it can be harvested cheaper, in proportion to its value, than any other fodder crop.

Fifth, in both the growing and the harvesting of the crop the labor involved is chiefly team labor, another great advantage, as you who have tried to get along with a large amount of work the past season and a small amount of available labor within your reach or within your possibility at the present time, will appreciate. It involves team labor chiefly and almost exclusively, further than the man required to drive the team.

Sixth, unlike corn and other annuals, when the crop of the year is secured the stand or the sod is still left all ready to repeat its bounty for a succession of years. That is, as the lecturer brought out plainly to you in his remarks, it does not call for nor require the annual repetition of the necessary cultivation and the necessary care and the necessary work involved in those crops which must be repeated each successive year. There is the seed, there are the plants, all you have to do is to feed those plants the food they call for and the crop repeats itself the next year, a fact of vast importance to every cultivator of the soil. The lecturer this afternoon has told you how he has succeeded in doing this by feeding the plant annually and not necessarily repeating the cost of cultivation.

Now when all these are credited their full share of value it is easily seen that the grass crop has more to its credit in Maine farming than any other fodder crop. I am aware that our Experiment Stations have been at work with other crops very largely, and have overlooked the importance of the grass growing under their feet all the way, and this is proper but it is unfortunate. It belongs to the Experiment Station to give its attention to the matter of establishing principles and establishing facts in connection with our work which may guide us in our future operations. They are not commissioned to work with the common, with the everyday affairs, with these things that we are supposed to know and can know just as well as they can. So it is no criticism to them to say that they have overlooked the humble grass while they have been experimenting on cow peas, Japanese millet, etc. The possibilities of the grass crop have never been measured among us. Thanks to the influence of the lecturer this afternoon in what he has been doing for several years past in regard to disseminating a knowledge of the possibilities of growing grass, we have hundreds of men in our own State who are now experimenting in the same line, and though none of them may secure the eight tons to the acre that he has been able to harvest, yet they are finding a rich reward for their efforts, and they are finding possibilities which they never dreamed of. In conversation with a young man in my own neighborhood only the night before I came away, in discussing this very subject that we have been dwelling upon this afternoon, he incidentally related the fact of a small field almost in sight of my own farm where twelve and one-half tons of hay were harvested this year from two and one-half acres on what has heretofore stood for inferior and unproductive soil.

These are facts in connection with the grass crop and it is certainly hoped that these experiments will go on and travel on from one farm to another until the grass crop of the State of Maine shall be double and treble its present average to the acre, as can be done easily, and even more profitably, on every farm in the State of Maine.

CHAS. S. POPE, Manchester.

I have been asked to relate a little of what we are doing in the way of producing cream, working in a little different line from that followed by most farmers. In fact, I know of no one in the State who is working exactly as we are. I am the owner of a large farm, and have always lived on a farm. I had a family of boys and wanted something for them to do and we concluded that the best line for us to work in was to commence manufacturing butter, making up our minds that there was a place in the market for first-class butter. If butter could be made which would sell at forty and fifty cents a pound, we would make that grade, and there would be money in it. After working a short time we found that others were putting cream into Boston and the city markets at a price that would give us more money for the same amount of cream in the form of cream without the expense of making it into butter. We at once changed over and began to sell cream. The Dairymen's Association some five or six years ago called to this State a gentleman from Illinois who was making a fancy article of milk for the Chicago market, and he gave his methods. This was Mr. Gurler. He was producing a very pure milk for the Chicago market, which sold at twelve cents a quart. We at once became interested. If there was a possibility of making a better article, that was our chance. I do not know of any one else in the State who took it up at that time. He used a peculiar make of pail for milking, the top of which was covered with two layers of cloth and about half an inch of absorbent cotton between. The milk was streamed on to this absorbent cotton, and no dirt or germs could enter the pail. We have milked in that way for years. We are thus able to produce a cream which we can send on the cars to Massachusetts and it will stand up without souring for two weeks or more without any trouble. In this way we can send a cream without pasteurizing, a sweet cream that has the peculiar flavor of fresh cream which the pasteurized cream does not have, therefore we are able to find a market at a good price. Of course it was difficult at first to convince the people to whom we shipped that the cream could be kept that length of time unless we had treated it in some way. We had that trouble in introducing it. But we have succeeded in getting customers for our cream made in this way. Not only must it be kept pure in the stable, but when it comes from the stable to the dairy house it must be separated at once, and every vessel scalded and kept clean and pure, without any chance for souring. The separator must be washed and scalded twice a day, the cream cooled at once on separating, and everything kept clean and pure from start to finish. The cream is put up in half pint jars in cases of two, four and five dozen, in the summer time with an iced box in the center. We ship direct to dealers, and our price, which is the best part of it, is almost double what we could get at the creamery. We have no trouble from any loss of cream, no cream is ever returned. This can be done by any farmer who has a mind to take the same pains, and it will give you returns nearly double what you are now getting. But I want to say that it is no use for any one to start in this business unless he makes up his mind from the first to follow it out. Everything must be kept sweet, clean and pure. It is only the purity that keeps the cream from souring. We introduced it at ten cents a jar, $1.60 a gallon, and increased it to eleven cents, or $1.76 per gallon. Some parties have it every other day, but sometimes they will get a little overstocked and they will send back word that we need not send them any more until the first of the week or the middle of the week. That shows that they were intending to keep our cream from Friday until the next Friday or Saturday. The cream will test about 37½ per cent. It is shipped to Everett, Cambridge and Lynn.

QUES. What is the arrangement of the pail?

ANS. The pail is made like a common milk pail with a snout like a strainer pail, which has a cap over it, and there is

Dining in newly constructed barn of H. E. Cook, Denmark, N. Y.

a ring around the top just large enough to slip inside the top of the pail, and around that there are five or six hooks soldered on to the outside. The cloth is made large enough to hook on to those hooks. It is two layers of cheese cloth with a thin layer of absorbent cotton between. Those are brought up and hooked over the hooks, so that the whole top of the pail is covered, frequently so tight that the air cannot get out. I got a sample from Mr. Gurler and carried it to our tin worker and he made my pails.

QUES. Do you consider that the increased price you obtain pays for the extra care which it is necessary to use?

ANS. We had a two days' surplus in July and we put it into the creamery. It would have netted us at the door $30 had we shipped it to Massachusetts. The creamery parties brought us back $16.80. We hardly expended the difference in the extra care.

CONSTRUCTION OF SANITARY DAIRY STABLES.

By H. E. COOK, Denmark, N. Y.

For the illustrations used in this article the Department is indebted to Cornell University, Ithaca, N. Y.

One can safely lay down the broad principle that live stock, whose bodily function is one of production, must have comfort in its fullest sense if they are to return a profit to their owner. If we expect a continuation of bodily strength equal to the increased demand upon it, we must not only approach but actually improve upon that season of the year when nature provides the most favorable conditions for production and for the support of the young. It is possible for owners of live stock, and especially those who keep dairy cows, to keep their stock all the time under conditions which are an improvement upon the month of June. The idea in stable construction is not to make the stable conditions more comfortable than the few ideal June days, but to protect the stock from storms and to provide the three essentials—a uniform temperature of from 55° to 60°, an abundance of light, and pure air.

I should like to change the point of view of many cow owners. They should look upon their cow stable as a dwelling-place instead of a windbreak. The cow stable should be subject to no greater fluctuations of temperature than the homes of the owners. A stable that is subject to the changes of outside temperature is, in varying degrees, nothing more or less than a modification of the primitive windbreak for stock.

I. MAKE THE STABLE SUNNY.

The ideal location of a cow stable in our latitudes is shown in the plan in Fig. 243. We are, of course, anxious to secure

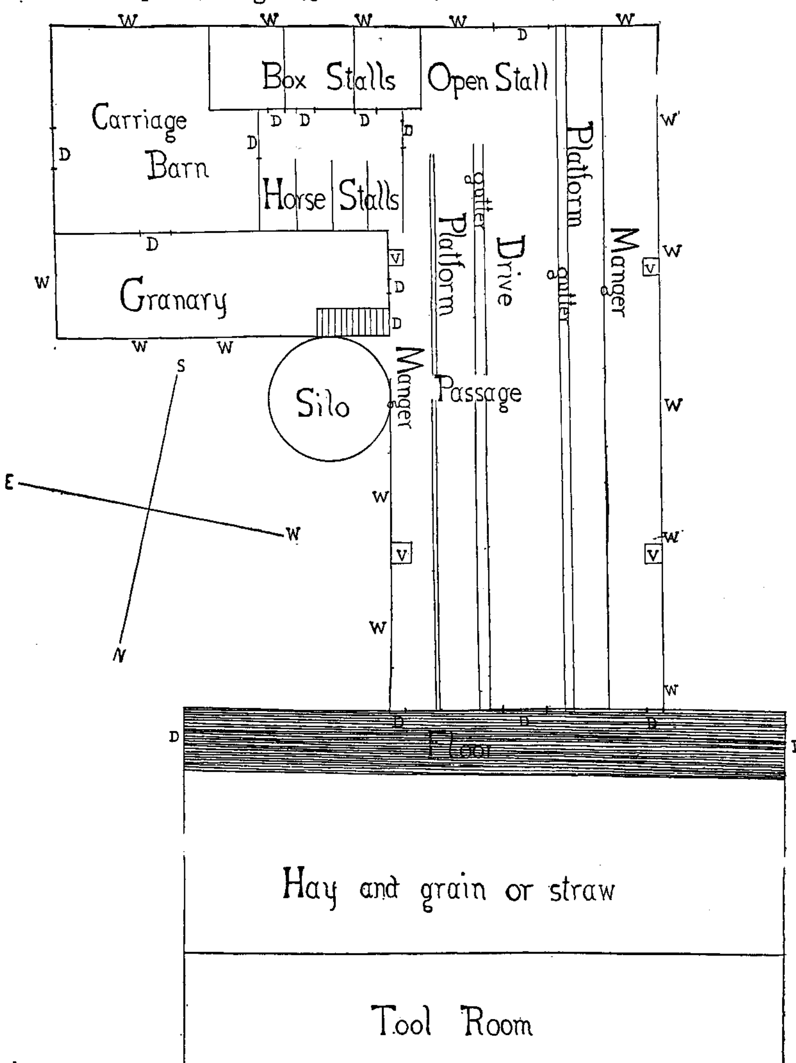


FIG. 243. *Plan of sanitary dairy stable of H. E. Cook, Denmark, N. Y.*

the admission of as much sunlight as possible, for without this continued health and sanitation cannot be maintained. The reader will observe that the building has a gentle turn to the southeast, thus giving the animals the benefit of sunlight during the whole day. Windows should be placed upon the east, south and west sides. Windows are not so necessary on the north side, although in some cases it may be desirable to secure the full complement of four square feet of window space to each one thousand pounds live weight of animals. Windows should always be double.

2. THE INTERIOR ARRANGEMENT.

The space required for each cow.—It will ordinarily be most economical of space and of time in caring for the cows to have two rows. A building 36 feet wide, outside measure, is ample. If the ceiling is 8½ to 9 feet from the floor there will be about 500 cubic feet air space for each mature cow. Of course this is only one-half the rule laid down by authorities in the past. However, it is all the space a cow can warm with the heat of her body when she is in a constant change of air. One has to trace the history of stable construction to understand our mistakes. In the early days stables were very small, providing less than 200 cubic feet of air space for each cow. Small apartments were better in the loosely constructed stables of early days. But when we closed the stables tightly with building-paper and matched lumber they were unhealthy, and we were told that a cow must have a cubic foot air space for each pound live weight. Few farmers could afford so large a space. The wealthy tried it, building mammoth stables having an air space per cow which it was beyond her power to warm. The ceiling was made of sound lumber, shutting off every avenue for air to escape. The result was that condensation took place and the stables were both cold and damp—breeding grounds for tuberculosis. If artificial heat had been provided no trouble would have followed. The point to keep in mind, therefore, is to build a stable which has only as much air space as the cows can warm, and yet has sufficient floor space so that the work can be done handily.

Shall we build mangers and partitions?—Nothing is more objectionable in a sanitary stable than unnecessary internal machinery. If necessary, an iron pipe can be attached to the upper stanchion frame and thence to the floor between the cows, about one-half of the distance from neck to gutter. But mangers are not desirable. In a warm stable, where succulent food is used, they are not easily cleaned and soon become sour and nauseating. A smooth, clean floor is best. With a little effort cows can be arranged in such a manner that they will not get more than their share of the feed. A depression in the floor appeals to me as nothing but an apology for a manger. Mangers can be used to advantage only when a few cows are kept and the feeder does not remain with the cows. We can safely say, however, that if the barn is so unpleasant that the feeder does not care to remain with the cows during the time in which they eat their grain feed, or if he is absent for any other reason, he will never become a successful dairyman. It will be noticed in the floor diagram (Fig. 244) that the cows stand upon a level platform with a raise of one and one-eighth inches, three feet from the gutter. All liquids are therefore carried quickly into the gutter, and there is no strain upon the back and kidneys of the cow as there is when she stands for a long period upon an inclined plane. The drive platform should be gently crowned so that any liquids falling on it will at once find a way to the gutter.

Watering devices.—A water-trough can be built into the floor, and into this water may be drawn at regular intervals. The objection is that it is seldom cleaned sufficiently before watering and the cows are forced to drink wash water. The drinking buckets in common use have the advantage of economy of labor, but the disadvantage of quickly getting filthy. They should be kept clean. We have in use a very cheap and simple method of watering—a mounted trough from which five cows drink at once. Water is admitted from a pipe running over their heads upon the stanchions. The water is always fresh and pure. This device has the one objection of taking more time than would be necessary for a man watering with buckets.

In my opinion swing stanchions are, all things considered, the most desirable fastener. We have in use a simple device for holding the movable piece, that can be attached to any make which has not been so built that the difficulty of always finding the movable piece where it is not wanted has been overcome. (See Fig. 238.)

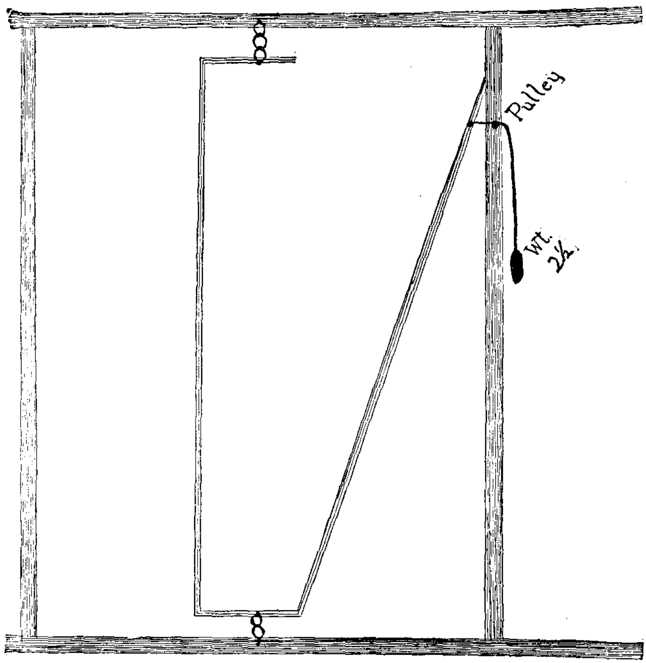


FIG. 238. *A good stanchion device. The weight on the end of the pulley is two and a half pounds.*

Making the floor.—First level the space to be floored. If it is soft dirt, drain it and solidly tamp the loose dirt. Ordinarily sufficient drainage will be given by the trench under the barn wall. If there is any doubt, put a run of tile drains through center of the building. Line through for the trenches, dig a ditch two and one-half feet wide and one and one-half feet deep, hand lay the small field stone of about five inches in diameter to an upper line, then fill in with a mixture of Portland cement, one part, and sand, five parts. This should be mixed dry and be made wet enough to enter every space between and under these round stones. Tramp the whole to insure firmness. Lay up a wall on each side exactly twenty inches apart. Then put upon the bottom, before the foundation is dry, two inches of mortar made of Portland, one part, sand, two parts, dry mixed and with enough water added to make it spread easily. As soon as this is set put a box upon it sixteen inches wide, eight inches high upon one side and six inches upon the other. Fill in this two-inch space with a finishing coat of two parts Portland to one part of sand. After the cement has set take out the form and trowel this gutter smooth with cement and sand equal parts. The rest of the foundation can be laid in the same manner. The surface should not be left smooth. After it has set, but before it has hardened, finish with a small board trowel which will give a sandpaper finish to all parts where the animals walk. This does away with all danger of slipping. In any portion of the building which is subject to freezing temperatures the floor should be laid in checks about three feet square. The finish coat should always be laid down before the grout has hardened and may vary in thickness from one inch to two inches, depending upon the strain to which it will be subjected. For example, a granary floor and feeding mangers may be finished light. The drive between the cows should be heavy, including gutters; the cow platform may be finished medium.

Wherever a partition is to be built anchor short pieces of three-quarter-inch iron pipe projecting above the finished floor one and one-half inches. Upon these can be placed a three by four scantling and the superstructure built thereon. There will be less danger of the horses slipping when hauling manure upon sleighs if at least one-half of the driveway nearest the outlet door is grooved or creased. This makes the driveway harder to clean, however. The whole passage may be grooved if it is thought desirable. Where one or two steps are needed to reach an elevation make them of concrete. Cover the barn wall where it projects into the stable so that every part will be smooth, easily cleaned and also offer no shelter to mice and rats. The granary floor should be of this same material, and should be laid in checks if there is danger of freezing under it. The stanchion bed-piece may be made of concrete instead of wood, thus avoiding a dirt catcher.

If small field stone are not at hand gravel or crushed stone can be used instead, six parts to one of cement. This should be put down three to four inches thick, firmly tamped, and the surface coat applied as suggested above.

The advantages of concrete.—It is impossible to give exact figures as to the cost of cement construction because the farmer will rarely hire the work done. About twelve cents a square foot will cover the entire expense of a cement floor built in a substantial manner. Much of the work can be done at odd times, thus reducing the money outlay by one-half. It is not advisable for any one not possessing a mechanical turn of mind to lay down the finishing coat. He may make it hard and durable, but it may lack that true to line finish which makes cleaning easy. Remember that a properly built concrete floor should last a lifetime. If it is not built properly it will be a constant source of trouble to man and beast. The writer has this floor in use under cows, horses, hens and pigs and it is

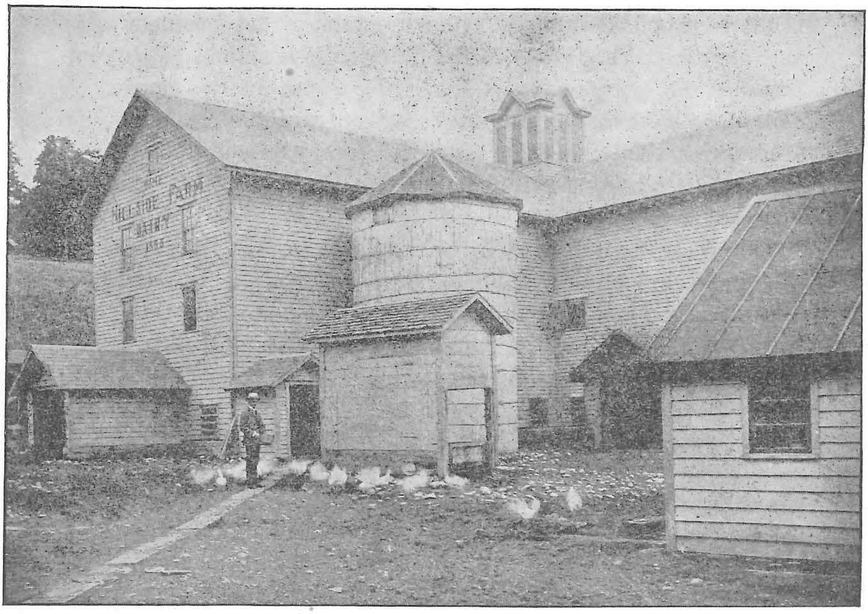


FIG. 236. *Exterior of barn shown in diagram in Fig. 243.*

successful in each case. While concrete makes sanitation possible, which cannot be said of plank, it also makes possible the perfect saving of all animal excreta. The oft-heard objection to cement, that it is cold, is as true today as ever. Cement is cold not because it has a lower temperature itself, but because it is a rapid conductor of heat; unlike wood, a non-conductor. A thin covering of any non-conducting material, like dry shavings, sawdust or straw, will insulate it and keep it from chilling the animals. No kind of domestic live stock should lie upon bare cement. A serious objection to a plank platform is that the soaking of liquids and the wear under the hind feet make cleanliness impossible. All this is done away with when cement is used.

4. WALL CONSTRUCTION AND VENTILATION.

The principle underlying ventilation is the control of air currents. The circulation both in and out of the building must be through specially constructed flues. It is idle to put the "King" system of ventilation into a foul-smelling, loosely built barn with a plank floor; it already has too much air circulation in and out. Therefore, the proper construction of the building is the first consideration. The cow stable is the business office and manufacturing plant of the dairyman; it should be as comfortable, in every way, as his living room in the house. *It should be a home for the cows and not a cheerless barn.* To accomplish this, the room must be completely insulated from the outside temperature. There is no reason why we may not now advise the best of all side wall construction.

Ceiling in the stable.—The ceiling, both inside and out, should be of single one-inch matched lumber, leaving an air space between of not less than eight inches. This space should be closely packed with cut straw, preferably, and if this is not convenient fill in with uncut straw. Put the ceiling on perpendicularly so it will not harbor dirt. To insure against this straw being wet by rain, waterproof building-paper should be used under the ceiling on the outside. The old way of building a stable of double boards, with paper between, is wrong, because a solid wall will be a good conductor of heat and hence it will be always damp. A single dead air space in the wall is satisfactory for a few years, but eventually the ceiling will check or a knot will fall out. Then the dead air space is gone, cold air comes in direct contact with the inside ceiling, and condensation follows. I therefore advise the straw filling at the outset. This provides, by means of its many air chambers, a nearly perfect insulation. Rats and mice will not be troublesome in this wall if concrete floors are used.

A damp atmosphere in the stable is dangerous to the health of the animals and must be avoided. Damp side walls lower the temperature of the stable because of a constant evaporation. The expense of the side described above is only a trifle more than the double boards and paper. The ceiling above must also be free from openings. It should be tight, not in the usual sense of barn tightness, but as closely built as a house. If air escapes into the loft the object of the ventilating system will be defeated and the barn loft will be damp and frosty. Use common ceiling and do not bead it, for this only makes so many more crevices to collect dirt. If there are hay shutes, arrange them so that the opening may be easily and perfectly closed.

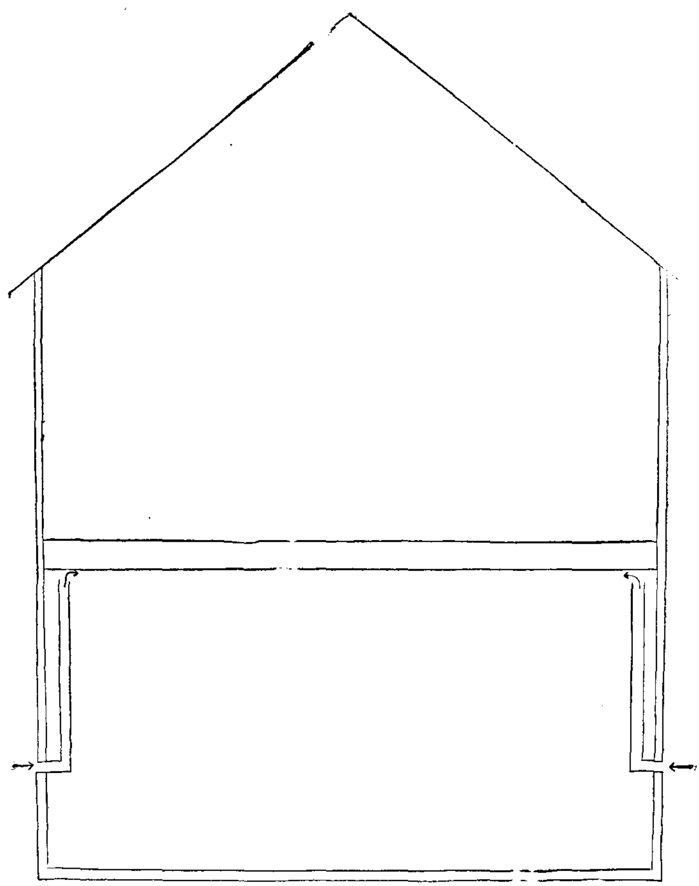


FIG. 239. *The construction of ventilation flues. The intake.*

Care should be exercised in arranging the stanchions, box stalls, etc., to distribute the unused spaces over the entire room. In other words, plan to have animal life distributed through the stable so that the temperatures will be equalized. Do not have an ell, in which little or no stock is kept; it will have a lower temperature with moisture condensation.

Where the moisture comes from.—We must not forget that the animal is the source of moisture in the room. The mature

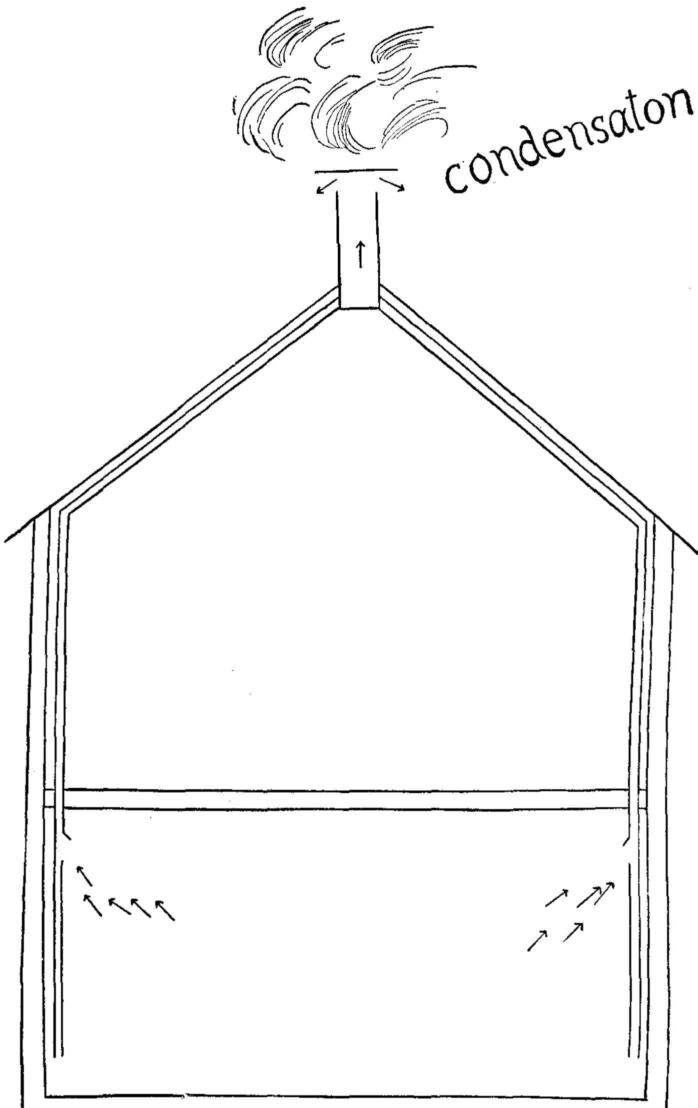


FIG. 240. *The construction of ventilation flues. The moisture should condense outside the stable.*

cow throws off from lungs and skin about seven pounds of water vapor daily. It is very important that we do not permit this vapor to condense into liquid water until it reaches the outside air through the ventilating flues. This is easily accomplished if the room is insulated and the temperature fairly uniform. We should realize that we have in the stables nothing more or less than a big box stove, the only difference being that the air comes in at the top and escapes at the bottom, while in an ordinary stove it is just the opposite.

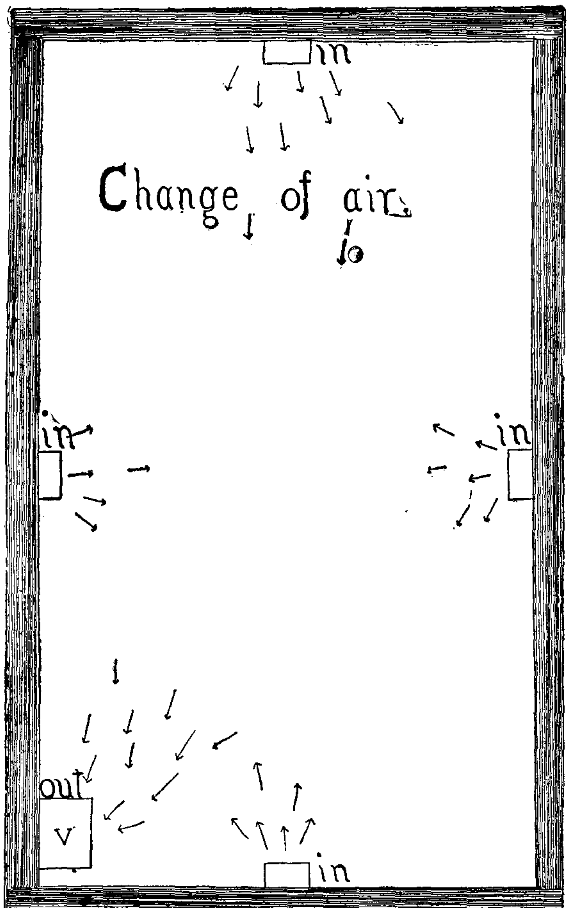


FIG. 241. *The right way to place the ventilation flues.*

Building the ventilating flue.—Having a stable built as just outlined we are now ready to put in dampers and pipes. Many a farmer has experienced serious trouble from dripping of a stove-pipe passing through a cold room; or horizontally for some distance; or into a large chimney where the warm air would cool off before reaching the top. The same trouble will follow this ventilation unless the flue is run straight or is insulated against outside cool air. It is therefore safe to build the flue only of matched lumber with paper between the two boards, thus making it vapor tight. If such a flue is built free from the building and is carried to the highest point of the barn and projects five or six feet above the ridge it will always work. The flue is covered with a cap about one foot above the top to keep out rain and to increase the circulation by the passing of strong air currents over the top. Do not build these flues of material which conducts heat readily, as galvanized iron; neither should they be taken out under the eaves or between rafters. They can be built outside the barn, if necessary, in which case insulation must be perfect to prevent condensation; probably a double flue, with the air space stuffed with straw, would be sufficient.

The size of the flue.—The size of the flues should be regulated by the number of animals, and not by the size of the room. A flue one foot square is considered sufficient for five or six cows. For ten cows the flue should be one foot by two feet; for twenty cows it should be two feet by two feet. It is the opinion of the writer, from observation, rather than from experience, that one flue located at any convenient place will be as satisfactory as two or more flues for a room holding thirty cows or less. For larger rooms, two flues or more would be better. My own experience has been with four flues for sixty animals. (Note Fig. 241.) These flues should open near the floor and also near the ceiling. In each place the opening should equal the full size of the flue. When the temperature outside is low, use only the lower opening; when high, use the upper. In a room constructed along these lines we are able to maintain a constant temperature of from 54° to 60° without regard to the outside weather conditions. This stable is located in the coldest section of New York state.

The intake.—Provision must be made for a constant inflow of cold air. No specific rule can be given for the number of these small flues. The points which must be kept in mind are to have the inflow from all four sides of the room; and through openings not over four inches in diameter, so small that the cold air will become mixed with the warm air before reaching the animals, and also to keep up a constant circulation in the room. The animals nearest to large openings might be chilled. To illustrate, if the flues were placed as shown in Fig. 242, the air would not be changed over the larger part of the room; but if located as shown in Fig. 241, the change of air would

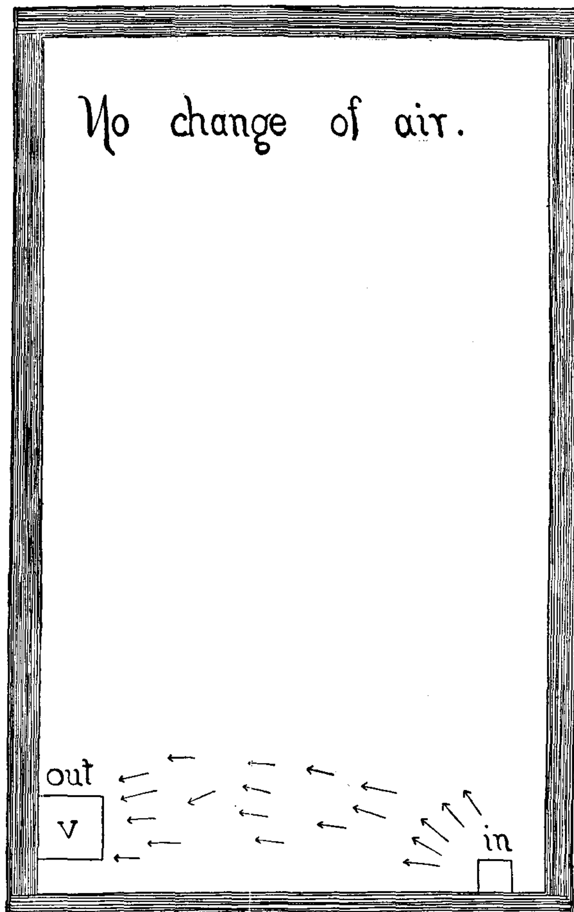


FIG. 242. *The wrong way to place the ventilation flues.*

be constant and complete. The manner of constructing the flues is shown in Figs. 239 and 240. These flues always work, because cold air entering the stable through them is soon warmed by contact with inside warm air and the animals, and hence rises rapidly. Air will never pass out through these intake flues. This inflow of cold air, under pressure, materially

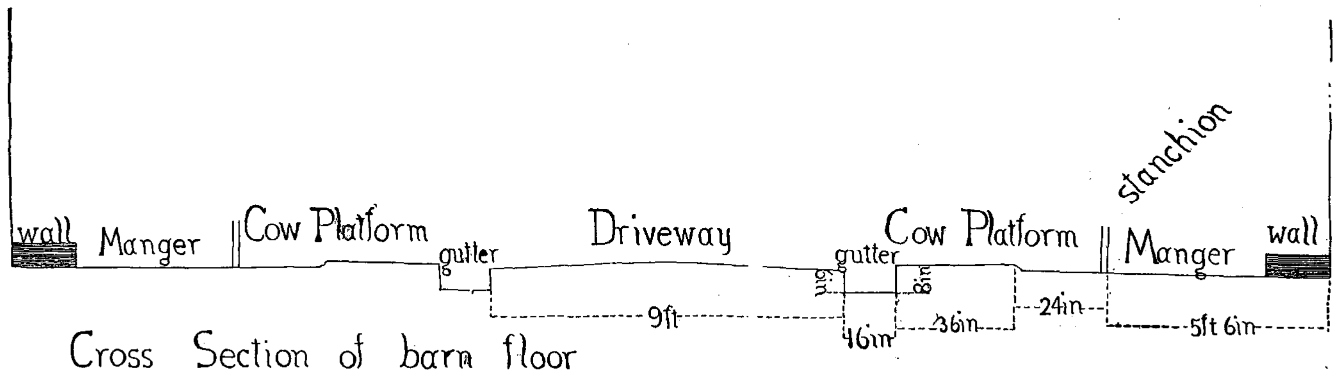


FIG. 244. *Ground plan of living room of the stable shown in Fig. 243.*

assists in forcing impure air out through the out-take flues; in fact, each flue assists the other. I am unable to give a definite rule as to the number of these small flues, for it depends so much upon wind pressure and how much air enters around doors and windows. All doors opening out should be double; where they open into other rooms single doors may answer and may be the means of admitting air to some extent. It is easy to judge whether the volume of air coming into a room is sufficient by observing the course of the air when entering the room. If the circulation is balanced there will be no suction in or out. If the warm air meets you in the face, the out-take flues are not doing their duty; if the air rushes in when when you enter, provide more cold-air flues. A stable can not be sanitary unless it has been provided with a good system of ventilation. The one outlined here has been very satisfactory. The health of the cows and the purity of the product demand that the matter of ventilation be given careful attention.

Is it wise to store hay over the cattle?—There is often a doubt in the minds of some dairymen whether a room over which hay is stored can be safely used for sanitary milk production. This sentiment is no doubt based upon the loose ceiling of former years from which chaff and dirt were constantly falling. It can have no foundation in fact when the stable ceiling is constructed as herein described. In our northern latitudes living rooms for cows should not be over eight and one-half to nine feet from floor to ceiling. We are therefore compelled to build a floor between the animals and the roof. Why not use this loft for storage, whether it be high or low? A track with car can be placed in the ridge of this loft, where it is not convenient to drive above, and hay can be filled in easily and cheaply. If the ceiling is perfectly tight, as it should be, there can be no objection to storing hay or straw above the stable. Only a few of the certified dairies have hay in a separate building; the dust of hay is, of course, the chief objection. If the hay should be thrown down into a narrow room separated from the cow stable by a partition, there can be no good objection to this arrangement.

When the building is narrow, or when it is not considered advisable to drive into the cow room for manure, as provided for in the stable in Fig. 244, the modern track and carrier are convenient and serviceable; use one that is easily and quickly raised and lowered for filling. It should also be high enough from the ground when run out of doors to dump into a wagon and thereby save one handling of the manure. It should be said that many dairymen prefer this arrangement because considerable dirt is unavoidably brought into the stable when the manure is collected with a team. In my personal experience this objection is more than offset by the convenience of the method. Convenience in feeding makes it essential that the granary, silo and root storage should be at the most readily accessible point, and stock can be cared for more quickly and more cheaply if all the working parts of the building are on the ground floor. Such construction might entail more barn roof but the extra expense of this would be fully offset by the lessened labor in caring for the stock.

This article is chiefly given to the points which should be considered in the construction of new buildings, but with a little study these points may be made applicable to buildings now in use. Stuffed walls, matched ceilings, cement floors and ventilation flues can often be introduced to great advantage into buildings now standing.

This work can often be done from time to time as means are at hand. Put in the floor first; at another time put in the flues, and then the ceiling. Never make the room tight until the flues are ready for use; a closed room without flues would be exceedingly bad for the animals.

On Wednesday evening the third annual banquet of the Maine Dairymen's Association was held at the Lancey House. This social feature of the Dairy Conference is becoming more and more interesting every year, and we trust has become a fixed event at these meetings. The rural people and the city people alike are pleased to have this opportunity of mingling together and exchanging thoughts, and listening to the wit and wisdom displayed in the responses to the various toasts. Many of the State departments were represented and prominent men from other states were present. A very enjoyable evening was spent.

THURSDAY, DECEMBER 7.

A business meeting of the Maine Dairymen's Association was held Thursday morning, at 9.30, for the election of officers and other business. The meeting was called to order by the president, F. S. Adams. The report of the secretary was read and approved. The following report was presented by the treasurer, and accepted:

Balance from last year's account..........	$107 09	
Received from L. W. Dyer, membership fees	31 00	
		$138 09
Paid bills as follows:		
B. C. Brett, itemized bill for banquet......	$33 75	
F. S. Adams, expense..................	3 00	
L. W. Dyer, itemized bill of expenses.....	21 40	
L. W. Dyer, postage and stationery.......	2 99	
		61 14
Balance in treasury		$76 95

Officers were elected as follows: President, F. S. Adams, Bowdoinham; vice-president, C. L. Jones, Corinna; secretary, L. W. Dyer, Woodfords; treasurer, Rutillus Alden, Winthrop; trustee, W. K. Hamlin, South Waterford; corresponding secretaries: R. D. Leavitt, Auburn, T. B. Bradford, Golden Ridge, W. W. Harmon, Falmouth, C. E. Wheeler, Chesterville, J. A. Peters, Ellsworth, Otis Meader, Albion, O. Gardner, Rockland, A. C. Fossett, Bristol, J. A. Roberts, Norway, C. L. Jones, Corinna, F. W. Leland, East Sangerville, B. M. Patten, Topsham, H. B. Ellis, Embden, E. C. Dow, Monroe, A. E. Lincoln, Dennysville, F. B. Pike, Cornish.

Hon. Rutillus Alden was elected member of the Advisory Council of the Experiment Station.

The following committee on resolutions was appointed: L. C. Bateman, Z. A. Gilbert, B. C. Brett and W. D. Hurd.

Voted, That a committee of one be appointed to co-operate with the Pomological Society and the Commissioner of Agriculture in relation to securing the printing of the report of the commissioner, which embraces the report of the Pomological Society and the Dairymen's Association, earlier in the season. Mr. F. S. Adams was appointed as that committee.

Voted, That a committee be appointed to confer with the trustees of the Maine State Fair in relation to the association taking charge of the dairy exhibit at the time they hold their annual fair. L. W. Dyer, R. Alden and Z. A. Gilbert were appointed by the chair, and on request the name of F. S. Adams, president of the association, was added to the committee.

Prof. Hurd briefly addressed the association in behalf of the students in the two years course in agriculture at the University of Maine. The four years course in agriculture has several prizes, but there are none for this course. In other states something has been done to help boys under similar circumstances, and he thought it might be advisable for the Dairymen's Association, one of our strongest agricultural associations, to recognize the course in agriculture as an educational feature. If something was done in this line it would not only help the boys but would be one step towards a federation of the agricultural interests. It was then

Voted, That three prizes be offered, one of $15, one of $10 and one of $5.00, to the boys taking this course who should prepare the best essays on dairying, the judges to be the president, secretary and vice-president of the association.

Mr. L. C. Bateman personally offered a prize of ten dollars to the members of the agricultural course at the College who would read at the conference next year the best essay on the Sanitation of Dairy Barns, following the lines suggested by Mr. Cook in his lecture. Mr. H. E. Cook added a second prize of $5.00 for this purpose. Mr. Geo. Aitken also offered a prize of $5.00 for the boys in the agricultural course, at the disposition of Prof. Hurd.

A prize of $25 was offered by Z. A. Gilbert for an essay, the title to be named later; and the sum of $25 was offered by Mr. Gilman, to be placed in charge of Prof. Hurd, for prizes as he might see fit.

The following resolutions were presented by the committee on resolutions and adopted by the association:

In closing the eighth annual session of the Maine State Dairymen's Association, it is fitting that the gratitude of the members should be expressed for the many kindly acts and the courteous attention which they have received. It is therefore

Resolved, That the association desires to extend its heartfelt thanks to the generous and public spirited citizens of Pittsfield who have made our stay so pleasant. Every possible courtesy has been shown, and in many cases the doors of private residences have been thrown wide open to receive the overflow of visitors.

The thanks of the society are due to Mr. J. Natt Gilman of Pittsfield for his splendid management and untiring exertion in arranging the details of these sessions and the exhibits in the grange hall.

To the managers of the Lancey House, Mr. and Mrs. Rufus Burns, our especial thanks are due for their hospitable treatment and the many personal comforts that they have thrown around us.

The press of the State have shown their friendly spirit by extended notices and most excellent reports and for all this we have a hearty appreciation. In this strenuous age no enterprise can succeed without this great moral force, and to the papers of Maine we extend our sincere thanks.

To the railroads for their kindness in giving reduced rates we are much indebted for our large attendance, and we do not forget their managers in extending our sentiments of gratitude.

Resolved, That in the death of our late associate, R. H. Libbey of Newport, we feel the loss of an interested and active member, and that the community has lost a public spirited citizen.

Resolved, That we renew our expression of confidence in the Dairy Division of the United States Department of Agriculture at Washington. The new chief, Prof. E. H. Webster, brings to the position ample technical training as student and teacher of dairying, and marked practical experience as a successful manager of large creamery enterprises. We pledge to the dairy division our hearty and continued support.

L. C. BATEMAN,
Z. A. GILBERT,
B. C. BRETT,
W. D. HURD,
Committee.

DAIRY LAWS AND THEIR ENFORCEMENT.

By S. C. THOMPSON, Dairy Instructor.

To the average producer, the matter of dairy laws is given but little thought or time, from the fact that honest dairymen are not violaters of law, and to many such, a discussion of this question is tiresome and seems out of place in a meeting of this kind. But without laws regulating the production, manufacture and sale of dairy products and their imitations, we soon find the honest producer and manufacturer competing with adulterated and imitation products, which necessarily narrows his market and lessens his sales.

We all agree that honest competition strengthens and broadens our markets, but the competition of imitations and adulterated products demoralizes all markets, consequently different states of the Union, as well as the Federal government, have passed more or less stringent laws regulating the sale of dairy products and their imitations, within their limits. It is an interesting fact to note, that in the states where dairying is receiving greatest attention, we find the most stringent laws, with provisions made for their proper enforcement, and each year the so called dairy states are revising and strengthening their laws, to more properly protect their interests, until at present forty-two states have some form of dairy laws; thirty-three having a milk standard law, forty having laws restricting sales of imitation products and twenty-four having laws regulating their use in hotels and other eating places. In nineteen states, the enforcement of these laws is by a dairy and food commissioner, in nine by boards of agriculture, in six by boards of health, in one by experiment station and in seven no department is specially charged with the enforcement.

The years of 1904 and 1905 have been a time of activity along this line, several states having done much work both in making laws and looking to their better enforcement.

In our own State, prior to 1905, no state department was charged with the enforcement of such laws as were on the statute books but the matter was left to local inspectors of milk, sheriffs, deputy sheriffs and constables, though the department of agriculture did whatever was done in enforceing the law prohibiting the sale of oleomargarine colored in imitation of yellow butter.

Our milk law was so worded that it was practically impossible to get convictions under it and none were attempted. Some cities, however, had passed ordinances eliminating the disagreeable features of the State law, but I am not able to find that any convictions have ever been made under them. We had a law which prohibited the manufacture or sale of any substance or compound made in imitation of yellow butter and charged inspectors of milk, sheriffs, deputy sheriffs or constables with its enforcement, though the board of agriculture was instrumental in making what prosecutions were made. The legislature of 1905, however, made several changes in the dairy laws; first, it charged the department of agriculture with the enforcement of the dairy laws; second, it amended the milk standard law; third, it amended the imitation butter law, by adding a restaurant clause, a fraud clause and requiring renovated butter to be sold under restrictions; fourth, it made a law requiring creameries to weigh and test all samples of milk and cream bought, also requiring all samples of cream to be weighed for testing. Following is the text of the laws of 1905 with the changes, where any occur.

Chapter 39 of the public laws of 1905, provides that, "The commissioner of agriculture shall inquire into the methods of making butter and cheese in creameries or cheese factories together with the methods of taking, preserving and testing samples of milk and cream in the same, investigate all dairy products and the production thereof;" that "he shall act for the State in the enforcement of the laws relating to the production, sale or manufacture of dairy products and their imitations;" that "he may employ chemists, agents and counsel as may be necessary, for the proper enforcement of such laws;" that "he and his agents shall have access to all places of business, factories, buildings, carriages and cars used in the manufacture, transportation or sale of dairy products or their imitations, and to all vessels and cans used in the manufacture or sale of dairy products and their imitations," and that "whoever hinders or obstructs him or his agents shall be punished by a fine."

Therefore it will be seen that by chapter 39 of the laws of 1905, the department of agriculture is specifically charged with the enforcement of the laws relating to the manufacture, transportation and sale of dairy products and their imitations, but this does not in any way affect the duties of local boards of health, milk inspectors, sheriffs or constables. This law is taken from the law of Massachusetts regulating the duties of the general agent of the Dairy Bureau and I find in looking up the laws of different states, that others have copied from Massachusetts for hers are among the oldest in the country and the courts have passed on them. The law relating to the sale of imitation dairy products has received several additions, while section 6, of chapter 129, the original law regulating the manufacture and sale of oleomargarine, remains practically the same, the penalty for violation alone having been changed. The law as amended now provides that, "No person shall manufacture, sell, expose for sale or have in his possession with intent to sell or take orders for the future delivery of any article, substance or compound made in imitation of yellow butter or cheese not made exclusively and wholly from milk or cream, whether named oleomargarine, butterine or otherwise named." It further provides that "No person shall furnish oleomargarine in any hotel, restaurant or boarding-house or at any lunch counter to a guest or patron thereof, instead of butter, without notifying said guest or patron that the substance so furnished is not butter." It further provides that "No person shall sell or offer for sale to any person who asks, sends or inquires for butter or cheese, any substance or compound made in imitation of butter or cheese." It again provides that "No person shall sell, offer or expose for sale any renovated butter unless the words 'renovated butter' shall be conspicuously and plainly stamped, labelled or marked, so that said words cannot be easily defaced, upon the top and side of every tub, firkin, box or package containing said article or compound. The seller at retail of said article or compound which is not in the original package shall attach to each package so sold and deliver therewith to the purchaser, a label or wrapper bearing in a conspicuous place upon the outside of the package, the words 'renovated butter.'"

"Any person who violates any provision of the preceding sections, shall be punished for the first offense by a fine not exceeding one hundred dollars and for the second offense by a fine not exceeding two hundred dollars."

While the law relating to the manufacture and sale of oleomargarine remains practically the same, the changes come in forbidding the serving of oleomargarine in hotels, restaurants, etc., without notifying guests, forbidding dealers to sell oleomargarine when butter is asked for, and the restrictions on the sale of renovated butter, these additions being in accord with those of many other states but more similar to that of Massachusetts. So the entire law as it stands now, gives control of oleomargarine and renovated butter under practically the same conditions as in other states.

The section of law defining adulterated and standard milk, section 3 of chapter 129, has received some very important changes. The law before being amended read as follows: "Whoever acting for himself or as the employe of another, knowingly and willfully, sells or offers for sale milk, etc." The first change made was the striking out of the words "knowingly and wilfully," so that the present law reads: "Whoever sells or offers for sale milk or cream from cows known to be diseased, etc., or from cows sick or fed upon any substance deleterious to its quality," (in place of, "fed upon the refuse of breweries or distilleries, or any substance deleterious to its quality") "or kept in a filthy or unsanitary condition, or milk to which water or any foreign substance has been added or sells or offers for sale as pure milk, any milk from which the cream has been taken or milk in or from cans or other utensils that are not kept in a clean or sanitary condition, shall for the first offense be punished by a fine not exceeding $50, and for a second offense by a fine not exceeding $100," leaving the amount of fine in each instance to the discretion of the court.

The new law states, "When milk shall by analysis be found to contain over 88% of water or less than 9% of solids exclusive of fat, it shall be deemed prima facie evidence that said milk has been watered, and when milk, by analysis, shall be found to contain less than 12% of solids and less than 3% of fat, it shall be deemed prima facie milk from which cream has been taken;" while the old law read as follows: "When milk shall by gravimetric analysis be found to contain over 88% water, it shall be deemed prima facie evidence that said milk had been watered and when milk by aforesaid analysis shall be found to contain less than 12% solids and less than 3% fat, it shall he deemed prima facie milk from which cream has been taken."

Thus it will be seen that the words, "knowingly and wilfully," have been stricken out, the word "gravimetric," before "analysis" whenever it occurred, and the amount of solids not fat must reach 9% in order for the milk to be standard, while before, milk that contained 12% total solids and 3% fat was standard and milk that contained 4% fat need not contain more than 8% solids not fat. By the change, it must contain 9% solids not fat without regard to the total solids or the fat, which is in line with Massachusetts although for six months in winter, their law requires 3.7% fat and 9.3% solids not fat, making total solids 13%.

Chapter 76 of the Public Laws of 1905, provides that "On and after July first, in the year nineteen hundred and five, all milk or cream purchased by any person, firm or corporation, for use in or to be resold by any creamery in this State, shall be weighed and shall be tested by the Babcock test, to ascertain the amount of butter fat per pound therein contained; and the value of the cream or milk thus purchased shall be determined by the amount of butter fat per pound as thus ascertained."

"The test herein provided shall be made by the owners or operators of the creamery purchasing as aforesaid, but upon petition in writing, signed by 25% or more of the patrons of any creamery and addressed to the commissioner of agriculture, or upon petition in writing signed by the owner or operator of any creamery and addressed to said commissioner, one or more tests shall be made by or under the direction of said commissioner and the finding of said commissioner shall be conclusive upon all parties therein concerned; provided, however, that when the total number of patrons of any one creamery exceeds one hundred then the number of petitioners herein required by patrons, need not exceed thirty. All samples of cream treated by said test shall be weighed and the standard unit for testing shall be eighteen grams."

Section 2 provides a penalty of a fine not exceeding fifty dollars and imprisonment not exceeding thirty days for each violation upon conviction.

This is entirely new and makes the amount of butter fat the standard for paying for milk and cream by creameries, also gives 25% of the patrons of any factory redress by petitioning the commissioner of agriculture to make tests and requires that samples for testing by the Babcock method shall be weighed.

In accordance with the provisions of chapter 39, of the Public Laws of 1905, the commissioner of agriculture has appointed me as his agent and assistant to enforce the laws as provided in chapter 39, and while the report of the work that has been done along this line belongs more properly in my report to the commissioner, where it will be considered at length, yet there are many, no doubt, who would like to know what is being done and what the existing conditions are.

It has been our purpose to make it a work of education rather than one of persecution and with that idea in view, we compiled and printed in a pamphlet all the dairy laws, and copies have been sent to producers, manufacturers, merchants who handle dairy products and eating houses. We have also called the attention of the dealers and all others by publishing the changes in the daily papers in the different cities. We have also visited the different cities in the State and called on the dealers to find out so far as possible, the amounts of oleomargarine and renovated butter handled and to discuss the changes and call attention to the requirements and at present we are making a systematic inspection of the stores and restaurants, having already made 408 inspections and taken 241 samples, several of which we found to be renovated butter and not marked according to law. We have also found oleomargarine served in eating houses in violation of the law, but so far we have generally found oleomargarine sold in stores according to law. It is our purpose to prosecute all persons who will continue to violate the laws, after having had proper notification. Thus far no prosecutions have been begun, as the chemical analysis has been delayed by other work which the chemist had on hand and the results were not known until recently. It is our purpose to go cautiously and be reasonably sure of our ground, for I find other states have learned by experience that a mistake at the outset had a bad effect on future work, particularly if it seemed to the courts that it was in any way a persecution, and from the reports of the Massachusetts dairy bureau, I find that for two years after it was established its work was almost wholly educational, no samples being reported and no prosecutions made, and for their third year, they made only 495 inspections and took 113 samples. Out of their 289 cases reported in 1903, 226 were for selling renovated butter in unmarked packages and 15 for serving oleomargarine in restaurants without notifying guests. So it seems that conditions there are very similar to what is found here, and as our laws are similar to theirs, it seems that similar methods to theirs can be successfully employed. I find also that Wisconsin has had similar conditions to our own and that they have copied from Massachusetts in the past.

It is only fair to say that this method is accomplishing the results, for in one city where several restaurants were using oleomargarine contrary to law, after being notified, all but two either stopped its use or posted signs, before we began our inspections three months later, and many dealers were found marking their renovated butter properly and nearly all seemed to appreciate having their attention called to the matter. The number of persons who have paid a United States tax to sell oleomargarine for the current year are six wholesale and 27 retail dealers, all for uncolored stock against eight wholesalers and 53 retailers last year, a result which is gratifying. The statutes provide that "Cities and towns of over 3,000 inhabitants shall annually appoint an inspector of milk, etc.," and the inference is that the quality of market milk is looked after by these local inspectors, but I find that half of the cities are neglecting to even appoint an inspector and in most instances where they are appointed, their salary is so small that the work done must necessarily be poor and incomplete, though there are some notable exceptions. The facilities for doing this work are also poor.

The question of better milk, particularly for family use, cannot be too thoroughly discussed and I fear that too often our people give but little thought to this question that affects the health of practically all our infants and most invalids, because nearly all use cow's milk uncooked as the chief article of food, and I believe that the public should give more attention to its milk supply.

Hon. H. C. Adams, formerly dairy commissioner of Wisconsin, whom many of you have heard, said in one of his reports that his department had found that towns having less than 3,000 inhabitants usually had a good milk supply but above that, it required to be constantly watched, and is it not reasonable to expect that our conditions are similar to theirs? Thus far this department has not made any inspections of market milk, but we have tried to ascertain the interest manifested and we believe it is our duty to find out the true conditions and to act accordingly. Chapter 39, among other things, provides that we shall investigate the methods of taking, preserving and testing samples of milk and cream in creameries and cheese factories, and we have been at work along this line, having secured a statement from each factory as to their methods of doing this work and at two different times have sent samples of cream to be tested by different factories, besides having had occasion to make tests in comparison with several of the factories, without their knowledge, during the year. I have also made several tests at the request of creameries and I am glad to say that the systems are improving all over the State, but I am convinced that this is one of the most important questions that we have before us, greater indeed than many creamery managers realize; for while a great deal of the fault-finding comes from a lack of actual knowledge on the part of the patron, it does come from an honest desire to get what is justly due, and to my mind, a satisfactory solution of this question to both creamery and patron will do more to strengthen the interest in dairying in this State than any other one thing. I hope that the creamery managers will think this matter over seriously. It is not enough to reaffirm their honesty, which I do not doubt, but some middle gound must be found where the rights of both will be protected and the feeling dispelled, at least, that unfair means are being used by the creameries in their own behalf, for there can certainly be no harm come to either, so long as the equal rights of both are respected. Variations in tests will always occur and are evidences of careful work, but some means must be devised to secure to each and every one concerned, a result which will seem impartial.

In conclusion, the last census credits Maine with producing one hundred and five million gallons of milk, or about nine hundred million pounds per year, and the average price paid for butter fat at our creameries, would make the value of the milk, if it tested 4%, worth over ten million dollars, and if we were to add ten dollars per cow for the by-products, which is the customary amount, we would have a total value of over twelve millions.

With an industry of this size and importance, when there is so great an opportunity to adulterate and imitate, and particularly, as it is so much used for food, it seems proper that Maine should be in tune with practically all the other states in protecting the honest producer and the consumer from every fraudulent practice.

WHAT MAKES THE MILK AND CREAM TESTS VARY SO?

By Jos. L. Hills, Director Vermont Agricultural Experiment Station, Burlington, Vt.

This is a burning question in Maine, as it is in Vermont; less so, perhaps, than it was a few years ago, but still a burning question. It is, I imagine, not quite as important an issue since the Pine Tree State is not quite as thickly studded over with creameries and cheese factories as is the Green Mountain State. Considerably less than one-half of her total area is in meadow, pasture and tillage; yet it contains within that small area over 250 separate concerns, or counting skimming stations, over 300 places where co-operative dairying is in vogue. At practically all of these milk and cream are bought and paid for by test, and at every one of them there is abundant querying as to the variations which appear in testing. What makes the milk and cream tests vary so? Doubtless the patrons of your creameries are asking the same question. I cannot hope this morning to resolve all their doubts, but perhaps I may be able to throw some light upon the subject and help to make better feeling between creamery managements and their patrons. Some of the matters I shall mention may have little or no pertinence here, owing to the differences in the methods of co-operative dairying in the two states.

Let us consider this matter under three heads:

I. Why does the milk or cream furnished by different patrons vary in test?

II. Why does the milk or cream furnished by the same patron when taken to different creameries vary in test?

III. Why does the milk or cream furnished by the same patron, at the same creamery, vary one week with another, and one month with another; why does not the quality remain unchanged?

I. VARIATIONS IN TESTS BETWEEN INDIVIDUAL PATRONS.

1st. *Why does Smith's milk or cream test differ from that of Jones?* Differences of breed, individuality, food, nervous excitement, environment, weather, the stage of lactation, and the management of the creaming devices may influence the result. Let us sketch some of these, which affect the milk flow directly and proportionately modify the fat percentage of the cream which it furnishes.

BREED.

Every observing dairyman appreciates that differences in cattle, due to the character of their breeding, are such that some cows giver richer milk than others. The Channel Island cows have been bred through many scores of years with a specific purpose in view, to make a high grade milk; and, on the other hand, the cattle of Holland and Scotland have been bred generation after generation more particularly to make a large quantity of milk. While there are exceptions to every rule, still, speaking broadly, Jerseys and Guernseys give richer milk than do cows of other breeds. Smith's test outranks Jones' because long lines of breeding with a definite aim in view have implanted in his animals a tendency toward making a better grade of milk than can Jones' cows.

INDIVIDUALITY.

While the differences in breed are frequently concerned in the test variations as between one patron and another, the individuality of the animal is often quite as important. There are families within breeds. The cows of some families give relatively rich milk, and others in other families relatively poor milk.

FOOD.

He who looks to food to grade up the quality of milk chases a will o' the wisp. Food variations may increase the quantity of milk, but seldom, if ever, bring about permanent changes in quality. If a cow is fed a very scant ration she may alter more or less the quality of milk given; but when a cow is changed from a good, palatable, plenteous ration to another of similar grade, but differently made up, no material change in the quality of the milk is likely to follow, provided the rations are normal. We have been trying for years at the Vermont Station to persuade cows to change the quality of their milk, but at no time and in no way have we brought about a permanent change. When we have fed fat (vegetable oils, like corn, cottonseed, linseed and palm oils, etc.) to the cow we have changed the quality of the milk to a slight extent; but we have hurt the quality of the butter far more than we have helped the fat percentage. Dried distillers' grains appear slightly and permanently to increase the fat content of milk, but the change is too slight to be of importance. In other words, no Holstein cow can be wheedled into giving Jersey milk by any normal rational feeding, unless it be by semi-starvation. A starving or half fed cow is apt to make richer milk as a consequence of her ill treatment—but far less of it.

NERVOUS EXCITEMENT.

Such conditions as may be provocative of nervousness have more influence upon the quality of milk than most people are apt to think. I once heard a Maine dairyman say that in his judgment the best thing on a dairy farm was a dead dog. He allowed that a coat of whitewash in the barn was a close second to it. A dog once thoroughly killed never again annoys cows, thus removing one of the most common sources of bovine agitation. Milk making is a nervous function and in proportion as a cow becomes excited, in proportion as the nerve force which should be concentrated upon milk making, is distracted therefrom by any cause, dogging, hornflies, abuse, noise, etc., in that proportion there is likelihood, amounting almost to certainty, that the milk flow will be influenced. If I remember aright Gov. Hoard tried a few years ago an experiment in this line. I believe he was the first man to urge that a cow be treated as if she were a lady; but once upon a time he abused a cow in order to know whether or not it would affect the quality of the milk. The cow was milked about half through and a sample of the latter portion of the milk was set aside; then a heavy pin was raked across her flank. She made a jump into the manger and was greatly excited. The milking was then finished and a sample taken. There was a difference of fifteen per cent in the amount of butter fat in the two halves of the milk, fifteen per cent of fat eliminated by the nervous excitation.

Another experiment in the same line: One of our western experimenters fired blank cartridges in front of cows just before they were milked. The explosions decidedly affected the quality of the milk. In our own experience an Ayrshire, temporarily in new and noisy surroundings, increased the quality of the milk without decreasing the flow, while another Ayrshire at the same time, treated in exactly the same manner, did precisely the reverse and shrank half in quality and a quarter in quantity. Anything that tends to make a cow nervously excited will be apt to affect the milking function and, as a rule, unfavorably.

Why should we expect a cow or a herd of cows always to give, week after week, the same quality of milk? Milk making is the cow's work, just as investigation and teaching and executive duties are my work, and the sundry farming operations, your work. Do we always do as well one day as another whether we feel well or ill? Though in the best of health do we do the same amount of work each day? Why should we expect a cow to do the same day after day? Her work is expressed by the milk she makes, and largely, by the per cent of fat she puts into that milk. We should not expect of her what we ourselves cannot do.

STAGE OF LACTATION.

The stage of lactation is another reason why Smith's milk test differs from that of Jones. It is well known that cows tend to better the quality of their milk as they progress in lactation. Investigation has shown that cows differ greatly in this matter. Some vary but slightly and others largely as they pass from freshness to stripping. A farrow cow goes dry giving milk but little richer than when she came in, but one which is to calve within a few weeks, usually gives when going dry considerably richer milk than when she came in. Experiment has shown, moreover, that on the average the increase from calving to drying-off approximates 1.25 per cent fat, that is to say, a milk testing 4 per cent at calving may test 5.25 per cent of fat at stripping. Smith's milk may be made largely by strippers, while Jones' cows may be mostly fresh in milk.

VARIATIONS FROM ONE TEST TO THE NEXT.

It is now generally understood that the quality of the milk of the same herd varies decidedly from day to day, from milking to milking, and that, in order to represent correctly the weekly or monthly quality, it is necessary to take a composite sample. It will sometimes happen, however, that even when composite samples are used tests may vary one week with another fifty, sixty or seventy "points," or expressed as percentages, 0.50, 0.60 or 0.70 per cent. I believe it the duty of the creamery management in extreme cases to verify the result by retest. Many patrons have an exaggerated idea as to this matter of variation. For instance, a few years ago a creamery patron told me that he was being defrauded by the management, because his test one month had been 3.90 and the next month, 3.85. These five points, 0.05 per cent, seemed to him something enormous. No operator can take the same test in the same Babcock bottle and always read it twice alike. Two-tenths of one per cent is not a wide difference between two tests, and three-tenths of one per cent, as between one month and another, even when the cows are in scant flow, is hardly a wide enough variation for cavil; more than that is of importance. But, as I shall say later on, one should not growl but investigate.

MANAGEMENT OF THE CREAMING DEVICES.

Milk is creamed nowadays either by shallow setting, deep setting or centrifugal means. Shallow setting is so out of date and inadequate that it is not practiced in co-operative dairying and may be dismissed from further consideration. Deep setting systems vary somewhat in character and efficiency. Smith may use a form capable of doing good work when conditions favor, and he may run it well. Jones may still be using one of the so-called dilution separators, sometimes and well called "delusion separators," now pretty much passed by, and get quite likely a richer cream than Smith as a consequence, but a good deal less of it. Or he may have purchased some later form of the gold brick type of deep setters, air cooled. Or one may have a centrifugal separator and the other none; or both may have the same device and handle it in different manners.

Many of the items already referred to affect cream as well as milk tests. Breed, individuality, lactation changes, etc., play their part here. The term "Jersey cream" is usually held to be a synonym for richness. As a matter of fact, Jersey milk properly creamed in a deep setting device is apt to make rather thinner cream than does the milk of other breeds containing smaller fat globules. In general, milk containing relatively small fat globules creams less thoroughly than that containing larger ones, but such cream as is thrown up is apt to be denser and richer. On this account as well as because of its well known greater richness, stripper milk is apt to make a richer deep-setting cream than does new milk.

II. VARIATIONS IN TESTS BETWEEN CREAMERIES.

Why should Smith's milk or cream taken this week to Brown's creamery and next week to Robinson's creamery, test differently?

I presume this is seldom done in Maine. It is a common practice in Vermont, in the eastern townships of Quebec and wherever creameries are crowded closely together; but it is an unwise procedure, since it accomplishes nothing.

When we go to bed at night we utter a prayer—or ought to if we do not—in which are to be found the words "Lead us not into temptation." Human nature is so constituted that it often happens that a patron, who takes his milk or cream, or samples thereof, from Brown's creamery to Robinson's is essentially leading the latter into temptation, into which he is apt to fall. He may feel inclined to raise the test, to make it read, or to report its reading, higher than it really is. In my judgment such a test is not a test of the milk, but of human nature; and the milk of human kindness is altogether too apt to be curdled by such a trial, as is the milk of the cow by the sulphuric acid of the Babcock test. Such a comparison has no standing and amounts to nothing. There are better ways whereby one may find out whether Brown's work at the creamery is or is not correct. One may help himself or be advised at the Experiment Station.

HOW TO CHECK THE CORRECTNESS OF CREAMERY TESTING.

I believe that a Babcock apparatus should be located in every dairy community; and that there should be there, also, some young man or woman capable of running it in a satisfactory manner, whose services could be had by any one in the community at a small consideration. I do not advocate that all dairymen own Babcock apparatus. Some are not so constituted as to make it likely that they would take care enough to run it properly. A Babcock incorrectly run is worse than none at all since results thus attained are misleading. If the test apparatus and some man or woman who is careful and capable of running it are available, one may know, if he wishes to, whether his creamery is doing him justice or not.

If the community is unwilling to combine in this way, its dairymen may turn to the Experiment Station, an institution which is helpful to hundreds of dairymen in the State in this very way. It is a common thing up our way for Smith, who doubts the correctness or the honesty of the creamery management's test, to take a sample and express it to the Experiment Station; and then if its test differs from that made at the creamery, there is music in the air. That is to say, there is if the home test is the lower of the two; if it is the higher, Smith's silence is profound.

You will ask, perhaps, how the Station knows that the sample which Smith sends has not been tampered with. If Smith is a rogue, if for any reason he is bound to make his creamery wrong, whether or no, it is easy for him to manipulate the sample. So can the creamery management tamper with samples. Yet if the men are sincere and anxious to know the truth, there are always ways in which they can insure accuracy.

Some time ago the Vermont Station put out a four page bulletin,—reprinted at the end of this article—giving methods of sampling milk and cream. This was printed in poster form and sent to every Vermont creamery and cheese factory with the request that it be posted near the weigh can. We suggest three schemes for sampling milk or cream whereby the patron who desires to check the testing work of the creamery may do so;

First, the creamery sample may be halved.

Second, the creamery employee who takes the samples may be required to take duplicates.

Third, a patron may take his sample for himself.

Neither of these methods of sampling ensures absolute accuracy. Errors of omission or commission, of ignorance or intent, may be made. If the creamery samples be halved, if the management is asked to furnish half of it that it may be sent to the Station, it is located, prior to halving, in the control of one of the interested parties, the creamery man; and if he is inclined he may tamper quite as readily with the sample as with the result. If the second method is used, if every time the operative puts a gill of milk or a measure of cream into his sample jar he puts one into the jar which the patron holds, the objection may be urged that the sample is in the hands of the other interested party, the patron; and our experience leads us to believe that he is quite as apt to fall into temptation as is the creamery man. If the dairyman takes his own sample at home, he may be ill informed as to the necessary precautions in sampling, or careless, or, indeed, as just indicated, intentionally deceitful, and as a result the sample will not be truly representative. In short, there is no way in which the Experiment Station can be certain that the samples sent it are correctly taken. Hence we are careful in our reports to those sending us samples to disclaim all responsibility as to the accuracy of sample taking. I think, however, that the bulletin to which I have referred which was sent to be posted at every creamery and cheese factory in Vermont, which was mailed by thousands throughout our state to the entire station mailing list, and which concludes this article, does help to make the samples that come to us somewhat more uniform and trustworthy.

III. VARIATION IN TESTS WITHIN THE SAME HERD.

Why is it that Smith's milk or cream taken to Brown's creamery varies one month with another? Why does it not test evenly?

Several of the reasons cited under the first head apply here.

LACTATION CHANGES.

The change in lactation of the cows is one important reason why there should be variation. The general tendency of the herd will be as the cows advance in lactation to give somewhat richer milk. While there are many exceptions, the general rule is that cows coming in in the spring will give a fairly even grade of milk for the first five months in their lactation, and then increase in quality until they go dry. If they are farrow cows, quality changes but little as time goes on. If an all-the-year-round dairy is kept there should be less change on this account.

These same changes pertain to the cream. The richer milk is apt to make richer cream for reasons hitherto pointed out, if it is handled in a deep-setting device. Centrifugal separators, however, are no respectors of rich or of poor milks. A rich cream or a thin cream quite at the operator's will may be made according to the setting of the cream-screw or regulating device. If, however, this remains unaltered and the same proportion of milk is taken as cream from the rich and from the thin milk, creams will vary accordingly.

For example if one dairyman has 1,000 pounds of new milk testing 3 per cent, and the other, 1,000 pounds of stripper milk, testing 5 per cent and each takes 100 pounds cream and 900 pounds skim milk, the former would have a cream testing nearly 30 per cent and the latter, one containing approximately 50 per cent fat.

WEATHER.

Stress of weather is another cause of variation. We have given much time at the Vermont station to the study of the effect of temperature upon the milk-flow. Our results indicate that the quality of a cow's milk alters inversely to temperature changes. When the temperature rises the tendency is for the quality of the milk to drop; when the temperature falls the tendency is for the quality of the milk to rise. There are, however, many exceptions to this rule. No attempt has been made to test this matter in long periods but only as to daily or weekly fluctuations. And these trials, moreover, have had to do more with summer and fall than winter conditions.

SURROUNDINGS.

The environmental differences, the nervous excitation of the cow already mentioned, as they vary from time to time, may cause fluctuations in the quality of the cow's milk. The change from barn to pasture, or the reverse, scarcity of water, poor water, drying pastures, new milkers and the like, may and often do have influence. Then, too, it must be confessed that there sometimes occur fluctuations in the quality of the milk of a cow, and, occasionally, of a herd for a week or more, for which no rational explanation can be offered, changes which, because of the care exercised in sampling and testing and in the control of the conditions surrounding the operations, can hardly be other than actual ones. That is to say, they are not due to errors in observation. There is much that we do not know about cow nature and cow doings in this matter of milk-making; and here, as is always apt to be the case, those who know the most are those who impute the least, while those who are less well informed are the more suspicious of wrong doing.

An editorial published some time ago in Hoard's Dairyman is very much to the point in this connection. It says:

"The cow is not a machine that will turn out the same quantity or quality of milk from day to day, and consequently the milk varies according to the physical and, perhaps, mental condition of the animal. The physical comfort or discomfort of the animal is reflected in the milk pail, and if the great mass of dairymen would only recognize this fact, it would have a beneficial effect on the state of the pocketbook.

In a careful record of the yield of a herd of cows for several years the following facts were noted:

They varied in quality of milk from one milking to the next, and from day to day, the quality rising and falling without apparent cause.

The changes were usually within 1 per cent of fat, but one cow changed 2.68 per cent in two days.

The average change during the period of lactation was 1.34 per cent, and the greatest change 2.78 per cent.

The above herd was exceptionally well taken care of and sheltered, and the changes in quality of milk were thus much less than would be noticed in cases of animals kept under less comfortable conditions.

The dairymen should remember that exposure to cold, drinking large quantities of cold water, exposure to cold rain, fright, worry, heat, flies, and dogs, walking several miles over poor pasture for food, starvation, soothing the cow with kicks or milking stool, will all remove fat from the milk and make such treatment more expensive than good shelter and kind treatment.

When a patron's milk shows a low test, let him make a careful examination of conditions at home before he lays the blame on the butter-maker or the test."

THE CREAMING DEVICES.

Actual variations in the management of the creaming devices, known or unknown to the operator, account to quite an extent for variations in the cream output. For the sake of convenience and clearness, let us consider the possibilities of variation in the deep setting and centrifugal methods each by itself. No pretense is made that all possible causes of variation are covered.

DEEP SETTING.

Temperature.—Completeness of deep-setting creaming is largely dependent upon the proper temperature of the water. The density of the cream is also thus affected. A warm water (45° and upwards) means poorer creaming and less of a richer cream. Colder water means better creaming and a less dense cream.

Length of setting.—As a rule the shorter the time the thinner the cream.

Delays in setting.—Delays in setting are apt injuriously to affect creaming, and, perhaps, to modify the fat percentage.

Deep setting creams from different sources may vary over quite a wide range, containing seldom, if ever, more than 25 per cent fat, or less than 12 per cent. I have seen quite wide differences from day to day in the same herd with the same milk, for which no adequate cause could be assigned.

SEPARATOR.

A good separator properly and uniformly run ought theoretically to turn out from milk of essentially even quality a cream of practically unaltered character. But milks from day to day do change in their fat percentages, even though the herds are of considerable size; and, consequently, creams vary accordingly. As a rule, however, one week with another, if no change occurs in the setting or the running of the mechanism, and barring the extreme changes of the latter part of the lactation, there should be only minor changes in fat percentages of the creams.

Changes in device for regulating thickness of cream.—All separators have means of controlling the proportions of the milk taken as cream and skim-milk. If in any way, accidental or intentional, the setting is changed, the quality of the cream is affected. Accidental changes often occur. The outlet becomes clogged, a hair lodges there, a chip or filing of steel, or a bit of curd or some speck of dirt gets in, the cream flow is retarded and its richness affected.

Incorrect running.—Too low or too high speed or feed, a trembling bowl, a machine ill cleansed, out of repair, or out of balance; all of these may and do affect results. I have known positive flaws to exist in the mechanism which have modified results. Sometimes the hair or chip or filing of steel above mentioned, causes spattering of the cream into the skim-milk, which results in a considerable loss of fat and a somewhat lower grade of cream.

While not exactly germane to the subject I may be permitted, I trust, to say a word in answer to the very common question at meetings of this kind—What is the best separator?

This was at one time a question which was very often asked of the Station. Our present feeling in the matter is that there is not, of necessity, any one make that is "best" in all points; that machines of all the more prominent makes are capable of doing a good grade of work when properly handled; that, since good skimming is the rule, other points, such as initial cost, durability, probable repair bills, ease of operation, etc., are now more important; and, finally, since flaws may occur in individual machines of any make, that agents' claims as well as the records of other machines of the same make are of less value, touching the quality of skimming, than is the analysis of the skim-milk of the individual machine offered. Many farmers in Vermont have bought separators on the condition that the skim-milk should be submitted to the Experiment Station for analysis, purchase to follow its favorable, and rejection its unfavorable report. The buyer thus has, free of expense, the advantage of the advice of disinterested experts, which, moreover, is given in ignorance of the kind of machine under trial.

We are now ready to consider a phase of the question which I desire to treat with the greatest care as to the words which I use and the impression which I leave with my hearers.

I believe that among the serious factors in this matter of milk and cream test variation are the *errors of the testing operation.* Let us discuss this possibility of error in the manipulation of the test under the sundry subheads, *sampling, apparatus, errors of ignorance and errors of intent.*

SAMPLING.

By no art of legerdemain can a dairy analyst return a correct result from an incorrect sample. I am inclined to think that a considerable part of the variation between tests is due to imperfect methods of sampling.

Three methods of sampling are more commonly in vogue, the dipper method, the core method and the automatic method. The latter is applicable to milk sampling only, unless very large quantities of cream are brought to the factory. The two former are used for both milk and cream. Since Maine deliveries are almost entirely of cream an exposition of the automatic method seems unnecessary. Upon such a scheme stress would naturally be laid in a discussion before a Vermont audience where milk deliveries are still the vogue, but it may be omitted here.

The dipper method of sampling is widely used. From the mass of milk or cream more or less (and generally less) thoroughly stirred (and, indeed, often not stirred at all) a gill or so is dipped for a sample. Such a procedure may result in affording an accurate sample; and it may not. Fresh milk, not creamed, well aerated and stirred, carted over rough roads and drawn from cows whose milk contains relatively small fat globules, may be accurately sampled thus with a minimum amount of stirring. On the contrary, milk which has creamed, which is a day or more old, from Jersey or Guernsey cows, but slightly shaken in transportation, if in considerable quantity, cannot be mixed by superficial stirring with sufficient thoroughness to insure accurate sampling. The Vermont Station several years ago did much work in investigating methods of milk sampling, as a result of which we are prepared to say with a fair degree of assurance, that when five hundred pounds of milk somewhat creamed is delivered at the factory, there is no surety of the accuracy of the sample taken therefrom by the dipper method, unless the milk is stirred for from two to three minutes, round and round and up and down. Hence it is desirable that those who sample milk should consider the advisability of adopting some method which is more likely than is this to insure accurate sampling. To such the automatic method should appeal. The dipper method works fairly well with cream. The mixing by pouring back and forth is generally feasible and then dipping affords, or may afford, essentially accurate samples.

The coring method of sampling offers some advantages over the dipper. Several devices designed to core milk or cream are used. The Scovell sampler, which was used in the World's Fair tests in 1893, is a fair type of this class of implement. It consists of a small brass tube with a perforated sliding cap at the bottom. It is lowered into the fluid slowly so that it will flow into the tube until it strikes the bottom, when the perforated cap slides over and closes the tube, thus producing a core. A sampler sold in Cedar Rapids, Iowa, suggested, I believe, by Prof. McKay of Iowa State College, consists of an inner sliding tube within an outer tube with slots which, when open coincidently, core the cream, and when closed, enclose the core thus taken. It is an admirable device. This method of sampling, provided the cream is not separated in clots and the milk is neither loppered nor frozen, is more apt to take a correct sample of either milk or cream, if carefully used, than are other methods; or, rather, it is less likely to take an incorrect one. This method is clearly much to be preferred to the use of the dipper for cream sampling. Either method should, however, be used only with thoroughly mixed lots of cream.

APPARATUS.

There has been a law upon the statute books of the State of Maine for nearly a decade concerning the accuracy of the test apparatus used at creameries. Several states, including Vermont, have copied this law. Our experience with it has been highly satisfactory. We found about three per cent of the apparatus in use at the time the law was enacted seriously defective. That now in use is, without exception, accurate. All the apparatus sold by Vermont supply houses today is certified to as to its accuracy by the Vermont Station. While this piece of legislation does not provide a cure for all the unhappinesses of creamery management, it does help the situation somewhat. The law is imperfect and can be bettered. It should cover not only the accuracy of the glass ware, but also of the centrifugal testing machines. Less often today than formerly, yet still not infrequently, these mechanisms are so constructed that correct results are difficult, if not impossible, to attain. The inspection of these machines should be provided for as well as the prohibition of the use of such as are likely to yield inaccurate results.

ERRORS OF IGNORANCE.

Both the Maine and the Vermont laws require that an operator of the Babcock test for dividend making shall be examined as to his knowledge in its operation, and that he shall secure a certificate stating that he is competent and well qualified in this line of work. This requirement is made by the laws of many of the eastern states. In many cases operators have been forced to perfect themselves in testing in order to pass the examination, who otherwise would have tested with but half a knowledge of the process. We have licensed over 550 parties desiring to test in Vermont. Over three score have been refused licenses,—men who otherwise would have operated the test system; men who, however, were unable to test correctly, even under conditions when if ever they would have done their best. Some of them would have been adjudicating the value of milk and cream at Vermont creameries and cheese factories today, had it not been that the operations of the law disclosed their lack of information. Many of the 550 licensees were refused licenses on the first examination, but were granted them after they had proved on the second trial that in the interim they had learned how. Every man testing in Vermont today at least knew how to test when he took the examination. Whether in after years and in actual work he has done as well as he knows is another story.

Would-be licensees today must be able to test cream as well as milk. These are almost the sole deliveries in Maine, and in Vermont they are rapidly getting to be common. There is, moreover, a greater likelihood that error may occur in cream analyses than in milk analyses. The results of cream analyses are apt to be less trustworthy than are those of milk analyses. Partly through ignorance, partly through neglect, partly through indifference, partly, I fear, for worse reasons, less special attention is paid to this matter by creamery managements than should be accorded it. A cream carrying more than 25 per cent of fat, one that is in the least sour or frothed, or which contains air or gass bubbles, is so thick that the full amount of cream is not delivered by the pipette into the bottle. In some states, Maine among them I believe, this fact is recognized in the passage of a law requiring that cream pipette deliveries be weighed. There is no way other than this whereby accurate results may be attained. When such creams are simply pipetted 18 grams are not delivered into the bottle, resulting obviously in a low test.

Weighing cream is a simple proposition; yet so many fail to have a clear conception of this matter or to understand the reasons which render it a necessary procedure that a few words may not be amiss. A thick cream flows so sluggishly that an over-large proportion remains behind upon the inside of the pipette. Sour, frothed or gassy creams carry sufficient gas or air bubbles, which contain no fat, to lessen the amount of cream the pipette contains. The 17.6 c. c. of milk or 18 c. c. of cream which the Babcock pipette contains are supposed to weigh 18 grams. The pipette is used simply as a convenient device of getting 18 grams in the bottle, a device which works well enough with milk or with thin cream but is inadequate when thick cream is handled.

The apparatus used is simple, consisting of small scales, much like a druggist's scales, and a few weights. Special forms have been made, one of which whereon several samples may be weighed at one time seems very serviceable. The empty cream bottle on one side of the scale is balanced by the slide or weight on the other. The 18 gram weight is then placed on the pan and the well mixed cream pipetted into the cream bottle until the balance swings evenly. It goes without saying that care must be taken to get no cream on the outside of the bottle or on the pan, since it will weigh just as much there as it would inside the bottle; that also in case too much cream is got into the bottle some must be withdrawn by the pipette or otherwise to make the weight correct. When the exact weight is obtained,—and after a little trial this may be attained with great speed, not to exceed a minute to a sample—the test is then proceeded with as usual. The operation is no more intricate than weighing butter into the tub in which it is packed. It is precisely the same thing, weighing into a weighed empty package a given weight of the material wanted. The extra time consumed need not be more than a minute to the sample, and as a result of its expenditure far greater accuracy is insured. Every patron taking separator cream to a creamery should insist that the management test eighteen grams of his cream, and that the delivery of the pipette is weighed.

ERRORS OF INTENT.

I believe in the "open door" system in a creamery. I would have the management open its books and its testing operations to patrons. I know of one creamery where, some years ago at any rate, the test operations were conducted in secret and the books kept under lock and key. Secrecy is unwise; publicity on the other hand tends to disarm suspicion. Dishonest methods of sampling or testing are used occasionally. I believe that "occasionally" is as strong a word as is warranted by the facts. I feel that ninety or ninety-five per cent of the troubles which have agitated and still to some extent continue to perturb the patrons as to the test system are imaginary rather than real. Yet, unfortunately, sometimes errors of intent, deliberate dishonesty, exist. I have, however, no sympathy for a patron who growls, or swears, or whines, who claims that he has no recourse, that he is in the hands of a management and must take what they give him, who alleges incompetence or worse, without striving to correct it or to confirm his allegations by investigation. He has recourse. He can, if he will, work out his own salvation, either by his own hand, by that of some bright young man or woman, or by that of Uncle Sam. If he is sincere, if he really wants to learn the truth, he can help himself or be helped to attain the right in the manner already cited.

One of my former associates on the Vermont Board of Agriculture was wont to say, that in this era of trusts, which are viewed with some suspicion, there is the one trust we should believe in much more than we do, and that is "trust one another." The present creamery conditions do not, in my judgment, warrant the wholesale feeling of distrust which is prevalent among patrons. I would substitute for the word "distrust" one which I think will be found far more helpful as a means of arriving at the truth, the word "investigate."

Do not *distrust* but *investigate*. I am confident that most creamery managements will gladly meet candid and sincere patrons more than half-way in the investigation of apparent discrepancies and in the rectification of any proved inaccuracy or injustice. When the day of general mutual investigation dawns in creamery work there will be greater harmony between patron and management, and better work all around.

SUGGESTIONS AS TO THE SAMPLING OF MILK AND CREAM.

Dairymen are learning to use the Babcock test more every year upon their individual cows or the entire dairy, either using it themselves or having tests made for them at the creamery or by the Experiment station. The results of analyses are useless and misleading if obtained on poor samples. There is reason to believe that many do not understand how easy it is to take an incorrect sample. Hence the following suggestions as to accurate sample taking are printed for the information of dairymen. Copies will be sent without charge to any address on application to the Experiment Station, Burlington, Vt.

They discuss how to sample with a view of:

1. Testing individual cows;
2. Testing the entire dairy;
3. Testing cream;
4. Testing skim-milk;

5. Testing buttermilk or whey;
6. Checking the accuracy of creamery testing.

I. *To test individual cows.*—Provide as many fruit jars (pints or quarts) as there are cows to be tested. (Wide mouthed bottles (with tight corks) will do if jars cannot be obtained. A narrow-mouthed bottle makes accurate handling of the sample at the time of analysis difficult and often impossible.)

Label each jar. Into each put preservative to keep the milk sweet. (Use either formalin, sometimes called formaldehyde, about 20 to 30 drops to a pint (not more lest the milk thus be made too dilute and the results affected); or corrosive sublimate, colored with analin red, about ten grains; or potassium bichromate, not more than ten grains. Formalin is preferable and non-poisonous; the other two are poisons and should be handled carefully. These, or some one of these, may be obtained at any drug store or at the local creamery.)

At the first milking pour the entire milk of the cow back and forth from one pail to another not less than three times and then *at once* dip out approximately a gill (a gill cup on a long handle works well—a small tea-cup will do) and pour into the jar. Close the jar and keep it closed until the next milking. Proceed thus with each cow. At the next milking repeat the operation, adding a second gill of recently-poured milk from the first cow to the gill taken at the first milking, and similarly with the other cows. Rotate the jar each time slightly to keep the cream from forming too tenacious a layer. Proceed thus for from four to eight successive milkings, keeping the jar closed except when putting in the milk. This makes what is known as the composite sample, one which is much more trustworthy than is a sample taken from a single milking. If samples are to be transported, sampling should be so planned that the last sub-sample of each composite sample taken *should be made to fill the jar absolutely full to prevent churning while in transit.*

Cows vary considerably in the quality of their milk at different stages of lactation. If only infrequent samples are taken, most nearly accurate results (that is, such as will most closely indicate the average quality for the year) will be usually obtained if samples are taken approximately as follows:

Cows calving in the spring: One composite sample six weeks and another six and a half to seven and a half months after calving; or two composite samples, taken about two weeks apart six months after calving.

Cows calving in the summer: One composite sample eight weeks and another six to seven months after calving; or two composite samples, taken about two weeks apart, from three to five months after calving.

Cows calving in the fall: One composite sample eight to ten weeks and one five and a half to seven months after calving; or two composite samples, taken about two weeks apart, from five to seven months after calving.

Samples taken at other times may give satisfactory results. Prolonged experience has shown, however, that greater likelihood of getting a correct average for the year is attained by sampling at these times.

II. *To test the entire dairy as a whole.*—Prepare a fruit jar as under I. If the churn will hold the entire milking, pour it in and slowly revolve the churn for a couple of minutes, then draw out, taking a gill soon after starting the milk out of the gate. Repeat for several milkings as under I.

If the milking is too big for the churn, pour the milk in each large can three or four times back and forth and after the last pouring of each can dip out at once a gill into a second jar. Having gills from each can united in the jar, pour these not less than three times. Take one gill and put into jar as under I. The stirring method of sampling from large cans should not be resorted to unless neither of those cited above is practicable. If used, the contents of each large can should be vigorously stirred with a long handled dipper round and round, reversing, and dipping deeply, from one to three minutes, and a gill taken into a second jar at once on the completion of the stirring of each can of milk, the several united gills to be poured and one gill taken for the final composite sample which should be built up as under I.

III. *To test cream from the dairy.*—(a) Shallow setting cream. This class of cream cannot be accurately sampled or tested.

(b.) Deep setting or so-called "gravity" cream. The entire lot of cream merged together should be poured as with milk under II and a gill taken into a jar as under I.

(c.) Separator cream. Proceed as under III. (b.) If thick, stirring may suffice as under II.

Not less than a half pint should be used for a sample. Small samples and narrow-mouthed bottles are untrustworthy.

IV. *To test skim-milk from a dairy.*—(a.) Shallow setting. If sour, add a little caustic soda or lye and mix and pour until fluid. Put a gill into a jar without preservative. Make composite sample (four sub-samples) as under I.

(b.) Deep setting or so called "gravity." Pour or stir vigorously; take gill from each can and finally pour or stir the united gills and take a single gill. Make composite sample (four sub-samples) as under I, using preservative.

(c.) Separator. Catch skim-milk from three to five times during each run, distributed throughout the run. Pour and take a gill for composite. Make four sub-sample composite for test as under I, using preservative.

Less time need be spent in mixing skim-milk than with the whole milk or cream.

V. *To test buttermilk or whey.*—Draw directly from gate or siphon; make use of the composite sample with preservative.

VI. *To check correctness of test at creamery or cheese factory.*—(a.) Halving creamery sample. When the creamery composite sample is complete and ready for testing, require the operator to furnish one-half of it. Be certain that the sample is thoroughly mixed by pouring, that all the cream from the sides of the jar, cover, etc., is mixed back into the milk or cream, and that the halving is done immediately after the last pouring.

(b.) Duplicating creamery sample. Every time that the party sampling milk or cream at the creamery or on the gathering route samples a patron's milk or cream, the latter may require him to furnish a duplicate sample in a jar controlled by the patron. Duplicate composite samples may be made thus which ought to test closely alike.

(c.) Sampling at the dairy. Follow directions under II or III.

All of these three methods of checking creamery testing are open to objection. In (a) the sample or testing may be incorrectly managed at the creamery, the sample being under control of one of the interested parties, the creamery man. In (b) the sample may be improperly handled by the other interested party, the patron under whose control it is located. Method (c) resembles (b) in this respect, and, moreover, results may be vitiated because of error or insufficient care in sampling.

Dairymen are strongly urged to make use of the Babcock test at their own homes. It is of more value as used between cow and cow than for settling money matters between man and man.

To such residents of Vermont as do not consider it advisable to make their own tests, or to have neighbors make them for them, the Vermont station offers its services to a limited extent. It cannot do regular and wholesale testing for any individual or company, but will handle small numbers of samples without charge. It makes but few requirements, which are as follows:

1. Samples should be carefully taken in accordance with these instructions.

2. Wide mouthed jars should be used.

3. *Jars should be filled absolutely full to prevent churning in transit.*

4. Express charges should be prepaid. In case the empty or partly full jars are desired back again, the owner should guarantee in advance to pay return express charges. The free return empty privilege is no longer granted by the express companies.

5. The shipper's name should be placed upon the package for purposes of identification.

ALFALFA FOR THE MAINE DAIRYMEN.

By E. A. ROGERS, Brunswick.

The upbuilding of the agriculture of Maine has always been a cherished work with me from my boyhood days. No part of our broad country has seemed to me to have more possibilities for an intensive and paying agriculture, making homes filled with every comfort of life, than has Maine. It is the desire to uplift our agriculture that has been at the bottom of my work along the line of potato culture, with which some of you present are familiar, and which has helped place Maine well in the lead in producing the largest number of bushels per acre of any state in the Union, with quality equally as high.

It was only a few years ago that but few would admit that Southern Maine could produce potatoes in a commercial way, and even some who should have known better referred to our soil as worn out. Take the little town of Richmond in the Kennebec valley that did not ship out a carload of potatoes a year up to three years ago and note the changed conditions. Many cars will be shipped from that town this year, and the same is true throughout all Southern Maine. And this is not all. Next year the grain crop will be increased in the same proportion, hay following in its turn, which means provision for more dairy stock.

All this I saw in my mind's eye years ago and my chain was not then complete, for as I travelled about I noted farmer after farmer, dairyman after dairyman, hauling home the grain of the West for his stock, thousands of tons sold in almost every little hamlet, and felt that if this could be stopped and its equivalent grown upon our own farms it would mean the difference between abundant prosperity on one hand and in too many cases a bare living on the other, and there was to me but one solution,—alfalfa.

Alfalfa is almost equal to wheat bran, eleven pounds of alfalfa hay being equal to eight pounds bran, and a barn full of well cured alfalfa hay means to the dairyman that he can at least cut his grain bill in half, if not better.

Think what this means to you dairymen of Maine. Half of your present grain bill to be kept at home to buy comforts and luxuries for your families, or to be used in farm improvements instead of paying it, as you are today, in tribute to the West, and in the growing of this hay you are bringing fertility to your farms cheaper and quicker than in any other manner. You will then grasp the motive that led me to experiment along this line of work. Could alfalfa be grown in Maine and furnish the protein lacking in our timothy hay and corn products and make the Maine dairymen independent of the grain dealer?

I believed it could, and this was the task I set myself to answer, and while my experience has extended over but three seasons, my first experimental field has passed through two winters in fine shape and given me three good crops of hay each year on the plots where the soil conditions were made right.

I believe it makes but little difference what kind of soil it is, whether underlaid with hard pan or not, if it is only well drained. Well drained it must be, for if water stands upon it at any time it will surely kill out the alfalfa.

There are three points of vital importance besides drainage in growing alfalfa, and neglect of either one will most surely doom the grower to disappointment and loss of his seeding.

First, "liming" the soil to remove any acidity that may be there. I doubt if we have much soil here in New England that will grow alfalfa successfully without liming; in my experiments it is absolutely necessary to the growth of the plant, and in my work I have used about one ton lime per acre, but the amount needed on different soils no doubt varies.

On my first experiment I used the common air slacked lime, and later I used the so called agricultural lime, manufactured for this purpose by the Rockland Lime Company, which promises to be equally as effective, costs less, and is in better condition to apply. It should be evenly broadcasted and worked into the soil before seeding.

Second, alfalfa bacteria. This is essential to the growth of alfalfa and without it the plants soon turn sickly, making a small growth, and then dying. They rarely live through the first winter, and in many cases die even before winter sets in.

It seems to be impossible for this form of bacteria to thrive in an acid soil. As New England soil does not contain this bacteria we must import it and there are two ways in which this can be done.

In my first experiment I used wholly soil from a thrifty New York alfalfa field and in my last, a two acre field sowed July 1st this year, 630 pounds of soil from New York was used on one acre at a cost of $6.20, while on the other nitro-culture costing $2.00 was used. Not until spring can I fully decide which is giving the better results. If both give equally as good results the nitro-culture is not only much cheaper but requires much less labor, as it is only a few minutes' work to inoculate the seed after the cultures are made.

Third, cultivation. The field intended to be sown to alfalfa should be planted the year previous to corn or potatoes; this will insure thorough working of the soil and rotting down of the sod, and what is more essential, the sprouting of the weed seeds; it should be thoroughly worked with the harrow after the crop is removed and again in the spring. This will insure that all weed seeds are killed and make a very fine seed bed, which is essential. Land treated in this manner can be sown to alfalfa much earlier in the season, without the danger of weeds starting.

The young alfalfa plant is very easily choked out either by weeds or grain, but if given the whole ground it will be able at the end of the first season to hold its own with almost anything.

I will not attempt to give the best time of seeding, but should sow as early as May 15 if ground was in fine shape and I was sure the weed seeds were all killed, and use 30 pounds of the best northern seed procurable per acre, thoroughly working this into the soil but not too deep and then rolling it smooth. If weather conditions are favorable, it should be showing at the end of three, or at most five, days, and at the end of a month on good land it should be nearly a foot high. If showing yellow it should then be cut very close with the mower. This makes a stronger root growth and in six weeks a good crop of hay can be cut, and two good crops can be obtained from rich land the first season.

Alfalfa should never remain uncut until in full blossom, for this weakens the roots and causes loss on crops to follow, but it should be cut when just well coming into bloom, regardless of the weather. It is even better to lose a crop in this manner than to allow it to stand and get woody. Alfalfa is a very rapid grower, under good conditions averaging an inch a day. I have no means of knowing the amount of hay it will produce per acre here in Maine but my first crop for the last two seasons has averaged four feet high and the second and third two and one-half feet each, this making a total growth per season of nine feet.

I sincerely believe any one can grow alfalfa here in Maine or anywhere in New England on well drained soil when he will comply with the conditions we now know the plant needs.

QUES. What tonnage of cured alfalfa per acre did you get this season?

ANS. I could not tell you, as I did not weigh it. I can only give you the height of the plant and the growth that I got. The first crop was four feet high and it was pretty thick.

QUES. Would that be equal to the same height of an ordinary field of hay?

ANS. I do not think it would, because that would give a tremendous crop. If I remember rightly it is claimed that a foot in height of a fairly thick crop will yield a ton. Following that rule, it would make nine tons, as the yield of my alfalfa, and I should not say it would run over five tons.

QUES. Have you fed the crop that you raised last year?

ANS. Yes, I fed it in quite a number of different ways. I began to feed it green. I did not remove it all from one acre. The rule is to let it stay and act as a mulch, but there was so much that I took off some of it. I fed this to the cows green, and following right along after that I began to cut the other acre and I fed all I dared to, to the cows night and morning. I have only two cows. Both were fresh the last of March or first of April. On that alfalfa fed to them green they held up almost to June in their flow of milk and the butter was just as yellow as June butter. I have not fed any of the hay that I cut this year. It is under a large amount of other hay so that I could not get at it easily. The hay that I made the first year was not nearly made. I only had three days of good weather. It musted badly, but the cows ate that musty hay with a relish and gave more milk and made more butter than when fed on any other hay in the barn.

QUES. Were the stock as eager for that as for cured hay or grass?

ANS. Fed as a grass, I never fed anything that the cows were more crazy over than the green alfalfa.

I am not claiming a great deal of experience with alfalfa. I am told that we should be very careful about feeding a great deal of green alfalfa to our cows. I began with a small amount and gradually increased. The piece being pretty near the barn, and as I had only two cows, I took a wheelbarrow at night and put on all I could wheel in and fed that to the two cows night and morning, and I never saw the least ill effects from it. I did not begin in this way but worked up to it. It will heat very quickly. I never saw anything wilt any quicker than green alfalfa. We hauled some on a drag at night, and by morning the steam would be coming right up through it, and some mornings I found that it had turned black, between six o'clock at night and five the next morning.

Prof. HILLS: We find over in our state that practically the only permanent success of any material account has been obtained in what is known as the Champlain Valley. One of the great reasons why alfalfa has been successful there more than elsewhere is the fact that that is a natural limestone soil, underlaid with limestone, and every farmer has been, through nature's agency, liming his soil. There is one other point that has not been touched, I think, by Prof. Hurd or Mr. Rogers, in connection with the relative success of the plant in New England, and that is the character and source of the seed. The bulk of the seed upon the market is western grown seed, and frequently grown under irrigated conditions. Now it is my judgment that if we can, either here or further west, develop northern grown seed on non-irrigated areas, the success with that class of seed will be much greater. We find in our state little patches seeding itself year after year, and I judge it is so found in this state, from the statements of some of the gentlemen. If the seed from these voluntary plants could be saved and got together into one package at the Experiment Station at Orono, and they should grow a crop from that seed, I believe that in the course of five years or more we could develop home grown (New England grown) alfalfa seed, and if this is given good conditions of tilth in the soil and proper freedom from weeds, the chances then for success in alfalfa growing will be considerably increased. But I am inclined to agree entirely with Prof. Hurd that the prospect of material success to any great extent in the immediate future is not great. That our children will be growing it, I have no doubt.

Mr. COOK: There is difficulty in obtaining seed that is free from dodder and trefoil. Our people in New York have been doing some very careful work with alfalfa, and the difficulty is growing worse. I do not know what you have found here, but this is the thought I wanted to leave: If any one is going to sow alfalfa in the State of Maine, I would send a sample of the seed down to the University and let them look it over. It is almost impossible for the ordinary observer to tell whether the seed contains trefoil or not. I am frank to say that I would not know which was alfalfa and which the trefoil. While you can tell the dodder by the size, when they are mixed it is pretty hard.

Prof. HILLS: That yellow trefoil is to a large extent a foreign seed, and it is imported into this country to quite an extent for no purpose except the adulteration of seed. It would be well to petition your senators and representatives to put up some bar against the importation of that seed.

QUES. How much seed would you recommend sowing?

Mr. ROGERS: I would not sow less than 30 pounds of seed to the acre. I was as careful as possible in getting my seed. I did not dare to risk these experiments with just one lot of seed, and had at first two lots of fifteen pounds each, from two different lots of seed. They were both claimed to be 99 per cent pure. Then later I sent and got some more from another lot which they claimed was Montana grown seed. I think I bought five different lots of seed to make up enough to sow those two acres. I thought if one proved bad there probably would be enough to give me a fair stand in the others. I used 30 pounds to the acre, I think, altogether. If you sow it early you will cut at least two fair crops of hay in a season, and possibly a small third crop. If at any time it begins to turn yellow, mow it as snug to the ground as you can. After you sow the seed roll it thoroughly so the cutter bar can cut close down to the ground.

Clipping the first season is considered necessary in order to strengthen the roots.

We never want it to get very much in blossom. It should be cut when it is just beginning to show a few blossoms. If you do not cut it until after it gets in full blossom the stalks will be woody. I would always be sure to cut it early. In making it, let it get well wilted and pile it up in bunches of 75 to 100 pounds in a bunch and let it stay for about two days, not longer or it would kill out the stand underneath it. I would not let it stay long enough to get musty before it was opened up to the sun.

ADDRESS.

By Hon. GEO. AITKEN, Secretary Vermont Board of Agriculture.

I do not propose to give you any routine subject or any set address. I am going to talk to you, and if you will excuse me, I am going to give you a leaf of my own experience, and you can do with it as you please. In listening to the talks yesterday and today it occurred to me that the best thing I could talk to you about was the dairy cow, as she is the first and most essential element in our success as dairymen. Prof. Hills told you this forenoon how much the milk tests varied, and some of the causes. I will try to show you how much the individuality of the cow has to do with our success or non-success in dairying. I brought this picture with me to show you a cow that has a unique, or rather a remarkable experience, showing very conclusively how far one cow can vary from another. This cow whose picture I have here was one that was tested in the great butter test at Chicago in 1893 at the World's Fair. They had what was called the heifers' test,—two-year-old heifers that were tested for butter for 21 days. This cow was only three days over two years old when she went into the contest, and during that test of 21 days, where she was under the supervision of experts and under rigid rules and regulations, where the feed was weighed and valued exactly at the market price, this heifer gave an actual profit of $11.61. All the heifers entered in that test were supposed to be good ones; they were picked for that purpose, but the next best Jersey to this one gave a profit of only $8.00 in the 21 days, and so on down until the one that gave the least profit gave only $3.00 in the 21 days. You can readily see what a difference there was in those young cows. All the heifers in that test were bred along the very same lines, bred on the same form; but while they were similar in appearance, the others came a long way behind this one in actual profit. The only safe method of finding out what our cows are doing is by the use of the scales and the Babcock test.

When I was a member of the cattle commission in our state it was my privilege to go practically all over the state and see different herds that were kept for dairy purposes, and I am positive that at least one-third of those cows were kept at a loss. It is not a very difficult matter to keep a record of the herd, and this will be greatly to the advantage of every dairyman. We weigh every pound of the milk every time we milk, and the weights are all set down on a sheet with spaces for a week. At the end of the week the gross amount is taken off and posted on a book under each cow's name, so that we can tell at a glance just exactly how much each of our cows has produced during the year or during a series of years. I picked out one cow at random and made a few figures to show you what one cow did in eight years. This cow, which by the way is not by any means the best cow we have, but I think is a fair average as to the amount she is giving, dropped her first calf December 1, 1896, and until December 1, 1904, she gave 52,903 pounds of milk with an average test of six per cent. We test all our milk for butter fat at least four times during the milking period, so that we know approximately what each particular cow is doing. This 52,903 pounds of milk at an average of 6 per cent butter fat will equal 3,704 pounds of butter or 463 pounds per year for eight years. Deducting $64 per year for the cost of feed, we can tell at a glance the profit, which in this case is $92.50 per year, or $740 for the whole period. That is only an average sample of our herd, and I have been at work on that herd for 22 years. I want to say that this building up process is a slow one. To go back to the cow we have on the chart,—that was a remarkable record for a heifer, for so young an animal, but it was nothing extraordinary when we take into consideration that she was bred and trained for that particular purpose. You may smile when I talk about training a cow, but I would no more think of raising a calf without training it than of raising a race horse without training it. Of course we do not have to train the same muscles in the cow as in the horse, but when we have a calf well bred and with a good constitution, we can train the muscles of that calf to do the right work just as well as we can the muscles of the race horse. I cannot describe the treatment better than to give you a few facts. We never allow the calf to nurse. It is taken away from the mother immediately, and fed on whole milk for a few days, the length of time depending a good deal upon circumstances. Then the milk is gradually thinned with skim-milk until the whole milk is taken away entirely. Then the skim-milk is supplemented with oat meal boiled thoroughly and a little flaxseed, just enough to keep the calf in a good growing condition without getting fat. In the summer time they have grass and in the winter time they are in open yards and run there all winter, with an abundance of coarse, rough fodder and all they can eat of turnips and beets, and just enough grain to keep them growing and in good health. They have a shed which they can run under, but it is not closed up at all except at night.

I want to take issue a little with my friend, Mr. Cook. He says that cows should be kept at an even temperature all the year round. I do not think that is right. I think the bracing, cold air of our New England winters is just as largely beneficial to stock as to the human race. For that reason in raising young stock I keep them as much out in the open air as possible. They are treated in the way I have described until they drop their first calves; then they come to the dairy barn. They are strong and their digestive organs have been trained and exercised in getting the juices and the nutriment out of the coarse fodder, so that when put into the dairy barn they make much more profitable cows, they make more butter than when raised in any other way. At least, that has been my experience. I have seen hundreds, probably thousands, of the very best bred Jersey cattle ruined by over feeding when they were young, feeding them on highly concentrated foods. Twenty-five years or more ago, when the Jersey boom was about at its height, every animal that had a pedigree, every animal that looked like a Jersey, brought a high price. These cows fell into the hands of jockeys and speculators who would take them and raise their calves, feed them on as highly concentrated food as they could, and keep them as fat and sleek as possible. I know of one man who turned his greenhouse into a place to keep his calves. They were smooth and beautiful to look at, their coats shining like satin when they came into the sale ring, but I am familiar with the breeding and handling of them all and I have never known one of those calves raised in that way to make a profitable cow. Not only were they not fit for profit in the dairy, but they were not fit to reproduce themselves. That is what is meant by breeds running down. We heard yesterday about the

Jerseys having run down in constitution and in size. It is nothing but that sort of treatment that has done it.

Another point,—the breeding of young males, as was said here yesterday, is a very prolific cause of deterioration in the stock. No man should ever breed too young animals, male or female. They should be fully developed. It is the most foolish policy that can be pursued. This heifer on the chart came in before she was two years old. It was altogether too young, but with the best of care she developed into a good cow. It is certainly a bad policy to breed too young. One element is essention in the training of the cows,—that is what I call constitution. You cannot feed it into them, it has to be bred into them. A few years ago I went over to England and while there I visited King Edward's stock farm. I went there on purpose to see his two great race horses, Persimmons and Jubilee, two young stallions, full brothers, that won the race in two successive years. I wanted to find out why it was that those two particular horses should run faster and go farther than any other horse of the breed. After looking them over I asked the attendant if I could see the dam, and he showed me the dam of those two horses, and I saw in a moment why they were better than all the other race horses of their age. It was simply a case of constitution, of vitality or virility, as you might call it. The dam and both of those horses were almost abnormally developed through the chest and lungs, which enabled them to stand up under severe training and win the race. We do not have to train cattle for this purpose, but we do have to train them for another purpose. You may say that cattle are not subjected to such a strain, but I think you will agree with me that the dairy cow is subjected to a greater strain through all her milking period than any strain that can be put upon a race horse. We must have room for the lungs and room for the heart to develop, or we might just as well not try to do anything in the dairy line. We have been preached at and told from time immemorial, at least ever since the modern cow was developed, that the conformation of the dairy cow must be wedge shaped. She must be narow in front and wide behind, it is true, but they have neglected to tell us all these years that it is only the top line of the cow that ought to be wedge shaped. I have seen cows that have been exhibited and won prizes at the fairs which were thin in front and carried their thinness down so that the two fore legs almost came out of one hole. They were given preference because of this mistaken idea of that being the dairy form, the thinness in front carried right down. They had absolutely no constitution. More than half of the cows in Vermont are of that conformation. The constitutions are weakened by that one thing. It stands to reason that a cow must have a strong, powerful heart, because the blood from which the milk is made is all manufactured by that heart. And she has to have strong lungs to vitalize that blood; then you have a cow that will be profitable.

There is another point in regard to the constitution, it is the vitality. You have all seen a bull dog, and you know that a bull dog is the very incarnation of courage, tenacity, vitality. You can kick the wind out of him and he will turn over again and come up smiling. It is because of his tremendous vitality. You notice the shape of the bull dog and see how well he is developed in his chest and lungs. It is the same with all animals, man included. A mistake that is often made is to confuse size with constitution. Size has nothing to do with constitution. I was at one time selected, along with two thousand other boys, to undergo a forced march in a tropical country. Every one of those two thousand were picked men because they were to be subjected to a strain, and I was the biggest man in the lot. They were all smaller than I, so you see it was not a case of size. It was constitution, strength and vitality to stand the strain that was to be put upon them.

A great many of our farmers in trying to breed up a herd think all they have to do is to purchase a high priced male and put into their barns and let the progeny go. That is all a mistake. In the first place, it is very hard to get a male at all times that will mate properly with the cows we have. In the second place, we are apt to get too young a sire, and the calves will not be constitutionally strong. Then they are raised on those concentrated foods and consequently the stock is going down and down. I wish all of you could see the method by which we raise our stock and the stock themselves. I am going to take Prof. Cook up there tomorrow and I am going to convert him to the open air process of raising cows. We have calves two years old just as strong, healthy and happy as they can be, out of doors in the yards right through the winter. In that way we are trying to raise better cows. We are trying to improve them instead of deteriorating them. I am so particular about the food I feed those cows that I never feed a pound of ensilage. That is supposed to be heresy, but it would not pay me to feed ensilage. In the first place, it is an unnatural food, and stock will deteriorate on it if they are fed too highly. I have seen so much of this that I am absolutely certain of it. First-class, thoroughbred herds that cost thousands of dollars have been ruined by feeding ensilage. I do not mean to say anything against feeding ensilage to the dairy cow. If you are going to buy a cow, feed her for all she is worth and then turn her over for beef. Feed all the ensilage you wish, it is the cheapest food for making milk and butter. But I cannot afford to feed it to our stock that we are trying to improve. I feed roots altogether in place of it. I grow about 200 tons of turnips and about 250 tons of mangel wurtzels and feed them with hay and corn fodder and all the rough fodder, and I get most excellent results from that.

Another point, we never try to force our cows to see how much milk or butter they will make. We feed them the rations that we have found to be the best and most conducive to their health and happiness, and in that way we get the very best results. I have often been asked how we fed our cattle. It is almost impossible to say, because we never feed two of them alike. We study the individuality of the cattle and feed them accordingly. And in that way, as I have said, we are improving the stock. At the time when I took charge of this herd, 21 years ago, I laid down the rule that we would not keep a cow on the place unless she would make two pounds of butter a day or fourteen pounds a week after she had dropped her second calf. The first two or three years I had to get rid of quite a good many of our young stock. We sold them to the butcher if they were poor milkers, and if they were heavy milkers we sold them to the milkmen around, but did not give them a registered transfer because we did not want them to perpetuate their characteristics. I am very happy to be able to say that for the last six years we have never had to get rid of one of the animals on the farm for that reason, and nearly every one of them in that time has gone into the fourteen pound class with the first calf, at three years old. So you see it is possible by careful breeding and careful handling to grade up your cattle so that they will be profitable. That is the point I have always kept in mind, the absolute profit, the money that we get from our cows over and above the food that they eat.

I should be pleased to have any one ask me questions.

QUES. You state that your heifers make two pounds of butter a day. You do not mean that they would average this during the year?

ANS. This two pounds a day or fourteen pounds a week is only for one week. They have to make 14 pounds in one week, and come into that list, before I regard them as desirable to keep. By rigidly adhering to that rule we have graded up the herd.

QUES. You said you had seen whole herds ruined by feeding ensilage. I would like you to explain in what way?

ANS. By the deterioration of the young stock. I have noted several instances that were very marked. A herd in New Jersey owned by a rich man is one of these. Having plenty of money, his son-in-law thought he would buy 100 Jersey cows, the best he could obtain. He put them into the barn and took the best of care of them, as he thought. I will admit that he carried the feeding of ensilage to excess, there is no question about that. He fed just as much as the cows would eat all the year round. He had advertised to bring the progeny of those 100 cows into Madison Square Garden every year for sale. The first year he brought 75 calves into the show ring, the next year 25, and the next year he brought the old cows and they were not worth a shilling apiece. I do not think he fed any hay, and all the succulent food was ensilage. We have another instance in our own state where a herd was started under much the same principles. The owner built a very elaborate silo and made a great deal of sour ensilage. It not only ruined the herd but they have done more damage to the cattle of the state of Vermont than any one thing, because the deteriorated animals were scattered all over the State.

QUES. If corn ensilage is used with good judgment as a ration each day during the winter, applied with other food to make it a balanced ration, is it not as desirable and as safe as any food we use?

ANS. I do not so regard it. But if I could not grow roots as successfully as I do, and as cheaply as I do, I would feed a small amount of ensilage.

QUES. Does it not cost twice as much to raise roots as ensilage?

ANS. Personally I can grow roots cheaper, pound for pound, than I can grow corn ensilage. They cost me four cents a bushel. I know that my friend, Prof. Hills, will tell us how much more feeding value there is in a ton of ensilage than in a ton of roots. That is all right, but I do not go by the analysis of the chemist, I go by the cow. Under the conditions in which I am working I cannot afford to feed enough of that stimulating food to make my animals deteriorate. The idea that I want to convey is that I must keep my animals in a healthy condition. If you are only looking for the immediate returns in butter and milk, and are paying no attention or but slight attention to the regenerating of your herd, ensilage fed in reasonable amounts might be the cheapest food for your cows. But you know it is talked everywhere that the dairy herd is deteriorating in size and constitution.

QUES. Does ensilage have a tendency to deteriorate stock if it is fed as a ration to the herd?

ANS. That all depends upon the amount that is fed, in my estimation.

QUES. Wouldn't the animals stand the ensilage better if you kept them warm?

ANS. Surely. If they are not kept warm too much silage will take the heat all out of the body. If I were down in the South where the temperature is warm in the winter time I should feed succulent food all the time, grass if I could get it and if not, ensilage. But up here where the thermometer goes down to 20 or 30 degrees below zero, it is not a proper food for a cow unless she is kept warm.

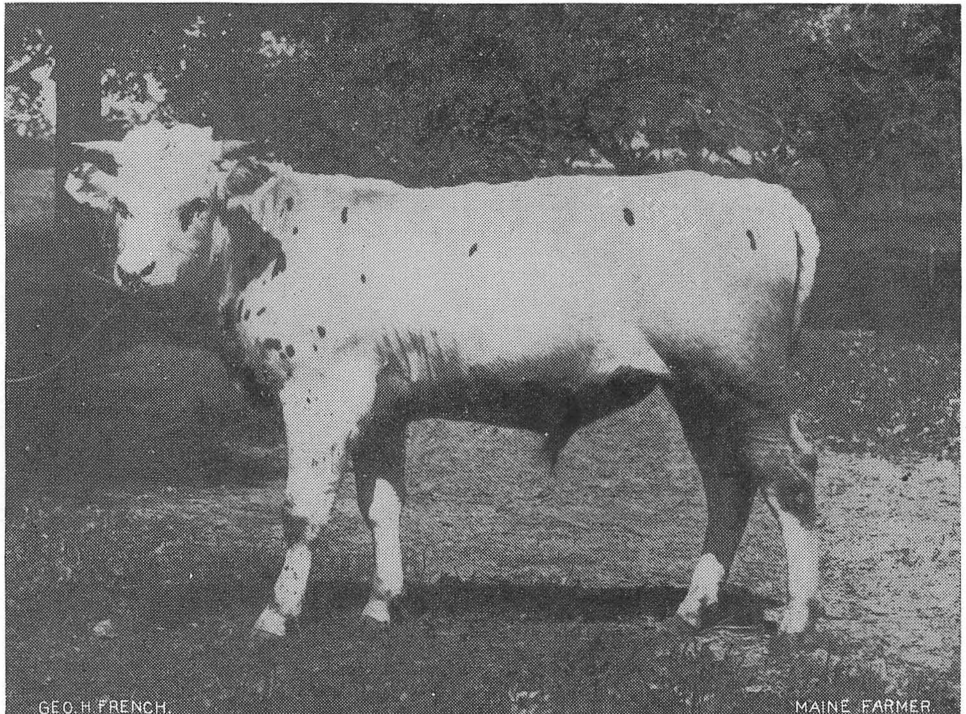
Mr. COOK: I will show you a cow that is 12 years old, that has given 40,000 pounds of milk in two years, and she has been fed silage ever since she was born.

Mr. AITKEN: Has any of her calves ever equaled the old cow?

Mr. COOK: No.

Mr. AITKEN: I know that I am feeding the best feed under my conditions to get the best results.

QUES. If you have a calf six or seven months old (I suppose they begin then to eat corn fodder) and you should feed that calf what when it was green was ten pounds of corn a day, in



Holstein Friesian Bull, Pauline DeKol Lilith Posch, 34,468. Property of C. L. Jones, Corinna. (Courtesy of Maine Farmer.)

your dry fodder, and I should feed mine of the same age what was ten pounds a day from my silo, do you think my calf would deteriorate faster than yours?

ANS. If fed so in the winter time I think it would, for the reason I have given. At the present temperature of our northern winters I would not feed green food to my cows. I believe that roots are the more natural food. They have not been changed from the state in which they grew. Too many roots are almost as bad as ensilage. We have to be careful about feeding roots. I feed my young stock all the rough fodder they will eat but I do not feed them all the roots they will eat.

QUES. What is your ration for your three-year-olds when you are testing them for the 14 pounds a week?

ANS. We feed a little grain all the year round, but never more than six pounds in a day. In the winter time they have clover hay and alfalfa, roots and grain. We feed a mixture of grain,—bran, ground oats and oil meal, and the amount is in proportion to the capacity of the cow.

QUES. How long a period are you milking your cows?

ANS. We let them go dry six weeks if we can. I have a cow 19 years old and she has had a calf every year since she was two years old and she has never been dry a day since that time. We have never been able to get her dry. That is Stoke Pogis' Regina. She is just as bright and happy today, seemingly, as she ever was. We were always afraid to force her dry. But that is an exception, of course.

QUES. How much butter would your cows average to produce in a year?

ANS. Two years ago I figured up the records of 12 of our best cows, the older cows, and they gave a little better than 600 pounds of butter a year apiece. That was just on an ordinary ration.

QUES. If a cow should perform that for several years would you expect her calves to have as much vitality?

ANS. I would, if that was the capacity of the cow, without being forced. That is the idea that I am trying to bring out. We do not force our cows. If those cows have a capacity to produce that much without being forced I say that their progeny will be as good, if not better than their parents, because of this ability to make that amount of butter without being forced.

QUES. Have you cows that will produce, without being forced, for 300 days in the year two pounds of butter per day?

ANS. I have. These cows do not make two pounds every day for that time; when fresh they make three pounds and over and their average is over 600 pounds for 365 days. We never feed more than six pounds of grain to any of the cows. I want to impress upon the people here that breeding right and rearing right, training the young stock to assimilate the coarse fodders of the farm, is where we get the profit, not by the feeding of concentrated foods and making a record. The idea is to get this stock bred and trained so that they will take any quantity of hay and corn-stalks, all of those coarse foods, and manufacture them into butter and good butter. We give them a balanced ration, of course, as near as we can make it, and they can digest so much of these coarser fodders that they make these records without forcing them with grain. I suppose what you mean by forcing is giving them grain. Of course we give them all they will eat of everything else, and all that is good for them of grain.

Prof. HILLS: I am convinced that Mr. Aitken is another heretic in the matter of silage, but I think he is entirely right in his explanation of the way in which those cows give that amount of butter. It is not so much the amount of grain given them; it is the 20, 30 or 40 years of ancestry and a judicious use of the excellent roughages grown upon the farm. They are remarkable cows. They are magnificent animals and there is no question but they are making remarkable records on that farm.

Let me say one other thing. I want the people here in the audience to understand that Mr. Aitken's conditions, in some respects, are not exactly the same as those of New England all over. One of his main products from his dairy herd is the sale of breeding animals, and he has to keep in mind more than you do here, and more than ordinary dairymen do, the product in terms of progeny. He is building up the progeny whereas most of you keep in mind immediate butter and immediate butter only. So bear in mind that some of the things he is saying are not exactly applicable to your work.

QUES. There are a number of people in this State who are advocating silage very strongly. If I understood you correctly, you said that for breeding animals silage could never be fed and the herd improved. I would like to ask you whether to use a ration consisting of 30 pounds of ensilage, 8 pounds of clover hay, a few roots and the rest grain, you think would be detrimental to the improving of a herd?

Mr. AITKEN: I think half that amount of silage would be better. I have made up rations with 15 pounds of silage and have found them to be safe. One of the herds in our state was in a deplorable condition at one time. I told the owners what the trouble with their herd was and they asked me what they had better do to obviate this difficulty. I made up a ration for them with 15 pounds of silage(they had been feeding 60 pounds) and they have been running that farm now for 15 years and they are feeding just exactly 15 pounds of ensilage and they find that to be a safe ration. They are growing a good deal of fodder corn and they leave it out in the field and draw it in as it is fed, cutting it and mixing it with this 15 pounds of ensilage, and they are finding that this is a first-class, safe feed. But with my ability to grow roots it is much better for me, and safer, to feed those roots than to feed even 15 pounds of ensilage.

QUES. In what quantity do you feed roots?

ANS. It depends somewhat upon the amount and kind of hay, or rather the rough fodder they are eating, and a great deal on the cow's capacity. I have fed as high as a bushel of beets a day to a cow. I never feed more than that, and it is very, very rarely that we feed as much as that. It is only under peculiar conditions that we will do it. We feed half a bushel, or a peck, just as the needs of the cow demand. The beets are all pulped and the fodder is practically all cut. We feed a little of what we call "long hay."

QUES. Can you feed turnips to your milch cows?

ANS. No, I never feed turnips to the milch cows; only to the young stock and sheep.

QUES. Will you explain your method of raising roots at 4 cents a bushel?

ANS. It is by the ridge system. I raise them on the tops of ridges. I do not do any hard work to the roots at all except to thin them out, and I can do that just as fast as I can walk across the room. I have some men trained who can almost keep up with me, and we can handle four or five acres of roots very easily. After they are singled out we do not do any more hand work at all. It is all done by cultivation. In the first place, when you come up to the Billings farm you will not see a row of corn, a row of potatoes, a row of beets, or a row of anything that is not just as straight as if laid out by a line. I have sometimes as many as 100 men at work for me, and I make every one of those rows myself. I have never yet been able to find a man who would plow straight enough to suit me. That is one of the secrets of growing roots cheaply. After those rows are made, and they are all exactly alike, I can set my machine and shave the roots just as close as possible, and it will not be gouging out some here and leaving weeds there.

QUES. What variety of beets do you raise?

ANS. I raise three and sometimes four varieties. I raise the Northern Giant, a long red beet for early use, then the yellow beet. We grow from 28 to 30 tons to the acre.

QUES. What do you use for fertilizer?

ANS. I am a convert to my friend, Prof. Hills, in regard to fertilizer. We make all our own, buying the chemicals and mixing them ourselves. As you readily see, we make a great deal of stable manure, and of course we use that and we use chemical manure besides. We use artificial manure on nearly all crops, some only a little and others quite a good deal. We do not manufacture it to sell.

W. G. HUNTON.

There is no doubt that we shall all go home from this feast feeling that we have gained a great deal of information. We have heard how to raise hay enough to fill a model barn. We have heard how to produce a model cow to go into that barn, how to produce absolutely pure milk and to make the creamery operators give us an absolutely perfect test.

I am particularly interested in the cow, and in the perfect cow. I was a good deal interested this afternoon in what was said about the future cow, for that is my hobby. In my five minutes I want to call the attention of those who are interested in the same line with me to one particular point, which I believe the gentleman from Vermont did not mention. In my experience of twenty years of trying to get what I wanted myself I have found that the individual characteristics of the cow herself are worth looking into, as affecting the progeny. The shape, conformation, and all those things, we can easily see that we must have, but I find that the individual temperament of the cow makes dollars difference with me in the progeny. If I have a cow that is right in every other respect, almost perfect, if she has a restless, disagreeable disposition I cannot afford to raise her progeny, because that cow, able to consume the same amount of feed, will not produce as many dollars worth of product in a year as the cow with an easy going, quiet disposition, that is willing to accept things as she finds them without finding fault with them. I think all of us who are intensely interested in working up our herds will find that this is a point that is worth consideration. I do not agree with any man who says it is a slow, disagreeable business to breed up to something better. I think it is the most interesting work I ever was engaged in. I think it is the one thing in which, above all others, nature will show how willing she is to assist us in bettering some of her own work. I know of no greater satisfaction than in being able to take a set of books where the progeny of each cow is known by the name of the original one and follow it down and find that each successive generation is giving you something, by your own efforts and the help of nature, that is worth two or three or five times more than the preceding generation. The other points in this breeding line have been well brought out and are worthy of careful attention.

One other point in the discussion of the afternoon I want to allude to. I do not want to go home and feel that the time I have spent in underdraining to produce better qualities of grass has been spent in vain. I am a firm believer that with the material to work with, no young, energetic farmer can better spend his time than in placing those stones that are lying around on his farm where they will drain the land and help us to grow clover. We do not have to raise clover in a hothouse or build racks in our fields to cure it. It is natural for it to grow on all our hillsides where the land is suitably drained. It produces an almost ideal feed for everything we raise upon the farm, and I want to go home feeling the same love and admiration for the plant that I have always felt, and the same inspiration to produce every pound of it I can on my farm and return it back again as the same natural fertilizer that was intended.

DR. GEO. M. WHITAKER.

It was a genuine delight to me, a week ago, to receive a letter from the Department of Agriculture at Washington ordering me to come here to Maine today and extend the greetings of the dairy division and its best wishes for the continued prosperity and success of your association and of Maine dairying in general. As I listened to the reading of the records by the secretary this morning, with the memorial tribute to the late Major Alvord, and then listened to the reading of the new resolutions, with a tribute of success to the new chief, I was reminded of the old saying, "The King is dead. Long live the King!" In Major Alvord we had a splendid friend to American dairying. As the first chief of the dairy division, his initiative and creative ability placed the division on a firm foundation. Major Alvord had, I believe, the respect and confidence of the dairymen of the country. He was a man intimately connected with New England, and for this reason we knew more of him. His successor, the present chief, is a man from the west, not so well known here in New England. He has had a thorough technical training in Kansas College, both as a graduate and afterwards as a specialist in dairying, and has done good work as a professor of dairying. His skill and promise as an executive was such that he was offered a better position as the head of a large continental creamery company at Topeka, and made a success there, as a skillful executive officer; so that he takes up his work in Washington equipped in every way, and my experience is that he is not only well equipped for the work but he is a genial, companionable man and an extremely agreeable person to work under, something which I appreciate because I found Major Alvord such a splendid man to be associated with in a subordinate capacity.

As to the work of the division, there has been nothing particularly new in the work of the past year. We have kept on in the work regarding renovated butter. A little difficulty is arising in New England that may make trouble and may not. The present law, for purposes of enforcement, declares all butter to be adulterated that contains over 16 per cent of moisture, and requires all such butter to pay a ten cent tax and the manufacturers of such butter to pay a license for manufacturing adulterated butter. With the 16 per cent standard, there is growing up a little bit of a temptation throughout the country for butter makers to get in as much as they can and keep their butter up to the standard, and when people are working along that line there is a little danger that they will get just a little over the standard. Last week it was my unfortunate duty to have to hold up 100 boxes of export butter and refuse to certify to it for export because it had a little over 17 per cent of moisture.

The division during the past year has done some good work in Connecticut in co-operation with the Experiment Station in discovering the special kind of bacteria that gives the peculiar flavor in cheese known as Brie and Camembert. So that it is going to be possible for considerable milk in this country to be diverted into the manufacture of those cheeses now quite largely imported. It is hoped that this will be of benefit to our American dairy interests.

The department has in press a bulletin on the milk supply of Boston, Philadelphia and New York, to be bound in one volume, giving those who are interested in studying the problem of the city milk supply a chance to examine the question comparatively, and to see wherein there is a difference in the Boston, Philadelphia and New York supplies. The last proofs of that have been read and the bulletin ought to be before the public in a short time. A bulletin is now in preparation relating to the dairy interests of New England, discussing the creamery interests (the sale of cream in the cities), the number of silos, the soiling system and similar subjects. Some blanks soliciting information on these subjects have been distributed among the people here this morning, and I trust they will be filled out and mailed as soon as convenient.

I think perhaps this covers in a general way the most important features of the work that would be of interest to this audience, that the division has done during the past year. Quite a little work has been done in the south in instruction in dairying, instruction in silo building and other lines, but that would be of minor interest to a meeting of this kind at this late hour.

B. W. McKeen.

The gentleman who has addressed you along the line of the dairy cow this afternoon has made some, to me, most excellent points. One of the first points he made is one that has long been dwelt upon at great length, the necessity of vitality and constitution in the animal, and the speaker well says that this is something that cannot be bred into the animal or fed into the animal. She must have constitution and vitality. Let us all bear in mind the necessity for this. This point alone coming to us from the sister state of Vermont will be worth to us, if we will take it home and get the benefit from it that we might, more than the expense of the entire meeting.

As to the matter of feeding, discussion of course brings results that are beneficial. In a multitude of counsel there is wisdom. I have as a feeder of dairy animals for quite a number of years settled down upon the broad, general principle that any food that is palatable, that the animal will eat readily, that she will digest thoroughly and thrive upon, must be good for the animal. That has been my experience. We are all reaching for the same goal, but we may go along different lines. I have no sympathy, however, with the man who compares the appetite of the cow with the appetite of the man, because I think he should apologize to the animal. I believe in consulting the individuality of the animal and feeding that animal according to her capacity, on general lines. I am not in sympathy with the idea of forcing. I do not like the word "forcing." I believe that no animal is forced when she is fed up to her capacity for production. I believe it is unwise to keep an animal in our barns and feed that animal one-half up to her capacity for production, as it would be for any manufacturing plant to run the machinery half up to its capacity. I believe in feeding our dairy cows in such a way that they will produce all that nature intended that they should produce, and we shall never know what this amount is until we study our animals as individuals.

It certainly is very gratifying to me to note the progress that is being made in Maine along dairy lines, and I know you will believe me when I say that I appreciate and enjoy this very much indeed, and I hope and expect that as time passes Maine will keep going higher and higher in dairy knowledge and in dairy practice, and we shall become more and more a dairy State.

J. N. Gilman.

It has not only given me a great deal of pleasure to assist in entertaining you here, but I know that every citizen in the town of Pittsfield has been benefited by your being here. I hope you

Field of Japanese Millet raised by C. L. Jones, Corinna.

will come again. I think I am expressing the wish of every man in Pittsfield, not only business men but farmers and working men. When I came to this town, about four years ago, they had here a run-down creamery, but today we have one of the most successful plants in the State of Maine. We have been able to make it successful through the co-operation of the Maine State Dairymen's Association and the Creamery Men's Association, with what we hope is good business judgment. One of the most important factors in making our business successful, not only in this locality but throughout the whole State, has been the enforcement of a rule which was adopted when we first started, of making a difference in the price of defective cream and good, pure, sweet cream. I think we were the originators of that idea. It has been carried out to the letter, and has been adopted by the Creamery Men's Association. The first day we received cream in this town not one drop of sweet cream came into our plant. For the last two or three months we have not had a drop of sour cream.

The creamery industry of the State of Maine, in which I am as much interested as any other at the present time, is on the increase. There is one thing I would like to suggest to the Dairymen's Association, and that is, that as long as the manufacture of sweet cream, pasteurized sweet cream for markets outside of our own State limits, is an industry of our State, at the next dairymen's meeting you offer a prize for the best exhibit of pasteurized sweet cream of a certain standard. Do not confine all your awards to butter, which is a secondary industry in the creamery business of the State of Maine. Our butter has always had a bad name in the Boston market. It has ranked the poorest of any state in New England. We manufacture butter that we ship to Boston, and know the reason why it ranks so low. Most of the butter that goes to Boston from Maine creameries is manufactured from defective cream that we cannot sell in the form of cream as a first-class product; consequently the butter is of inferior quality. I think the score that has been obtained on butter this year will demonstrate the fact that if we use the best of our product to manufacture into butter we can score as high as any state in New England. I have the honor of being the manager of the sweepstakes creamery.

I hope you will think over carefully before the next meeting the question of offering prizes for cream. It seems to me wise to encourage that industry.

Z. A. GILBERT.

We have had an admirable address this afternoon by the gentleman from Vermont on the important matter of breeding or building up the dairy cow. He gave us an explanation of the complex problem of building a strong, vigorous dairy cow that was able to carry on this work and at the same time in connection with the work of production bring forth young animals that will grow up into still stronger cows. This is a great problem that is before New England today. Some of us breeders who have been at work in this business, studying on the intricacies of this problem, know and realize that he was giving you sound doctrine. And then to prove his doctrine sound he told you what his cows, bred and reared in that way, were accomplishing,—remarkable results, as you all admit, with the feed given them.

I have been greatly pleased at the interest manifested here at this meeting, in connection with our efforts in improving and extending the dairy interests of our State. Certainly it is a high compliment to the Dairymen's Association that we are evidently going on from one year to another, to still better things, and that we are awakening a wider interest as we progress in our work. The State is just beginning to find out what we have in hand and how we are trying to do it, and to come forward cordially to assist us in the work. And I assure you, to the few individuals who started out to build up this interest for our State in its earlier years and have watched its progress up to this time, it is a source of great gratification that this interest is taking root and bringing forth this fruit. I go home from this meeting greatly encouraged in this line. I want to express my personal gratification at the interest that has been manifested by the citizens of this village and town, and the courtesy that has been shown us. I certainly appreciate it and wish to express my personal thanks for the kindnesses that have been shown me. I shall watch with a still greater interest for the further progress and the greater success which I have no doubt is in store for us in the future.

REPORT OF STATE DAIRY INSTRUCTOR.

I herewith submit my third annual report as dairy instructor for the year ending December 31, 1905.

The legislature of 1905 passed several new laws and revised some already in existence, pertaining to dairy matters, which very materially affected my work for the past year. It passed an act which provides that the commissioner of agriculture or his agent shall enforce the laws pertaining to the production, manufacture and sale of dairy products and their imitations, and as your appointed agent and assistant, I have spent a large portion of the time following out the provisions of this and the other acts, which are as follows: Chapter 39 of the Public Laws of 1905 provides, that the commissioner of agriculture shall inquire into the methods of making butter and cheese in creameries and cheese factories together with the method of taking, preserving and testing samples of milk and cream in the same.

Chapter 38 of the Public Laws of 1905 provides, that no person shall sell any article or compound colored in imitation of yellow butter or cheese; that no person shall serve any oleomargarine in any hotel, restaurant or at a lunch counter or in any boarding house to a guest or patron without notifying them of the fact; that no person shall sell oleomargarine when butter is called for; that no person shall sell any renovated butter without plainly marking the package, whether in the original package or at retail. These are practically all new to our State and in consequence thereof, I have gone cautiously, hoping to accomplish more in that way.

It has been my purpose to make this a work of education rather than one of persecution, for radical changes in laws do not become familiar at once, even to those whom they affect, and I find that it takes considerable time to call their attention to the requirements.

In order that all should have an opportunity to become familiar with them, I compiled all the dairy laws in a pamphlet and invited all who were interested, by publishing notices in the papers in different cities and counties, to send for copies.

I then sent them to all grocers and eating houses whose names appeared in the year-book for 1904, after which I visited many of the stores and eating-places in different cities to ascertain the conditions and call attention to what the law requires and get general information as to the quantities of oleomargarine and renovated butter being used. Later in the fall, I started a systematic inspection of the stores and eating-places, having already made 408 inspections and taken 241 samples of suspected butter, but unfortunately the chemists were so busy with other work, that I did not get a report of the analyses until late in December. As a result, I was unable to make any prosecutions during the year, but find that many dealers are not yet familiar with the law requiring them to mark renovated butter and that some restaurants are serving oleomargarine without notifying guests. But I also find that many who formerly sold renovated butter in unmarked packages and used oleomargarine illegally are complying with the law and as fast as they understand what is expected, are generally willing to accept the new order of things.

I find by comparing our work with that of Massachusetts Dairy Bureau, that we have many conditions in common. From their report of 1903, I find that out of 289 cases reported, 226 were for selling renovated butter in unmarked packages and 15 for serving oleomargarine in restaurants without notifying guests.

I also find that theirs was started as an educational work, and that for the first two years they reported no samples taken and of course no prosecutions made; and the general agent has told me that by so doing he was satisfied that better results had been obtained with but little antagonism from the dealers.

I have found no samples of oleomargarine in stores except where a special tax has been paid for handling the same, and then always uncolored, and the number of special taxpayers to handle oleomargarine is six wholesalers and 27 retailers, against eight wholesalers and 53 retailers last year, a fact which is significant.

The number of dealers who handle renovated butter is so much greater than the number of oleomargarine dealers as to make the latter seem almost nil, for in some localities nearly all dealers have renovated butter for their second grade, and regulating its sale in this State is more difficult than regulating the sale of oleomargarine. But I trust that, with the co-operation of the better dealers, it can be successfully accomplished without resorting to harsh means.

I have investigated the methods of sampling and testing as required, and some of the results are exceedingly satisfactory, while others are very much the opposite.

There is a uniformity along some lines, which to my mind is a "good sign" and that uniformity should extend to every line and condition of the work. The apparent interest looking toward that end is a very satisfactory result of a mingling together of the creamery managers, but the wide variations in results along certain lines are discouraging.

I find from looking over the reports of about fifty factories the following results: Twenty-two take samples at the factory, 15 take samples on the road, 10 do both; 41 use a tube, 4 use a dipper, 4 use both; 20 use a tube one-fourth inch in diameter, 14 use a tube three-eighths inch in diameter, 5 use a tube one-half inch in diameter, 4 use tubes of various sizes; 37 sample every lot each time, 11 do not sample every lot each time, 43 sample every can, 5 do not sample every can; 10 agitate before sampling, 32 pour before sampling, 3 stir before sampling, one shakes before sampling; 32 test once per month, 10 test every two weeks, 3 test every week, 3 test every delivery; 28 keep samples in refrigerator, 15 keep samples in receiving room; 33 use bichromate to preserve, 4 use nothing, 1 uses corrosive sublimate; 32 have close fitting stopples in sample jars, 10 do not have close fitting stopples in sample jars.

The diameters of testers vary from 13 to 20 inches, speed of testers varies from 700 to 1,500 revolutions; all but one warm samples before testing. Temperature varies from 60 to 120 degrees F. Temperature of cream varies from 40 to 90 degrees F. when acid is added; temperature of acid varies from 60 to 170 degrees F. when added to cream. Twenty-four whirl two times, 17 whirl three times, 5 whirl once. Three whirlings of 5, 5 and 3 minutes each is the longest, and one whirling of 5 minutes is the shortest time that samples are in the machine. Nineteen read from a bath of water, 23 from the machine. Temperatures of reading vary from 110 to 180 degrees F., with many reports showing that no attention is paid to temperature.

During the month of June I sent samples of the same cream, which I took myself, to 16 creameries for testing. October 10th I sent samples to a representative of each creamery; that is, some companies operate several factories and the testing is done by one man, so to these but one sample was sent. In both instances the results show a variation which is far too wide. Evidently there is need of greater care, accuracy and uniformity in the work done along this line, though in both instances a majority of results varied less than .5%, which shows, I think, a uniformity among the majority which is highly satisfactory.

I wish that some means could be devised whereby the patron would get what seems to him an impartial test, where there would be no appearance of evil. I think that it would greatly improve the situation and tend to add confidence, which is necessary in all business, "more especially ours." I would not recommend any radical change, but suggest that more uniform methods be adopted and greater care be exercised, and that this department be given a general oversight looking to this end. But I want to repeat what I have often said before, that the testing systems are improving all over the State, that the work is carefully done as a rule, and that a lack of understanding is responsible for a large measure of the distrust. It makes no difference what the cause is, it should be removed. I have tested several samples taken by the collector and left at the farms, for the patron in comparison with the sample at the creamery, and the results have not been very satisfactory, though when the factory and myself both tested the same sample we agreed very closely. The result showed that the samples were not alike.

The taking of the sample is an important factor in getting correct tests, and should be looked after as carefully as the testing, and when possible it should be done in the creamery by an experienced person under the direction of the foreman. Sampling on the road has some serious difficulties to overcome, with but little to recommend it, but when it is necessary it should be done along certain prescribed rules formulated by a competent person in charge of the work.

The results of investigations along this line warrant a deeper study of the whole question, so far as our factory conditions of sampling and testing are concerned.

The statutes provide that the municipal officers of cities and towns of 3,000 inhabitants, and all others on petition of 10 voters, shall annually appoint an inspector of milk, but I find on examination of the conditions that only about half the large cities and towns are complying with the law in appointing that official, and in the other towns practically none have interested themselves in this important matter. The work along this line is, as a rule, incomplete and of but little value, and while the department of agriculture has undoubted authority to make inspections of market milk, so far it has not done so unless a request has come to me. But I feel that the time is ripe for us to keep a closer watch on this product so vital to the health and well being of a great majority of us.

Blanks were sent to all the creameries early in the year, to be filled out by them and returned, and a majority have complied with the request. From them the following is taken: The number of creameries in the State is 60; average number of patrons per factory, 197; average number of cows per factory, 1,149, an average of 5.83 cows per patron. Twenty-five factories report an increase in business, 12 report neither loss nor gain, 10 report a loss of business from last year. The business is divided between sweet cream and butter in the ratio of 6 to 5, six-elevenths of the product of all the factories being sold in cream and five-elevenths made into butter. In 18 factories no butter is made, and in 13 no cream is sold.

The amount of butter made and sold as such is 5,640,545 pounds and the amount of butter sold in sweet cream is 6,768,654 pounds annually from the factories in Maine.

The reports on defective cream are very interesting and encouraging for they show a continued improvement over last year, which very materially increases the revenue to the patrons of the State in the increased value of the product made.

The difference in the price of extra butter and the grades made from this product easily amounts to an average of 5 cents per pound, and cream received sweet and in condition to be made into extras can be reduced to seconds by the addition of comparatively small percentages of defective cream; thus the injury is not confined to the defective itself, but has its effect on the whole product and may easily cause a reduction of 5 cents per pound on twice the volume of butter, if so mixed, which would be equivalent to 10 cents per pound on itself.

The reports show a very material decrease in defective cream. Nine factories report that they received none at all, 30 a decrease ranging from 5 to 50%, and 10 report about the same, not one reporting an increase.

The average amount of defective cream received at all factories is 8% of the total product and if the average decrease in defective cream for all factories be placed at 15%, it shows that 148,909 pounds of butter have passed from a second to an extra and if the price be increased 5 cents per pound, it shows increased receipts to the factories and indirectly to the patron of $7,445.45 last year.

The number of cows in the State shows a slight decrease from last year but everything points to a better quality being kept. Factories have reported paying more money to a less number of patrons. One reported paying $1,000 more in one month with 100 less patrons, on a total of 600 patrons, which indicates either more cows or better ones, probably the latter. The United States census report of 1900 credits Maine with producing more milk per cow than any other of the dairy states, which shows the quality to be improving, for the increased yield in 10 years is over 20%.

I find from the reports of the State Assessors, that the number of cows increased in the State from 1898 to 1902 12,426, for 1902 and 1903 the increase was 16,231 or a total increase from 1898 to 1903 of 28,657. For the year 1902, a gain of 10,181 was made and for 1903, a gain of 6,050. After deducting the losses of 1,500 reported last year and 850 reported this year, we have a net gain of 26,307 or over 19% in the past eight years, every county in the State showing a gain. Franklin county made the largest gain, 58%, Somerset county second with 33%, Kennebec county third with 29%, Aroostook and Waldo fourth, each 28%. Knox and Hancock made the smallest gain, 3% each.

With an increase of almost 20% in the number of cows in the past eight years and an increase of over 20% in the yield per cow in the past ten years, we have reasons to feel that the industry in our State is making substantial gains, and when we consider that in the past ten years, the average price shown by the

Boston Chamber of Commerce reports has advanced 20%, we can see good reasons for this advance in our work.

Maine butter is slowly but steadily advancing in quality, which fact is attested to by the majority of the commission men in Boston, a source which is reliable and the last one from which we would expect to receive such information, because of the fact that they are the last to receive the better quality of our product.

The creameries of Maine which make butter in any quantity, do not as a rule sell their product to commission houses but sell direct to dealers, the same in fact that commission men would sell to, and the product from many of our creameries is going to first-class trade in the city of Boston and its suburbs, as well as to our own fashionable summer markets and regular city trade, at prices which compare with that paid for the product of any state.

The creameries which make a specialty of selling sweet cream, and make butter only from that class of product which cannot be sold as sweet cream, are the ones that patronize the commission men, knowing that their product is not of such quality as is necessary to get and hold the trade of the best consumers. This is the class of butter which goes to the commission houses and the general market and is what makes our reputation on butter, and when we learn from them that our product is advancing in quality, we can realize that something is being accomplished by association and organization.

Cream is still our stronghold, and with it we are bringing our butter to the front.

When we consider the Boston Chamber of Commerce figures for the past ten years, we are surprised to learn that the price of butter has advanced from an average in 1896 of 20.4 cents per pound to 24.7 cents in 1905, an increase in price of more than four cents per pound for fancy fresh creamery, and that the consumption supplied by the Boston market increases at the rate of over 500,000 pounds per year, a gain of ten per cent or what is equivalent to the product of 2,500 cows each producing 200 pounds per cow.

The increase of four cents per pound for ten years, for the increase of 500,000 pounds per year amounts to $20,000 per year, value of the increase for one year over 1896 prices and the increased value on the total consumption amounts to almost two and one-half million dollars per year, when compared with 1896 prices.

The consumption of butter supplied from Boston for 1905 was almost 60,000,000 pounds and would require about 300,000 cows to produce it. This fact alone would indicate that there is but little chance that the business is being overdone.

Our sweet cream industry continues to remain on the same sure foundation and the attempts of other states to get our business by cutting prices, have so far failed, because our factories are making a better quality of cream, which contains the guaranteed amount of butter-fat and is free from preservatives and other foreign substances, so that when a person buys Maine cream, it is a guarantee of its purity. So closely has its quality been guarded of late that a reputation has been established, which must surely stand, so long as its quality remains unchanged. The demand is steadily increasing and the supply is keeping pace, though it is at the expense of the butter.

In 1900 it was estimated that we were selling 2,810,733 gallons of cream and in consequence of this enormous sale, our factories are paying better prices to their patrons than their competitors in other states can afford.

The prices paid for butter-fat have been higher than heretofore and I trust this is partially due to the improved quality.

Our factories were never in better condition to meet the demands either for cream or butter than today.

The value of our dairy industry is always interesting reading. The United States census report credits Maine with producing over 105 million gallons of milk or practically 900 million pounds per year. At an average test of 4% fat this would make 36 million pounds of butter-fat or 42 million pounds of butter, worth at the average creamery prices $9,360,000, to which, if we add $10 per cow for skim-milk and veal, for 185,548 cows we have the total value of $11,215,480 and if we add to this the value of the cows kept for milk $7,851,014, we have a grand total value of $19,066,494.

I attended the following fairs; Eastern Maine State at Bangor, Maine State at Lewiston, Central Maine at Waterville, Piscataquis County at Foxcroft, West Oxford at Fryeburg, Sagadahoc at Topsham, Gloucester and Pownal. At three I made tests for butter-fat, at five I judged dairy products, at two I judged dairy stock.

The annual dairy conference was held in Pittsfield, December 5, 6 and 7, 1905, and proved to be one of the best meetings ever held in point of interest manifested, attendance and exhibit of dairy products and dairy machinery. The highest score for butter was 98 which is more than usual, if it ever has been given in the State, and the average score was higher than usual, which gives Maine butter-makers a chance to consider themselves on an equal with other New England States, a fact which has not been evident before. I spent some time in the interest of this meeting by direction of yourself and officers of the association and I trust that it was not spent in vain. I have attended the usual number of grange meetings and institutes, where I have made tests and my talks have been along the line of producing cleaner and better products by careful feeding, better ventilation and care of the product and utensils.

The cheese industry is being neglected in favor of cream and butter, though there was more activity in this line during the year than for several years previous. The prices were good enough to warrant a continuance which I hope will follow, for there are certain localities where cheese factories can be profitably run, that would not support a creamery, and the establishing of a market awakens an interest and starts the locality to better farming and more profits.

Taken as a whole, the year has been a prosperous one for the dairy butter and cheese maker; the prices have been good for both, particularly the latter, whose product is always in great demand. The former, that class who make butter simply because they have a little cream that they do not know what to do with, should either sell the cream and let somebody who can afford to bother with it, make it into butter or cream for them or else find a market sufficient and keep enough cows to make a specialty of that work, when it can be done profitably and with more satisfaction. I think that the problem of Maine dairying is solved when we consider that the demand for our products is in excess of our supply and that the prices are high enough to warrant us a profit.

I wish to acknowledge the assistance, in my work, that I have received from the officers of the Dairymen's Association and yourself, also the hearty co-operation that I have always received from the creamery men and dairymen in general and trust that the united efforts of all to improve the quality and condition of Maine's dairy products, and dairying in general throughout our State, may attain greater success in the future.

Respectfully submitted,

S. C. THOMPSON.

REPORT OF THE STATE ENTOMOLOGIST.

To the Hon. A. W. Gilman, Commissioner of Agriculture:

I have the honor of submitting my first annual report as State Entomologist under the Department of Agriculture.

The year 1905 will pass into history as a memorable one as regards the depredations of injurious insects in the State. There have been several outbreaks of a very serious character in the past.

A noted outbreak of the army worm (*Heliophila unipuncta*) occurred in the year 1861. These caterpillars appeared in vast numbers and destroyed large areas of grass and grain.

Perhaps the most noted outbreak is that of the Hackmatack Saw-fly larvæ (*Nematus ericksonii*) which stripped the trees all over the State. This extensive outbreak occurred in the year 1882 and so complete was the devastation that hardly a tree survived the ravages of this insect.

The Forest tent caterpillar (*Malacosoma disstria*) and Apple-tree tent caterpillar (*Malacosoma americana*) have had their periodical cycles of abundance when they have damaged our orchard and shade trees to a greater or less extent.

Many of our native insects and those that have become acclimated make their periodical visits, but are kept under control by the birds and parasitic enemies. The past year will be remembered by the infestation of the brown-tail moth in Maine and the establishment of an Entomological Commission.

Upon receiving the appointment to this office I at once began an inspection of the district reported to be infested with the brown-tail moth. In the towns of Kittery, Eliot, Wells and York I found the situation very much more serious than was anticipated. Fruit and shade trees alike were so badly infested that in many cases they could not have leaved out if the nests had been allowed to remain. I found nests on the following: Apple, pear, plum, cherry, wild black cherry, choke cherry, bird cherry, thorn, elm, maple, ash, oak, mountain ash, walnut and willow. They have been reported on rose bushes, grape vines, white and yellow birch, chestnut, and raspberry bushes. Undoubtedly they were taken on many other species of trees and shrubs but in the hurry and rush of the campaign against them no special thought was given to the kinds of trees infested. In fact, I think that but few deciduous trees or shrubs are immune from the attacks of this pest. Upon reporting the situation, a sufficient number of men were employed to cover all suspected territory before the warmth of spring should release the caterpillars from their winter homes. The men employed were instructed in regard to the appearance of the brown-tail moth nests as compared with the Tussock egg clusters, leaves crumpled by plant lice, cecropia and polyphemus cocoons, etc. Then the work of education began and with it the destruction of nests. Town and city officials were notified and at once entered heartily into the plans for extermination. Grange meetings were attended, schools visited, village improvement societies became interested and the good work went on. This educational work was all that could possibly be done by those employed by the State, as the territory was too great to be covered in so short a time in any other way. The amount of money raised by the several towns and cities, together with that donated by societies and private individuals, was of material aid in the work of nest destruction. In some towns the local grange paid for the nests cut. In fact, this organization was of great assistance in the work of extermination; but the educational work done in the schools by those employed by the department was of the greatest importance, as the most of the nests were brought in by the scholars and paid for by the towns at so much per dozen. York was the banner town of the State, appropriating $1,000 at its town meeting without a dissenting voice, and its private citizens added about $200 to this amount. So active were they in the campaign that about 300,000 nests were taken, mostly by the school children.

The Experiment Station at Orono has done a great work in the assistance it has rendered through the efforts of its director, Prof. Chas. D. Woods, in furnishing the much needed literature and sending Miss Edith M. Patch, its very efficient entomologist, into the infested territory to do pioneer work toward educating the people to the great importance of a thorough extermination of the pest. Through her efforts a great deal of effective work was accomplished that otherwise would have of necessity been greatly delayed.

Much credit is due to the press of the State for its hearty endorsement and material aid in the dissemination of information on this subject. The assistance thus rendered is greatly appreciated by the department and was a great incentive to the progress of the work.

At this time the following warning was sent out from the department by the entomologist and also published in many of the leading newspapers:

"One great obstacle in the way of a thorough extermination of the brown-tail moth is the total indifference of many of those who own fruit trees, or even shade trees, in the infested region. During a recent trip from Kittery to Kennebunk, although the great majority were deeply interested in the matter and realized the great importance of a speedy and thorough campaign against this insect, yet I found not a few who said they thought the thing would take care of itself without their interference. This idea is entirely wrong, although the same opinion is somewhat widespread. Because the past ravages of some of our native insects have been kept in check by our bird and insect friends there is no reason to suppose that this is always so to be.

This little foreigner came to us leaving behind its parasitic enemies, its bird acquaintances, its fungous diseases, and entered upon a new existence with new environments, and large opportunities for widespread devastation. In its already short sojourn among us it has fully demonstrated its inherent instinct to hold its own against the forces of nature that have kept in check many of our native species. Do not think for a moment that we can afford to let this pest get the upper hands of us, as it surely will if we are not alive to the situation. Every man, woman and child should have a responsibility in the matter, whether owners of property or not; it is for the well-being of every citizen of our commonwealth to see to it that no stone is left unturned in the thorough work of extermination.

In all the towns I visited the active work of gathering the nests is left wholly in the hands of children; this is all well and good as far as it goes, but in the hurry and scramble for the most nests very many of the scattering ones will be overlooked, and those situated in tall trees like our maple and elm, will not be reached at all. This will be another very serious obstacle in the way of extermination. If these are left until later, when the caterpillars are scattered through the tops of the trees, the expense of spraying will be tenfold greater than it would were they on the lower limbs of the pear or apple.

I strongly advise the officers of every town to see to it that a thoroughly trustworthy man is employed to secure all such nests. By means of extension ladders and long poles with pruning shears attached, the nests can be obtained and destroyed."

The act passed by the legislature was not approved until the last of February, so that work could not be begun until the first of March. The above named territory was as thoroughly covered as possible during the short time remaining. The caterpillars were found out of their nests feeding on the buds of trees during the first warm days in April, and by the middle of April the most of the men employed had been called in. Of course the situation in Massachusetts and a knowledge of the work done there during the past fifteen years was a great incentive. Added to this was the danger of losing many of our most desirable summer visitors, who annually come to our resorts to spend the summer. Letters were received from such parties stating that if the brown-tail moth was not gotten rid of in Maine they would be compelled to go elsewhere. I inspected the resort towns in July during the flight of the moths and failed to learn of any one being kept away by them, although there were several cases of families having the "brown-tail moth itch," as it is called.

It was thought at first that the infested district did not extend outside of York and Cumberland counties, but as the work progressed it was found that this was but a small part of the total area. Nests were taken in most of the coast towns from Kittery to Bar Harbor, including many of the islands. Bar Harbor on the island of Mount Desert was the most eastern limit. They were taken inland as far as Bucksport on the Penobscot, Augusta on the Kennebec and Turner on the Androscoggin.

Over the infested district of about 4,000 square miles we found a total of nearly 1,000,000 nests, being very abundant in York county and gradually diminishing toward the eastern limit.

On the island of Mt. Desert only 11 nests were taken in the spring, but later developments show that some nests were overlooked in all sections of the State. One must bear in mind that a complete extermination is next to an impossibility. With the most diligent search we cannot be sure but that some nests will be overlooked. With such a diversity of food, from the oak to the raspberry bush, it would be strange indeed if all nests were secured.

THE BROWN-TAIL MOTH IN ITS NATIVE LAND.

It may not be out of place to give a brief history of this little foreigner that has so thrust itself upon us without even "by your leave."

The early history of this insect is not known. It dates back to an origin in Central Europe. Probably long before America was discovered this little fellow was working its ravages in the Old World, little dreaming of what the future had in store. Many of our common insect pests have been gradually making their way across the ocean, slowly but surely, until now the variety of our insect fauna equals or exceeds that of any other country of the globe. The history of this moth in its European home is such that we do not desire a repetition of it here. It has been the dread and scourge of the husbandman and is still ranked as the worst insect pest that the farmer has to contend with. Laws have been enacted to check the spread of the pest, and where these have been neglected furious outbreaks have been the result.

ITS ADVENT INTO THIS COUNTRY.

From the Massachusetts Report on the Brown-tail Moth, by Fernald and Kirkland, 1903, we glean the following:

By investigations made by the authors it is very clearly demonstrated that the brown-tail moth was first introduced into this country at Somerville, Mass., in about 1890, and that it must have come from France or Holland on some rose bushes imported at that time; but owing to the vigorous campaign against the gypsy moth this new addition was not brought to the attention of the commission until 1897. An investigation was then made with the above results.

From 1897 to 1900 this new arrival was included in the fight for the extermination of the gypsy moth. Then came the fatal mistake of the Massachusetts legislature when the appropriation was discontinued and from then until 1905 these two pests, the most noted of any that had ever visited our country, were allowed to go unmolested save by what restrictions the local authorities could place upon them. This was wholly inadequate to check their onward march with the result that at the beginning of the present year, 1905, the brown-tail had extended south into Rhode Island and Connecticut, north to the White Mountains in New Hampshire, and invaded Maine from Kittery to Bar Harbor. The gypsy in the meantime was slowly but surely extending its domain over hundreds of square miles and has now reached Portsmouth, New Hampshire, on its way down east.

For our own enlightenment and we trust as an economic incentive it may be well to note the expense involved in Massachusetts' brave struggle to rid herself of this scourge.

During the campaign of the first commission, extending over a period of ten years, from 1890 to 1900, the State expended over one million of dollars, to say nothing of the hundreds of thousands contributed by private and public benefactors. It was then thought that perhaps the local authorities would be able to keep it in check, but the history of the past four years shows too plainly the fallacy of that proposition. As a result of investigations made by Dr. L. O. Howard, entomologist of the department at Washington, and other noted scientists, it was decided that something must be done to control the ravages of these formidable enemies to public safety. The legislature was again asked to provide means to this end, and an appropriation of three hundred thousand dollars was granted with an additional thirty thousand for experimental purposes; this last to be used in procuring parasitic insects from Europe and other foreign countries for the purpose of exterminating, or at least controlling the spread of the gypsy and brown-tail moths. This fund in conjunction with aid from the United States government will, it is thought, be sufficient for this purpose. Last spring Dr. L. O. Howard made a tour through Europe and succeeded in securing the services of a number of entomologists who have been collecting and sending parasites to Prof. Kirkland to be used against these pests.

Prof A. H. Kirkland, formerly employed by the old commission, was given sole charge of the work as superintendent, and we have no doubt that under his efficient management the work of the department will result in the final control of these much dreaded insect enemies. But our experience of the past leads us to believe that we must still keep a diligent watch and not for a moment cease our vigilant campaign against these two pests.

LIFE HISTORY OF THE BROWN-TAIL MOTH.

(*Euproctis chrysorrhoea.*)

For the benefit of those who are unfamiliar with the life history of the brown-tail moth I will add a brief description of the same.

The eggs are laid usually on the under side of the leaf. These are cream white in color, almost spherical in outline, and about one-thirty-second of an inch in diameter. The female remains quiet while laying her eggs excepting a slight onward movement as the cluster is deposited. Her pure white wings which act as a roof covering offer quite a contrast to the golden colored egg mass. The cluster varies from ¾ to one inch in length by about ¼ of an inch in width, and is half round in cross section with each end rounded, the whole being covered with the golden brown hairs removed from the abdominal tuft in the process of laying. This cluster contains on the average about 300 eggs. The eggs hatch in about three weeks into very small caterpillars, about one-sixteenth of an inch in length. The head is black, the second segment is bordered with yellow, with an oval brown patch on the dorsal portion. General color, greenish yellow, darker near the head and growing lighter from the seventh to the eleventh segments. The fifth and sixth and last segments are of a brownish color on the back. The body is covered with fine hairs.

As soon as the tiny caterpillars hatch from the eggs they begin feeding on the soft tissue of the leaves on which they were laid. These caterpillars are gregarious in their habits, feeding together on the leaves of their food plant. They are so small that it requires only a few leaves to satisfy their hunger, and these they only skeletonize, leaving them of a dull brown color. Enough silk is evolved in the process of feeding to firmly attach these few leaves to the twig. This nest is made up of a number of cells constructed of silk, into which the young larvæ crawl and remain dormant through the winter. As the silk is a good nonconductor this is the reason they can stand the severe cold of our Maine winters. The nests are generally attached to the terminal shoots of the new growth so that they are easily removed with but slight damage to the tree. In fact, the damage done to the trees by the young caterpillars in the fall is very slight unless they are quite abundant.

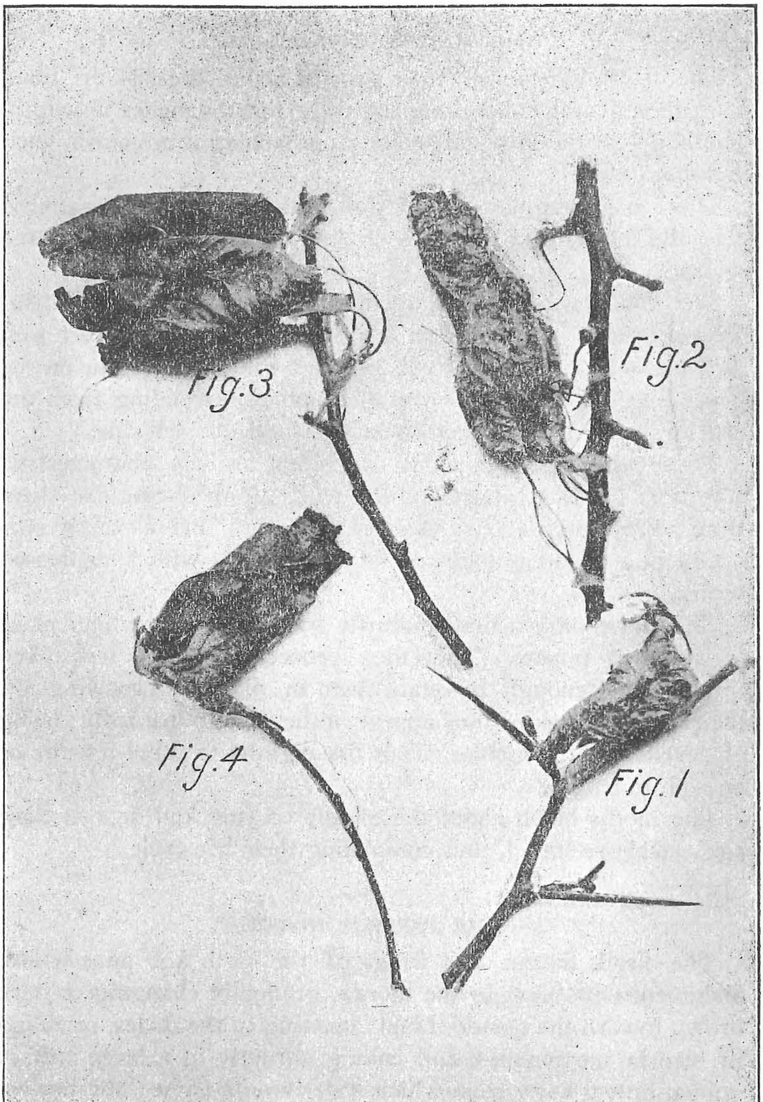
It will thus be seen that the time for active and economic work against the pest is during the fall, winter and spring months while the trees are bare of their foliage.

One great mistake, however, will be in leaving the work until spring, as the caterpillars will crawl out during the first warm days of April to feed on the buds.

In conversing with some of the citizens of the different towns I find that the opinion with many is that nothing will be done until spring on account of funds, the excuse being that they must wait until after town meeting in March before money can be obtained to conduct a campaign against the pests. Now this is wholly wrong, for in badly infested towns it would be practically impossible to get all of the nests after so late a date.

If necessary the contingent fund of the towns could be drawn upon for this purpose and made up at the annual meeting.

I cannot too strongly urge the absolute necessity of immediate action in removing all nests at the earliest possible moment.



Nests of the Brown-tail moth. Fig. 1 shows a nest on the thorn; Fig. 2, on a pear twig, with seven distinct silken attachments; Fig. 3, on a cherry, showing four attachments; Fig. 4, a terminal nest on the apple. The nests are from 1½ to 3½ inches long by ½ to 1½ in diameter.

THE MATURE CATERPILLAR.

The caterpillars reach their growth about the last of June. They then average about one and three-fourths inches in length. The body is of a dark slate color, approaching a brownish-black in some cases.

There are irregular yellow and orange markings scattered over the body, also a double broken dorsal line of the same colors.

The tubercles are black, from which project long reddish-brown hairs. The hairs on the second segment project well forward over the head. Tufts of short white hairs occur on the upper edge of the medial row of tubercles, extending from the fifth to the twelfth segment inclusive, eight on each side.

These white patches along the sides are the characteristic markings for this caterpillar and will readily distinguish them from other species. On each of the tenth and eleventh segments is a round orange-red dorsal tubercle with a depressed center.

The larvæ on reaching maturity seek some convenient place in which to pupate. They then proceed to spin a few silken threads, just enough to retain them in place. Throwing off their caterpillar skins they appear in the usual pupæ form; being of a reddish-brown color, from five-eighths to three-fourths of an inch in length.

The moths hatch about the middle of July and deposit their eggs as above stated, thus completing their life cycle.

THE PERFECT INSECT.

The head, thorax and wings of the moth are pure white; abdomen white next to the thorax, gradually changing to dark brown toward the posterior end; tapering in the males, retaining its size in the females, and ending abruptly in a large tuft of golden-brown hairs from which it derives its name "the brown-tail moth." The antennae are white above, light brown underneath. The under anterior edge of the fore wing in the male is dark brown. Expanse of wings from one and one-eighth to one and one-half inches.

The moths are nocturnal in their habits, flying by night, and are attracted by a light. As they are strong flyers it would be possible for them to fly long distances before depositing their eggs. This accounts for the extensive territory they have covered during the past few years.

The four stages in the life history of any perfect insect are the following: First, the egg; second, the larva, (caterpillar in this case); third, the pupa; fourth, the imago, or perfect insect.

Two of these are dormant, or sleeping, namely the egg and pupa; two are active, namely the larva and imago; and in this case as in many others there is but one injurious stage, that of the larva or caterpillar.

The injuries in the case of the brown-tail caterpillar are two fold, one as a destroyer of vegetation, the other as a menace to the health and comfort of the human family. After the third moult of the caterpillar some of the fine hairs are covered with spines which on coming in contact with the moist surface of the body break up, and working under the skin produce a very painful eruption, which has received the name of the "brown-tail moth itch."

This in many cases is a very serious matter, and had not the work of last spring been so thoroughly accomplished our resort towns would have suffered a great loss in being deprived of the revenue derived from our summer visitors.

MANNER OF EXTERMINATION.

As will be seen from the above description of the nests, they are quite conspicuous objects, and can generally be seen for some distance.

The only way to clear up the nests is to cut and burn. By means of a pair of pruning shears attached to a long pole the most of the nests can be secured. Then by means of extension ladders the rest ought to be reached.

It will not do to depend on a brush fire to destroy the nests as it requires a great deal of heat to penetrate the silken cells. They should be burned in a stove or furnace.

OUR PRESENT SITUATION IN MAINE.

The territory infested by the brown-tail moth last spring was found to cover four thousand square miles. When we consider the orchard and forest interests of Maine we can realize to some extent the great importance of an active educational campaign along the lines of economic entomology. It is rather early yet to predict what the actual situation is as regards the brown-tail moth invasion in our State. As a result of the systematic work done last spring hundreds of thousands of nests were taken and destroyed. This infested district extended from Kittery on the southwest to Bar Harbor on the northeast, and so effectively was this work done that no serious complaint has come to the notice of the department from any source. This speaks volumes for the enterprise and public spirited enthusiasm of the several cities and towns along the border line. Thousands of dollars were spent and time and energy freely given in the good cause. While inspecting the nursery at Bar Harbor in August I discovered several clusters of eggs of the brown-tail moth and later in the summer and early fall I received a number of nests from there, but the authorities are wide-awake to the situation and will do all in their power to rid the island of the pests during the coming winter. In Portland, where a large number of nests were taken, the situation is very encouraging. Of course we should expect that many nests would be found there as a result of the moths coming direct from Boston by steamer and rail as heretofore. Last July, during the flight of the moth, I was in Kittery to investigate the situation and found that they were coming in by the thousands. The moth is a night flyer and strongly attracted by a light. They were reported on the navy yard buildings in great numbers and were killed by the thousands by the workmen employed on the yard. A recent investigation showed the trees in many localities to be as badly infested as they were in the spring, but taking the territory as a whole I have every reason to believe that the worst is over PROVIDED THAT A DILIGENT WATCH IS KEPT UP AND A VIGILANT CAMPAIGN CONTINUED EACH YEAR. It is earnestly desired that all possible information of any insect invasion may be sent in to the department as soon as discovered. We can then be in a position to successfully cope with all of our insect foes before they gain a strong foothold in the State. This is the only way in which we may hope to check the gypsy moth and San José scale.

OTHER INSECT PESTS.

All through the season I have been receiving specimens of every description to be identified, accompanied with requests for remedies for their destruction. In fact, this office has been a regular bureau of information in regard to injurious and beneficial insects. Never before in the history of the State has there been such an awakening on the part of our farmers and horticulturists to the importance of looking after the insect enemies of their farm, orchard and garden crops. Hundreds of letters have been received, and the correspondence in this line alone has been of incalculable value from an economic standpoint.

When we realize that our farmers are losing each year from insect depredations a sum equal to the expenditure of the whole educational system of our country, including the higher universities, it would seem to be high time for this awakening.

INSECTS RECEIVED DURING THE YEAR.

Date.	Name of insect.	Locality.	Name of person sending.
March 25......	White-marked tussock eggs, *Hemerocampa leucostigma*........	Eliot........	H. R. Libby.
March 28......	Brown-tail moth nest, *Euproctis chrysorrhoea*........	West Eden........	A. S. Bunker.
March 28......	White-marked tussock eggs, *Hemerocampa leucostigma*........	West Eden........	A. S. Bunker.
April 1......	Brown-tail moth nest, *Euproctis chrysorrhoea*........	Tenant's Harbor........	John H. Taylor.
April 5......	White-marked tussock eggs, *Hemerocampa leucostigma*........	North Bluehill........	Jas. L. Saunders.
April 8......	White-marked tussock eggs, " "	North Haven........	Cora F. Ames.
April 10......	White-marked tussock eggs, " "	Surry........	F. H. Clark.
April 12......	White-marked tussock eggs, " "	Mt. Desert Ferry........	Geo. A. Foss.
April 18......	White-marked tussock eggs, " "	Searsport........	L. C. Eaton.
April 29......	Polyphemus cocoon, *Telea polyphemus*........	Winslow........	Mr. Simpson.
May 19......	Spring canker worm, *Paleacrita vernata*........	Augusta........	
May 25......	Apple tent caterpillar, *Malacosoma americana*. (Very common)........	New Meadows........	
May 25......	Apple tent caterpillar, " " . (" ")........	West Gardiner........	
May 25......	Apple tent caterpillar, " " . (" ")........	Chelsea and Randolph..	
May 25......	Forest tent caterpillar, *Malacosoma disstria*........	Waterville........	
June 12......	Strawberry weevil, *Anthonomus signatus*........	Farmington........	Hermon Corbet.
June 16......	Plant lice on rose bushes........	Wilton........	Enoch Bridges.
June 19......	Carpet beetle, *Anthrenus scrophulariæ*........	Wilton........	Enoch Bridges.
June 19......	Eyed elator, *Alaus oculatus*........	Waterville........	Oscar W. Carroll.
June 20......	Polyphemus cocoon, *Telea polyphemus*........	West Brooksville........	G. M. Farnham.
June 22......	Oyster-shell bark louse, *Mytilaspis pomorum*........	Orrington........	A. W. Leathers.
June 22......	Luna moth, *Tropæa luna*........	Augusta........	Miss Josephine Tuell.
June 23......	Rose chafers, *Macrodactylus subspinosus*........	Wilton........	Enoch Bridges.
June 23......	Sphinx moth, *Paonias astylus*........	West Farmington........	
June 23......	Cockscomb elm-gall, *Colopha ulmicola*........	....	
June 23......	Larvæ of mourning cloak butterfly, *Euvanessa antiopa*........	West Farmington........	
July 7......	Willow saw fly (larvæ)........	Augusta........	Mrs. M. Fuller.
July 7......	Elm plant lice........	Camden........	L. E. Bramhall.
July 7......	Cherry-tree ugly nest, *Archips cerasivorana*........	Chelsea........	Bernice Watson.
July 12......	Cherry-tree ugly nest, " "	Brunswick........	Prof. L. A. Lee.
July 12......	Specimen of *Orthosoma brunneum*........	Gorham........	A. D. Plummer.
July 13......	Birch plant lice........	Waterville........	Geo. W. Dorr.
July 13......	Larvæ and pupæ of coccinellidæ........	Waterville........	Geo. W. Dorr.
July 13......	Tineid moth on Juniper........	Portland, N. H. Rooms..	A. H. Norton.
July 18......	Cherry-tree ugly nest, *Archips cerasivorana*........	Greenville........	C. H. Brochu.
July 18......	Larva of *Vanessa cardui*........	York Beach........	

July	20....	Pupæ cherry-tree ugly nest, *Archips cerasivorana*	Greenville	C. H. Brochu.
July	20....	White-marked tussock, *Hemerocampa leucostigma*	Portland	Dr. N. G. Gehring.
July	21....	Species of Agrotis (broken)	Oakland	Mrs. Hiram Conforth.
July	24....	Brown-tail moth nest, *Euproctis chrysorrhoea*	Portland	Z. Thompson.
July	25....	Apple-tree woolly aphis, *Shizoneura lanigera*	Farmington	D. H. Knowlton.
July	25....	Specimen of horned corydalis, *C. cornuta*	Gorham	A. D. Plummer.
July	28....	Fall web worm, *Hyphantria cunea*	North Pittston	C. R. Green.
July	31....	Apple-tree woolly aphis, *Shizoneura lanigera*	Farmington	Ida S. Cowan.
July	31....	Gall aphis	Farmington	Ida S. Cowan.
August	1....	Larvæ of sphinx moth, also *Vanessa cardui*	Chelsea	Ivy E. Thompson.
August	2....	White-marked tussock larvæ, *Hemerocampa leucostigma*	Squirrel Island	
August	2....	Larvæ of mourning cloak butterfly, *Euvanessa antiopa*	Squirrel Island	
August	4....	*Vanessa cardui* and *Vanessa huntera* (very common)	Seguin Island	
August	7....	Green apple aphis, *Aphis mali*	Springvale	M. A. Bridgham.
August	7 ...	Maple leaf gall	Farmington	Ida S. Cowan.
August	10....	Larvæ of willow saw fly, *Cimbex americana*	North Sedgwick	
August	10....	Larvæ of *Papilio glaucus*	North Sedgwick	
August	12....	Red-humped caterpillar, *Schizura concinna*	Carmel	C. J. Bowen
August	12....	Red-humped caterpillar, " "	Sidney	W. Manter
August	12....	Red-humped caterpillar, " "	Jacksonville, Me	
August	15....	Red-humped caterpillar, " "	Pembroke	Sidney A. Wilder
August	15....	Oyster shell bark louse, *Mytilaspis pomorum*	Pembroke	Sidney A. Wilder
August	16....	Red-humped caterpillar, *Schizura concinna*	Sangerville	G. H. Knowlton
August	16....	Red-humped caterpillar, " "	Waterville	Eben Wood
August	16....	White-marked tussock eggs, *Hemerocampa leucostigma*	Millbridge	Nathaniel Storer
August	16....	Larvæ and beetles of *Dermestes lardarius*	Norway	Mrs. Mary L. Witt
August	16....	Yellow-necked caterpillar, *Datana ministra*	Chelsea	Bernice Watson
August	18....	Yellow-necked caterpillar, " "	Barrett	F. W. Bisbee
August	18....	Red-humped caterpillar, *Schizura concinna*	Barrett	F. W. Bisbee
August	18....	Yellow-necked caterpillar, *Datana ministra*	Auburn	R. D. Leavett
August	18....	Hickory tiger moth, *Halisidota caryæ*	Canton	C. E. Mendall
August	18....	White-marked tussock caterpillars and moth, *Hemerocampa leucostigma*	North Brewer	Mrs. Jas. M. Valentine
August	18....	Specimen of Plusia	North Brewer	Mrs. Jas. M. Valentine
August	20....	Hickory tiger moth caterpillar, *Halisidota caryæ*	Arnold	M. F. Armold
August	20....	Hickory tiger moth caterpillar, " "	Gilman	C. M. Gilman
August	20....	Hickory tiger moth caterpillar, " "	Waterville	Mr. Waldron
August	21....	Eggs of brown-tail moth, *Euproctis chrysorrhoea*	Bar Harbor	William Fennely
August	21....	Species of Chermes on spruce	Bar Harbor	William Miller
August	22....	Yellow-necked caterpillar, *Datana ministra*	Sidney	F. E. Blake
August	22....	Yellow-necked caterpillar, " "	Liberty	J. O. Johnson
August	23....	Red-humped caterpillar, *Schizura concinna*	North Penobscot	E. E. Gross
August	23....	Colony of Io caterpillars, *Automeris io*	Ellsworth	
August	26....	Red-humped caterpillar, *Schizura concinna*	West Buxton	E. E. Abbott

INSECTS RECEIVED DURING THE YEAR—Concluded.

Date.	Name of insect.	Locality.	Name of person sending.
August 26....	Larva of *Samia cecropia*....	Gorham	Mrs. A. V. Plummer
August 26....	Yellow-necked caterpillar, *Datana ministra*....	Columbia Falls	W. E. Ingersol
August 26...	Red-humped caterpillar, *Schizura concinna*....	Sidney....	Fred Hamlin
August 26....	Currant span worm, *Cingilia catenaria*....	Columbia	J. E. White
August 28....	Specimen of *Cicada tibicen*....	Bar Harbor	William Miller
August 30....	Red-humped caterpillar, *Schizura concinna*....	Columbia	J. E. White
Sept. 1....	Red-humped caterpillar, " "	Weeks' Mills....	Mrs. Ellen A. Barton.
Sept. 1....	Yellow-necked caterpillar, *Datana ministra*....	Razorville....	W. E. Overlock.
Sept. 4....	Larva of white pine weevil, *Pissodes strobi*....	Bar Harbor	William Miller.
Sept. 9...	Old tussock moth, *Notolophus antiqua*....	Greenville Junction....	
Sept. 9....	Hop-butterfly, *Polygonia comma* (very abundant)	Greenville Junction....	
Sept. 12....	Red-humped caterpillar, *Schizura concinna*....	Surry	J. G. Davis.
Sept. 12....	Larva of *Telea polyphemus*....	Northeast Harbor	Mr. Sierman.
Sept. 12....	Pine borer, *Monohammus confusor*....	Northeast Harbor	Mr. Sierman.
Sept. 12...	Larva of notched winged geometer, *Ennomos magnarius*	Northeast Harbor	Mr. Sierman.
Sept. 12....	Fall web worm, *Hyphantria cunea*....	Northeast Harbor	Mr. Sierman.
Sept. 13....	Specimens of *Halticus intermedius* (feeding on clematis vitalba)....	Bar Harbor	William Miller.
Sept. 13....	Brown-tail moth nests, *Euproctis chrysorrhoea*....	Bar Harbor	Chas. L. Shand.
Sept. 13....	Lappet moth, *Tolype velleda*....	Augusta	Miss A. C. Childs.
Sept. 21....	Specimens of maia moth (*Hemileuca maia*)....	Surry	J. G. Davis.
October 3....	Cut worms, *Agrotis*....	Farmington....	L. G. Brown.
October 3....	Wire worms, *Elateridæ*....	Farmington....	L. G. Brown.
October 3....	White grub, *Lachnosterna*....	Farmington....	L. G. Brown.
October 4....	Larva of Sphinx chersis....	Bar Harbor	William Miller.
October 4....	Oak tortricid....	Bar Harbor	William Miller.
October 4....	Oak pruner, *Elaphidion villosum*....	Bar Harbor	William Miller.
October 7....	Apple-tree woolly aphis, *Shizoneura lanigera*....	Milo	E. G. Brown.
October 23....	Cocoon of cecropia moth, *Samia cecropia*....	East Dixfield	Mrs. H. T. Prescott.
October 27....	Eggs of white-marked tussock moth, *Hemerocampa leucostigma*....	Portland....	L. M. Federicks.
October 27....	Moth of fall canker worm, *Alsophila pometaria*....	Portland	
October 27....	Apple-tree woolly aphis, *Shizoneura lanigera*	Portland	Z. Thompson.
October 27....	Specimen of *Catocala concumbens*....	Augusta	Ben Shaw.
Nov. 17....	Eggs of white-marked tussock, *Hemerocampa leucostigma*....	South Portland	Miss Eliza W. Rand.
Nov. 17....	Nest of brown-tail moth, *Euproctis chrysorrhoea*....	South Portland	Miss Eliza W. Rand.
Nov. 17....	Nest of spiders' eggs....	South Portlaud	Miss Eliza W. Rand.

Many inquiries have been made in regard to our plant lice, especially the common green apple aphis (*Aphis mali*), and the dreaded white, woolly apple louse (*Shizoneura lanigera*). This last has been found in several places, the worst infested locality being the city of Portland. I discovered one tree at least ten inches in diameter literally alive with them, its vitality destroyed, practically dead and standing as a menace to the trees near by. This pest deserves more than a passing notice as it is a dangerous one to have in our midst. It is rather a peculiar insect, leading a dual existence; one form living on the fibrous roots of the tree, producing galls similar to the dreaded grape phylloxera of Europe and as hard to combat. The other, a white woolly form found covering the limbs and trunk of the tree. An allied species (*Shizoneura tessellata*) is very common on the alder and is especially abundant this season. I have seen whole alder swamps literally covered with this snow white mantle of crawling aphids. But this species will not attack the apple. If an orchard is infested by the woolly aphis it will soon sap the vitality of the tree to such an extent that the best remedy is to cut and burn all infested trees. The root form inoculates the soil so that new trees should not be set in the same places, although pear, plum or cherry trees might be substituted with no evil effects.

When a few trees in an orchard are affected they should be sprayed with kerosene or whale oil soap emulsion and the roots treated with powdered tobacco or carbon bisulphide.

Many letters have been answered regarding the San José scale (*Aspidiotus perniciosus*). As yet it is not known to exist in the State, but it will be only a matter of time before it appears as it is quite common in Massachusetts. The common oyster-shell bark louse (*Mytilaspis pomorum*) has been confounded with the San José and full explanations have followed each request.

The scurfy bark louse (*Chionaspis fufurus*) has been reported, but as yet has not appeared in sufficient numbers to be a menace to our orchards. Our common rose chafer (*Macrodactylus subspinosus*) was so abundant in one locality that they destroyed all of the Harvey apples. This was about the middle of June. The fruit was literally covered with them, twenty beetles being counted on one apple.

The much dreaded strawberry weevil (*Anthonomus signatus*) was found on some plants obtained from New York. Fortunately only a small plot was affected. The beetles were destroyed and every precaution taken to exterminate them. The same pest has been reported in other localities.

These are only a few of the many insects sent in for identification, and will give but a faint idea of the amount of work done in this line.

Colonies of the brown-tail moth and several other species of our more common and destructive insect pests have been reared in breeding cages in the office of the department for experimental purposes in order that specimens of these insects in their different stages of development might be prepared for use in schools and elsewhere as an aid in identifying and obtaining a thorough knowledge of the character and life history of these pests.

LECTURE WORK.

In connection with the active work of the department I have been obliged to devote much extra time to lecture work. The demand along this line was much greater than we had time at our command, but as far as possible these requests were granted, as we considered this to be one of the vital features of the campaign. In many cases from one to three requests were made for the same evening. These came from state societies, county associations, town meetings, farmers' institutes, village improvement and league societies, subordinate and Pomona granges, seminaries, academies, schools and teachers' meetings.

Exhibits were made at two of our fairs, and many engagements are already booked for next spring and summer.

NURSERY INSPECTION.

As the act referring to nursery stock inspection was not passed until the last of February it was necessary that an early inspection be made so that the nurserymen could be protected in their spring shipments. This was done as thoroughly as possible under the circumstances, as it was difficult to locate them, no list being available. As the annual inspection should properly be made in the early fall, I had to go over the ground the second time. This last inspection showed very plainly the great need of such work being done in Maine. I found conditions that needed immediate attention, and in every case I was much gratified to receive the hearty support of those in charge.

As a matter of fact, all of the owners of nurseries in the State were loud in their appreciation of the step taken by our last legislature and were only too glad to aid in the extermination of all insect pests and fungous diseases.

ORCHARD INSPECTION.

I have inspected quite a number of orchards during the season but have not had time to cover half the ground I desired. In fact, I could not possibly meet the demands made upon me. I hope another season to be able, not only to comply with the requests that have already been made which could not be responded to, but also with all others that may be received. In these inspections I have found many cases of gross neglect on the part of those who were not familiar with our insect pests, but in every case the owners were only too glad to remedy the evil as far as possible. The great importance of these inspections cannot be over-estimated. There should be more object lessons given in this line. Nature teaches us through our senses rather than in the abstract.

Respectfully submitted,

E. F. HITCHINGS,

State Entomologist.

EXTRACTS FROM CATTLE COMMISSIONERS' REPORT.

We herewith submit our report ending December 1, 1905, together with an account of cattle and horses destroyed under provisions of the law of 1887, chapter 19, relating to contagious diseases among cattle and horses in the State, and as amended in 1898, and also the new law passed by the legislature in 1905.

The amount of business done commencing December 1, 1904, and ending December 1, 1905, for testing, destroying, disinfecting stables and all other expenses pertaining to the business was $24,951.86. Amount paid for cattle and horses, $9,766.50; amout paid on expenses, $5,376.40; amount due on December 1, 1904, $9,808.96; total, $24,591.86.

It has not been our custom to give an itemized account on the year in which the legislature is not in session, but a general statement of the finances and the condition of the business, and the report will show that 1905 has been a busy year for the commissioners.

In the investigation of the work of the board last winter by the agricultural committee, it was the unanimous sentiment that the cattle commissioners were not doing enough along some lines, in view of the fact that we exceeded our appropriation over six thousand dollars for the years 1903 and 1904. The committee succeeded in passing a new law in addition to the old one, whereby all pure blood cattle coming into Maine from other states should be tested by order of the commissioners, and also all pure blood cattle changing hands within the State should be tested in order to protect the buyer. We hardly think the committee realized what this new law meant as to the expense to the State, neither did the commissioners know what the result would be. We have found, however, that it has increased our expenses nearly one-third from the year previous, or 1904, by bringing us in contact with pure blood herds, causing many to be destroyed at a cost double that of the common breeds. Yet we can report that in the short time the law has been in force in our judgment nearly one-half of the pure blood herds in the State have been tested and cleaned up, and are considered, as far as we know, free from tuberculosis. And if we are allowed to go on with the work, by the end of another year nearly all the pure blood herds in the State will be practically free and above suspicion from disease, and with our experience we are free to say that the new law was a move in the right direction and is working satisfactorily; and if faithfully lived up to by the breeders themselves and the work thoroughly done by the commissioners, that the expense will be justified by the benefits derived.

There have been 86 pure blood cattle condemned and appraised this last year, and 22 destroyed that were not eligible to an appraisal by not being in the State long enough to permit it.

There were 707 cattle and horses condemned and destroyed in 1905 against 273 in 1903 and 526 in 1904. The cattle cost, including all expenses, an average of $35.25 each, against $33.98 in 1904, $1.27 more than in 1904. It cost to condemn and destroy, including all expenses, $12.07 each, 16 cents more than in 1904.

The owners received in 1905, $23.18 upon an average for each animal, against $22.07 in 1904, an addition of $1.11. The appraisals upon the common breeds of cattle have not been as high as in 1904, but by destroying more pure blood cattle the average was brought up. Neither has the expense upon common cattle been as high as last year, but paying for testing some over 300 pure blood cattle has brought the average expense per animal up to 16 cents more than in 1904.

JOHN M. DEERING,

Secretary.

OFFICERS OF AGRICULTURAL SOCIETIES.

Name of Society.	President.	P. O. Address.	Secretary.	P. O. Address.	Treasurer.	P. O. Address.
Maine State Agricultural	B. J. Libby	Oakland	J. L. Lowell	Auburn	E. G. Eveleth	Auburn.
Eastern Maine Fair Association	F. O. Beal	Bangor	E. L. Sterns	Bangor	S. D. Benson	Bangor.
Central Maine Fair Association	E. P. Mayo	Waterville	E. T. Wyman	Waterville	Elmer E. Smith	Waterville.
Maine State Pomological	Z. A. Gilbert	North Greene	D. H. Knowlton	Farmington	Ellis L. Lincoln	Wayne.
Maine State Poultry and Pet Stock Association	Silas Bartlett	Lewiston	A. L. Merrill	Auburn	T. H. Sclater	Auburn.
Androscoggin County	I. B. Clary	Livermore Falls	J. W. Maxwell	Sabattus	W. F. Hutchinson	Livermore Falls.
Aroostook, Northern Maine Fair Association	Frank P. Grant	Fort Fairfield	E. T. McGlauflin	Presque Isle	A. E. Irving	Presque Isle.
Aroostook, Madawaska	Eloi Albert	Up'r Madawaska	Kemi A. Daigle	Up'r Madawaska	Alexis K. Cyr	St. David.
Cumberland County	J. L. Robinson	South Windham	C. H. Leighton	Cumberland M'ls	F. D. Scammon	Gorham.
Cumberland, North	S. H. Mann	Casco	R. W. Fogg	Harrison	H. Thompson	Harrison.
Cumberland Farmers' Club	M. M. Burnham	Cumberland Ct'r.	A. M. Crocker	Cumberland C'tr.	N. M. Shaw	Cumberland Ct'r.
Cumberland, Bridgton Farmers' and Mechanics' Club	Edwin Pingree	Denmark	J. S. Ames	Bridgton	J. S. Ames	Bridgton.
Cumberland, New Gloucester and Danville	E. K. Merrill	R. F. D. 2, Auburn	J. P. Witham	R. F. D. 1, New Gloucester	Geo. W. Haskell	R. F. D. 1, New Gloucester.
Cumberland, Lake View Park Association	Arthur Dyer	Sebago	A. L. Brackett	East Sebago	A. L. Brackett	East Sebago.
Cumberland, Freeport	W. C. Anderson	Freeport	Willis Snow	Freeport	S. H. Fitts	Freeport.
Cumberland, Freeport Poultry Association	Willis Snow	Freeport	George P. Coffin	Freeport	L. E. Curtis	Freeport.
Franklin County	W. Thornton	Chesterville	R. S. Sampson	Farmington	Geo. M. Currier	Farmington.
Franklin, North	D. D. Graffam	Phillips	H. W. Worthley	Phillips	C. N. French	Phillips.
Hancock County	F. P. Merrill	Bluehill	C. S. Snowman	Bluehill	M. P. Hinckley	Bluehill.
Hancock, North	A. D. Archer	Amherst	A. N. Jewett	Amherst	J. H. Patten	Amherst.
Hancock, North Ellsworth Farmers' Club	Francis McGown	Nicolin	H. F. Maddocks	North Ellsworth	A. E. Maddocks	Nicolin.
Hancock, Eden	Charles F. King	Eden	Ephraim Alley	Eden	W. L. Alley	Eden.
Kennebec County	John H. Swift	R.F.D.36, Oakland	L. O. Tebbetts	Readfield	C. H. Stevens	Readfield.
Kennebec, South	Geo. A. Moody	R.F.D.10 Gardiner	A. N. Douglass	R.F D.9 Gardiner.	Jasper S. Gray	Windsorville.
Knox, North	E. E. Thurston	Union	Geo. C. Hawes	South Union	H. L. Grinnell	Union.
Lincoln County	Chas. E. Peaslee	Alna	E. R. Castner	Damariscotta	E. F. Metcalf	Damariscotta.

Lincoln, Bristol	John M. Bryant	Bristol	George A. Huston	Damariscotta	C. B. Woodward	Damariscotta.
Oxford County	Wm. J. Wheeler	South Paris	W.O.Frothingh'm	South Paris	W.O.Frothingh'm	South Paris.
Oxford, West	H. D. Harnden	Fryeburg	B. W. McKeen	Fryeburg	W. R. Tarbox	Fryeburg.
Oxford, North	Charles T. Poor	Andover	John F. Talbot	Andover	S. F. Abbott	Andover.
Oxford, Androscoggin Valley	A. L. Stanwood	Rumford Falls	O. M. Richardson	Canton	D. W. Goding	East Peru.
Oxford, Riverside Park Association	H. S. Hastings	Newry	L. A. Hall	Bethel	E. C. Rowe	Bethel.
Penobscot, West	C. L. Jones	Corinna	E. E. Colbath	Exeter	F. C. Barker	Exeter.
Penobscot, North	S. T. Mallett	South Springfield	B. D. Averill	Prentiss	C. M. Lombard	Springfield.
Penobscot, Orrington	A. G. Dole	South Brewer	N. A. Nickerson	South Orrington	N. A. Nickerson	South Orrington.
Piscataquis County	W. E. True	R. F. D., Foxcroft	F. W. Leland	East Sangerville	C. C. Dunham	Foxcroft.
Sagadahoc County	A. S. Dunning	North Harpswell	Geo. R. Tedford	Topsham	Lyman E. Smith	Brunswick.
Sagadahoc, Richmond Farmers' and Mechanics' Club	Geo. M. Curtis	R.F.D., Richmond	Daniel Brown	R.F.D.13 Gardiner	D. W. Alexander	Richmond.
Somerset County	Ernest Hilton	Anson	J. F. Withee	Madison	E. H. Athearn	Anson.
Somerset, East	J. A. Goodrich	R.F.D.2, Pittsfield	E. A. Webber	Hartland	F. S. Burrill	Hartland.
Somerset, Central	S. W. Gould	Skowhegan	J. P. Clark	Skowhegan	E. D. Packard	Skowhegan.
Waldo County	J. F. Wilson	Belfast	H. E. Ellis	Belfast	Fred Rackliffe	Belfast.
Waldo and Penobscot	C. M. Conant	Winterport	F. H. Bowden	Monroe	Dr. E. C. Newcomb	South Newburgh.
Waldo, Unity Park Association	Wm. Kimball	Burnham	E. T. Reynolds	Unity	E. T. Reynolds	Unity.
Washington County	P. A. Rich	Dennysville	V. May Rich	Dennysville	Walter Morrison	Charlotte.
Washington, West	J. E. White	Columbia	E. F. Allen	Columbia Falls	Willis H. Allen	Columbia Falls.
York, Shapleigh and Acton	A. M. Mann	Shapleigh	Fred K. Bodwell	Acton	W. P. Ferguson	Springvale.
York, Ossipee Valley Union	M. S. Eastman	Cornish	James C. Ayer	Cornish	Walter Pease	R. F. D., Cornish

ANALYSIS OF EXHIBITION.

Name of Society.	Number of horses and colts.	Number of thoroughbred bulls and bull calves.	Number of thoroughbred cows, heifers and heifer calves.	Number of grade cows, heifers and heifer calves.	Number of oxen and steers.	Number of animals for beef.	Number of cattle shown in herds.	Total number of neat stock.	Number of sheep.	Number of swine.	Number of poultry (coops).
Maine State Poultry and Pet Stock Association	-	-	-	-	-	-	-	-	-	-	1,250
Androscoggin County	80	22	45	38	68	20	-	193	35	22	86
Aroostook, Northern Maine Fair Association	165	32	121	25	8	-	50	154	42	10	57
Aroostook, Madawaska	40	-	-	32	16	2	-	50	45	6	-
Cumberland County	85	32	53	40	186	16	76	403	30	62	23
Cumberland, North	36	4	26	13	96	8	32	179	-	21	5
Cumberland Farmers' Club	27	16	47	23	40	8	32	166	-	21	60
Cumberland, Bridgton Farmers' and Mechanics' Club	31	9	29	16	36	6	16	112	26	21	36
Cumberland, New Gloucester and Danville	28	1	9	15	16	-	8	49	5	39	19
Cumberland, Lake View Park Association	1	2	6	4	2	-	-	14	-	-	10
Cumberland, Freeport	18	5	7	5	2	-	27	46	9	41	95
Cumberland, Freeport Poultry Association	-	-	-	-	-	-	-	-	-	-	572
Franklin County	91	28	73	62	168	28	32	391	184	22	58
Franklin, North	51	3	28	23	62	10	12	138	9	1	6
Hancock County	25	8	40	35	40	25	-	148	20	4	20
Hancock, North	24	-	-	14	6	-	19	39	6	-	6
Hancock, North Ellsworth Farmers' Club	2	1	6	5	-	-	-	12	4	-	9
Hancock, Eden	-	2	6	10	-	-	-	18	3	10	8
Kennebec County	47	19	40	42	152	14	41	308	25	20	38
Kennebec, South	49	9	6	24	154	9	15	217	2	1	21
Knox, North	34	3	19	25	82	8	41	129	13	1	4
Lincoln County	37	7	21	22	40	6	-	96	4	3	22
Lincoln, Bristol	12	1	1	10	38	-	-	50	9	7	18
Oxford County	95	36	59	87	142	10	24	358	183	7	59

Oxford, West	56	4	35	20	100	8	-	167	-	12	20
Oxford, North	23	2	4	16	24	4	12	62	10	10	15
Oxford, Androscoggin Valley	48	11	30	15	172	8	28	264	1	9	14
Oxford, Riverside Park Association	22	18	20	22	50	14	36	160	36	18	12
Penobscot, West	43	19	50	55	44	3	18	189	25	10	38
Penobscot, North	40	9	15	20	36	8	15	103	-	4	9
Penobscot, Orrington	11	-	-	5	-	-	-	5	10	1	5
Piscataquis County	43	9	22	85	24	-	35	175	26	-	42
Sagadahoc County	50	42	115	83	90	10	71	330	20	74	240
Sagadahoc, Richmond Farmers' and Mechanics' Club	21	3	16	35	10	-	25	65	15	-	23
Somerset County	37	9	10	37	90	20	15	181	97	1	10
Somerset, East	61	5	15	47	22	8	35	132	-	11	24
Somerset, Central	35	5	6	24	48	6	-	89	10	-	27
Waldo County	14	12	23	24	76	6	34	141	23	1	12
Waldo and Penobscot	46	15	46	19	40	18	25	163	7	4	23
Waldo, Unity Park Association	37	8	21	8	12	11	18	78	31	3	2
Washington County	14	5	6	11	4	-	18	44	15	1	9
Washington, North	-	-	-	-	-	-	-	-	-	-	-
Washington, West	56	17	30	23	20	-	-	90	85	30	57
York, Shapleigh and Acton	5	1	-	14	110	6	-	131	7	2	26
York, Ossipee Valley Union	12	6	12	27	112	6	6	169	21	15	28
Total	1,652	440	1,118	1,160	2,438	306	816	6,008	1,093	525	3,118

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ANALYSIS OF AWARDS.

Name of Society.	Amount of premiums awarded trotting bred stallions.	Amount of premiums awarded trotting bred brood mares.	Amount of premiums awarded draft stock stallions.	Amount of premiums awarded draft stock brood mares.	Amount of premiums awarded family horses.	Amount of premiums awarded gentlemen's drivers.	Amount of premiums awarded matched carriage horses.	Amount of premiums awarded colts.	Amount of premiums awarded horses for draft.
Androscoggin County	$22 00	$9 00	$10 00	$10 00	$9 00	$15 C0	$12 00	$54 00	$27 00
Aroostook, Northern Maine Fair Association	26 00	-	52 00	20 00	24 00	15 00	-	103 00	50 00
Aroostook, Madawaska	4 00	-	2 00	3 50	3 00	-	2 50	7 00	4 50
Cumberland County	45 00	30 00	-	31 00	20 00	15 00	15 00	25 00	57 00
Cumberland, North	3 00	4 00	-	-	6 00	-	6 00	10 00	21 50
Cumberland Farmers' Club	3 00	3 00	-	-	-	10 00	-	9 00	17 00
Cumberland, Bridgton Farmers' and Mechanics' Club	18 00	6 00	-	6 00	6 00	25 00	7 00	18 00	35 00
Cumberland, New Gloucester and Danville	-	3 00	-	-	3 00	-	3 00	7 00	14 00
Cumberland, Lake View Park Association	2 00	-	-	-	-	-	-	-	-
Cumberland, Freeport	-	-	-	-	3 00	5 00	3 00	4 00	7 00
Cumberland, Freeport Poultry Association	-	-	-	-	-	-	-	-	-
Franklin County	20 00	6 00	9 00	3 00	20 00	20 00	13 00	16 00	40 00
Franklin, North	1 50	6 50	3 50	4 50	-	7 00	4 50	11 05	6 00
Hancock County	5 00	12 00	-	-	-	3 00	-	25 00	-
Hancock, North	-	-	-	2 25	2 00	1 50	2 00	2 75	18 00
Hancock, North Ellsworth Farmers' Club	-	-	2 00	-	-	-	-	1 00	-
Hancock, Eden	-	-	-	-	-	-	-	-	-
Kennebec County	22 50	33 00	9 00	22 00	9 00	9 00	6 00	30 00	28 00
Kennebec, South	5 25	2 50	-	3 75	4 15	4 75	-	39 00	14 00
Knox, North	3 15	3 15	-	-	3 15	2 63	3 68	11 55	17 28
Lincoln County	5 00	3 00	-	3 00	3 00	-	5 00	9 25	14 00
Lincoln, Bristol	-	-	-	-	-	-	-	-	-
Oxford County	59 00	27 00	-	-	-	59 00	25 00	68 00	78 00

Oxford, West	19 00	12 00	-	-	-	-	9 00	24 50	44 00
Oxford, North	-	3 00	6 00	3 00	1 50	-	-	6 00	49 00
Oxford, Androscoggin Valley	26 00	10 00	-	-	-	10 00	15 00	16 00	54 00
Oxford, Riverside Park Association	12 35	31 00	12 35	6 00	-	-	-	4 55	50 00
Penobscot, West	5 00	-	3 00	3 00	-	8 00	8 00	19 50	107 00
Penobscot, North	3 50	4 00	2 50	3 00	-	2 50	2 00	15 00	3 50
Penobscot, Orrington	-	-	-	2 50	-	4 50	-	6 00	-
Piscataquis County	10 00	6 00	5 00	6 00	-	5 00	11 00	7 50	62 00
Sagadahoc County	16 00	10 00	10 00	10 00	9 00	22 00	-	43 00	29 00
Sagadahoc, Richmond Farmers' and Mechanics' Club	2 50	1 00	2 00	1 00	1 75	-	-	4 00	3 25
Somerset County	10 50	4 50	-	3 50	3 50	4 50	-	20 00	18 00
Somerset, East	13 00	7 50	-	6 00	-	5 25	-	14 75	103 75
Somerset Central	8 75	6 00	2 00	4 50	-	4 50	-	7 00	7 00
Waldo County	-	5 00	-	3 00	-	-	5 00	8 00	-
Waldo and Penobscot	25 00	5 00	-	12 00	12 00	10 00	14 00	40 00	40 00
Waldo, Unity Park Association	9 50	6 00	9 00	6 00	6 00	6 00	6 00	24 75	12 00
Washington County	-	4 00	-	-	-	-	-	16 50	4 00
Washington, North	-	-	-	-	-	-	-	-	-
Washington, West	25 00	9 00	25 00	-	-	65 00	6 00	25 00	42 00
York, Shapleigh and Acton	-	-	-	-	3 50	3 00	-	-	-
York, Ossipee Valley Union	9 00	3 00	-	-	-	3 00	-	21 00	-
Total	$439 50	$275 15	$164 35	$178 50	$152 55	$345 13	$183 68	$773 65	$1,076 73

ANALYSIS OF AWARDS—Continued.

Name of Society.	Amount of premiums awarded thoroughbred bulls and bull calves.	Amount of premiums awarded thoroughbred cows, heifers and heifer calves.	Amount of premiums awarded grade cows, heifers and heifer calves.	Amount of premiums awarded herds.	Amount of premiums awarded working oxen and steers.	Amount of premiums awarded matched oxen and steers.	Amount of premiums awarded trained steers.	Amount of premiums awarded beef cattle.	Amount of premiums awarded town teams.	Amount of premiums awarded oxen and steers for draft.
Androscoggin County	$52 00	$80 00	$76 00	$20 00	$29 00	$30 00	$9 00	$19 00	$66 00	$52 00
Aroostook, Northern Maine Fair Association	182 00	379 00	25 75	66 00	14 00	-	-	-	-	-
Aroostook, Madawaska	-	-	5 50	-	6 50	4 00	3 00	-	5 50	4 50
Cumberland County	115 00	120 00	85 00	36 00	31 00	27 00	8 00	22 00	16 00	61 00
Cumberland, North	9 00	5 00	4 00	29 00	6 00	21 50	18 00	5 00	10 00	49 00
Cumberland Farmers' Club	29 00	41 00	32 00	39 00	27 00	13 00	-	14 00	27 00	23 00
Cumberland, Bridgton Farmers' and Mechanics' Club	37 50	54 00	12 00	14 00	12 00	38 50	5 00	6 00	36 00	53 00
Cumberland, New Gloucester and Danville	2 00	13 50	17 25	5 00	2 00	4 00	-	-	5 00	10 00
Cumberland Lake View Park Association	4 00	5 00	4 00	-	3 00	-	-	-	-	-
Cumberland, Freeport	8 00	4 75	1 00	5 00	-	-	2 00	-	-	-
Cumberland, Freeport Poultry Association	-	-	-	-	-	-	-	-	-	-
Franklin County	44 50	107 00	32 25	84 00	50 00	39 50	9 00	23 50	94 00	48 00
Franklin, North	2 50	19 40	9 75	8 00	4 50	7 90	1 50	8 00	21 40	6 00
Hancock County	-	25 00	45 00	-	40 00	25 00	-	15 00	-	30 00
Hancock, North	-	-	9 50	5 00	4 00	-	-	-	-	-
Hancock, North Ellsworth Farmers' Club	3 00	11 00	4 00	-	-	-	-	-	-	-
Hancock, Eden	6 00	12 00	8 00	-	-	-	-	-	-	-
Kennebec County	41 50	57 00	38 50	21 00	58 00	18 00	6 00	15 00	56 00	40 00
Kennebec, South	22 50	18 00	34 50	14 25	28 75	29 50	18 30	16 50	62 00	25 50
Knox, North	3 68	22 58	21 53	21 90	12 60	10 50	-	3 68	35 70	37 28
Lincoln County	8 50	19 00	21 50	-	9 00	17 00	1 50	6 50	26 00	35 00
Lincoln, Bristol	1 00	3 00	4 75	-	-	-	-	-	-	3 00
Oxford County	160 00	162 00	180 00	27 00	140 00	70 00	-	20 00	116 00	163 00
Oxford, West	63 00	95 00	25 00	-	23 00	30 00	-	12 00	68 00	100 00
Oxford, North	4 00	-	2 50	8 00	4 00	8 50	2 50	3 75	-	10 00

Oxford, Androscoggin Valley	17 00	36 00	11 00	23 00	9 00	66 00	5 00	9 00	60 00	39 00
Oxford, Riverside Park Association	.131 25	71 00	36 25	94 00	14 25	9 37	3 00	-	24 00	34 00
Penobscot, West	45 00	101 00	69 50	22 00	15 00	45 00	-	5 00	-	-
Penobscot, North	4 50	6 75	12 00	15 00	20 00	-	-	-	-	-
Penobscot, Orrington	-	-	4 00	-	-	-	-	-	-	-
Piscataquis County	21 00	50 50	44 00	23 00	20 00	2 00	-	-	-	-
Sagadahoc County	122 50	219 25	121 75	55 00	67 00	43 25	15 00	15 00	46 00	71 50
Sagadahoc, Richmond Farmers' and Mechanics' Club	2 75	6 50	4 40	3 75	1 05	1 60	50	-	-	-
Somerset County	7 25	9 00	30 50	6 00	15 50	13 75	-	12 50	22 00	18 00
Somerset, East	19 50	36 00	66 25	25 50	24 00	12 00	4 00	10 75	-	20 50
Somerset, Central	5 25	7 75	23 75	-	17 25	10 50	-	9 00	5 00	9 00
Waldo County	8 00	22 00	6 00	33 00	-	16 00	3 00	5 00	25 00	-
Waldo and Penobscot	41 00	100 00	50 00	92 00	30 00	34 00	12 00	46 00	33 00	29 00
Waldo, Unity Park Association	20 00	38 00	10 00	15 00	12 00	-	-	25 10	-	12 00
Washington County	15 00	10 50	22 00	22 00	6 50	-	-	-	-	-
Washington, West	74 00	88 00	65 00	-	65 00	-	-	-	-	10 00
York, Shapleigh and Acton	1 00	-	13 00	-	6 00	31 50	-	6 00	45 00	12 00
York, Ossipee Valley Union	17 00	35 00	40 00	12 00	54 50	28 00	1 00	9 00	50 00	64 00
Total	$1,350 68	$2,090 48	$1,328 68	$844 40	$881 40	$706 87	$127 30	$342 28	$954 60	$1,069 28

ANALYSIS OF AWARDS—Concluded.

Name of Society.	Amount of premiums awarded sheep.	Amount of premiums awarded swine.	Amount of premiums awarded poultry.	Amount of premiums awarded grain and root crops.	Amount of premiums awarded fruit and flowers.	Amount of premiums awarded bread and dairy products.	Amount of premiums Awarded honey, sugar and syrups.	Amount of premiums awarded agricultural implements.	Amount of premiums awarded household manufactures and needle work.	Amount of premiums awarded objects not named above.	Total amount of premiums and gratuities awarded.
Maine State Poultry and Pet Stock Association	-	-	$1,472 10	-	-	-	-	-	-	-	$1,472 10
Androscoggin County	$26 00	$16 00	80 00	$90 00	$73 50	$32 09	$12 50	$15 00	$94 00	$302 00	1,342 00
Aroostook, Northern Maine Fair Association	82 50	23 50	77 00	78 30	95 75	28 50	20 50	-	89 85	264 30	1,716 95
Aroostook, Madawaska	4 00	2 00	-	8 00	-	4 00	-	-	5 70	-	79 20
Cumberland County	20 00	12 00	52 00	22 50	8 75	24 00	-	-	25 75	12 00	936 00
Cumberland, North	-	19 00	3 75	14 00	2 00	6 50	-	-	9 50	-	261 75
Cumberland Farmers' Club	-	3 00	52 00	33 50	25 65	12 75	-	-	24 80	22 00	460 70
Cumberland, Bridgton Farmers' & Mechanics' Club	20 00	12 00	13 20	26 75	5 00	15 50	-	26 00	33 20	27 25	567 90
Cumberland, New Gloucester and Danville	3 00	22 00	6 00	18 75	15 05	14 55	17 50	-	21 65	51 50	258 75
Cumberland, Lake View Park Association	-	-	3 75	5 70	3 75	-	25	-	7 75	-	39 20
Cumberland, Freeport	3 50	6 75	23 40	9 45	13 60	3 25	1 50	-	15 85	72 90	192 95
Cumberland, Freeport Poultry Association	-	-	404 72	-	-	-	-	-	-	4 50	409 22
Franklin County	131 00	9 50	25 25	26 10	45 60	11 75	2 30	16 00	37 90	28 65	1,012 80
Franklin, North	13 05	1 00	2 45	10 30	6 45	3 65	3 80	-	15 20	3 40	192 80
Hancock County	15 00	10 00	15 25	65 00	25 00	14 00	8 15	-	35 40	8 00	420 80
Hancock, North	2 00	-	2 75	20 30	19 25	2 50	1 05	-	35 20	75	130 80
Hancock, North Ellsworth Farmers' Club	3 00	-	6 50	24 00	27 00	10 00	4 00	7 00	14 50	-	117 00
Hancock, Eden	1 00	7 00	3 00	34 55	12 10	2 00	-	-	10 55	-	96 20
Kennebec County	25 00	12 00	32 00	110 25	91 00	32 50	3 50	-	72 00	-	897 75
Kennebec, South	1 50	1 00	13 80	21 20	15 60	13 60	2 15	-	54 95	7 00	474 00
Knox, North	4 73	2 10	1 94	11 55	22 74	8 03	10 09	-	35 16	17 38	327 71
Lincoln County	1 00	4 25	26 50	27 50	30 05	6 75	2 00	-	26 75	9 00	320 05
Lincoln, Bristol	4 00	-	6 75	21 50	8 65	5 50	-	-	42 80	3 00	103 95
Oxford County	103 00	25 00	33 60	43 75	78 50	49 00	15 75	7 00	104 70	350 00	2,164 30

Oxford, West	-	22 00	25 00	22 00	17 00	15 00	7 00	-	25 60	53 38	711 48
Oxford, North	7 00	7 00	11 25	14 46	-	-	-	-	-	22 00	173 46
Oxford, Androscoggin Valley	2 00	2 00	5 20	21 15	17 25	9 25	1 50	6 00	24 10	79 10	573 55
Oxford, Riverside Park Association	12 00	11 50	12 50	6 25	8 35	8 55	4 00	-	26 20	60 20	682 92
Penobscot, West	13 50	4 00	20 25	26 80	26 15	11 50	6 45	-	77 45	43 54	685 64
Penobscot, North	-	3 00	4 50	32 00	40 31	6 00	5 50	-	40 00	-	225 56
Penobscot, Orrington	4 50	2 50	3 00	19 90	26 65	3 00	1 50	-	25 65	9 50	113 20
Piscataquis County	20 00	-	30 75	8 00	13 25	9 00	1 00	-	10 25	2 00	367 25
Sagadahoc County	17 50	60 00	151 50	122 00	112 25	73 00	6 00	3 75	121 20	336 50	1,928 95
Sagadahoc, Richmond Farmers' & Mechanics' Club	3 35	-	4 10	14 15	10 80	2 80	1 55	-	10 90	5 75	89 45
Somerset County	19 75	75	2 25	5 55	2 70	2 00	85	-	9 50	1 95	244 30
Somerset, East	-	4 00	14 00	27 75	11 75	6 15	2 25	-	15 10	27 25	477 00
Somerset, Central	4 00	-	20 25	6 25	9 75	4 00	2 00	-	5 25	2 00	180 75
Waldo County	26 00	-	7 50	6 00	14 00	2 00	-	-	47 65	5 00	247 15
Waldo and Penobscot	32 00	28 00	18 25	59 70	36 00	29 50	2 00	-	158 47	43 25	1,032 17
Waldo, Unity Park Association	14 25	3 00	1 50	37 10	27 75	10 50	2 25	1 50	37 00	11 25	363 45
Washington County	10 00	3 00	9 00	57 00	22 50	20 25	-	-	25 10	-	247 35
Washington, West	76 00	36 00	54 25	214 14	80 75	23 80	10 75	-	163 75	49 75	1,208 19
York, Shapleigh and Acton	3 25	2 50	16 00	65 00	32 00	7 00	5 00	-	28 25	66 75	346 75
York, Ossipee Valley Union	6 00	12 00	23 50	12 00	30 00	12 90	2 50	3 00	39 40	21 00	508 80
Total	$734 38	$389 35	$2,792 26	$1,500 15	$1,164 20	$556 53	$167 14	$85 25	$1,703 98	$2,023 80	$24,402 25

FINANCES.

Name of Society.	Amount received from State.	Receipts for membership.	Receipts from loans.	Receipts from entry fees for trotting purses.	Receipts from all other sources.	Total receipts.
Maine State Pomological	$1,000 00	$95 00	-	-	$103 34	$1,198 34
Maine State Poultry and Pet Stock Association	405 00	85 50	-	-	1,368 71	1,859 21
Androscoggin County	-	-	-	-	-	-
Aroostook, Northern Maine Fair Association	426 83	84 00	-	$504 00	4,888 99	5,903 82
Aroostook, Madawaska	32 17	48 00	-	-	-	80 17
Cumberland County	361 18	-	-	370 00	4,082 90	4,814 08
Cumberland, North	142 95	-	-	-	157 49	300 44
Cumberland Farmers' Club	147 37	79 00	$100 00	152 00	793 57	1,271 94
Cumberland, Bridgton Farmers' and Mechanic's Club	211 42	-	350 00	175 00	315 62	1,052 04
Cumberland, New Gloucester and Danville	103 16	15 00	-	165 00	920 93	1,204 09
Cumberland, Lake View Park Association	19 41	-	-	74 00	352 71	446 12
Cumberland, Freeport	-	2 00	-	259 25	747 43	1,008 68
Cumberland, Freeport Poultry Association	156 24	10 00	-	-	550 45	716 69
Franklin County	403 68	688 00	-	132 50	4,755 83	5,980 01
Franklin, North	106 78	252 00	-	183 50	1,202 83	1,745 11
Hancock County	140 09	-	-	86 75	1,480 70	1,707 54
Hancock, North	52 51	-	-	-	536 03	588 54
Hancock, North Ellsworth Farmers' Club	-	-	300 00	12 10	677 23	989 33
Hancock, Eden	47 45	-	-	-	437 35	484 80
Kennebec County	286 49	1 00	-	290 00	1,529 07	2,106 56
Kennebec, South	145 67	-	-	58 75	1,183 24	1,387 66
Knox, North	135 16	2 00	-	-	1,455 94	1,593 10

Lincoln County	102 69	18 20	-	-	1,289 83	1,410 72
Lincoln, Bristol	33 29	1 50	-	-	218 21	253 00
Oxford County	758 00	18 00	800 00	588 75	310 00	2,474 75
Oxford, West	296 53	180 00	-	362 50	2,932 46	3,771 49
Oxford, North	77 09	-	-	130 00	-	207 09
Oxford, Androscoggin Valley	166 55	9 00	161 61	263 75	1,477 55	2,078 46
Oxford, Riverside Park Association	300 58	-	-	225 00	637 85	1,163 43
Penobscot, West	217 21	20 00	-	285 00	1,312 50	1,834 71
Penobscot, North	70 24	15 00	-	-	239 76	325 00
Penobscot, Orrington	49 62	-	30 00	47 50	443 20	570 32
Piscataquis County	146 55	75 00	-	-	545 35	766 90
Sagadahoc County	742 48	437 00	4,000 00	860 00	5,353 42	11,392 90
Sagadahoc, Richmond Farmers' and Mechanics' Club	21 86	2 50	-	-	137 08	161 44
Somerset County	93 59	-	-	129 75	620 20	843 54
Somerset, East	181 19	138 50	100 00	340 00	1,514 04	2,273 73
Somerset, Central	69 43	20 00	-	26 20	690 00	805 63
Waldo County	85 58	120 00	-	613 00	1,844 66	2,663 24
Waldo and Penobscot	406 85	20 00	12 35	298 75	3,149 48	3,887 43
Waldo, Unity Park Association	140 23	-	-	215 25	587 50	942 98
Washington County	-	3 00	-	-	509 45	512 45
Washington, West	415 51	1 00	-	150 00	3,058 56	3,625 07
York, Shapleigh and Acton	140 91	208 00	60 00	-	34 33	443 24
York, Ossipee Valley Union	214 18	-	-	218 73	1,135 00	1,567 93
Total	$9,053 72	$2,648 20	$5,913 96	$7,217 05	$55,580 79	$80,413 72

FINANCES—Concluded.

Name of Society.	Amount expended in improvements.	Amount expended in trotting purses.	Expenses during the fair.	Amount expended for all other purposes.	Total amount paid out including premiums and gratuities.	Value of property belonging to the society.	Amount of liabilities.
Maine State Pomological	-	-	-	-	$1,407 97	-	-
Maine State Poultry and Pet Stock Association	-	-	$930 68	$491 65	2,894 43	$1,200 00	$1,859 21
Androscoggin County	-	-	-	-	-	-	-
Aroostook, Northern Maine Fair Association	$2,000 00	$1,300 00	800 00	86 87	5,903 82	10,000 00	700 00
Aroostook, Madawaska	-	-	-	-	79 20	-	-
Cumberland County	919 98	1,235 00	835 50	729 15	4,655 63	5,500 00	350 00
Cumberland, North	-	-	59 00	-	320 75	2,000 00	-
Cumberland Farmers' Club	116 70	425 00	221 03	112 34	1,335 77	2,500 00	250 00
Cumberland, Bridgton Farmers' and Mechanics' Club	169 08	525 00	75 00	60 00	1,396 98	4,000 00	2,025 00
Cumberland, New Gloucester and Danville	108 33	401 25	155 05	113 11	1,056 49	2,300 00	105 00
Cumberland, Lake View Park Association	-	264 00	31 65	75 70	410 55	900 00	-
Cumberland, Freeport	42 18	500 00	241 40	-	976 53	2,000 00	850 00
Cumberland, Freeport Poultry Association	93 07	-	163 75	5 72	671 76	250 00	75 00
Franklin County	745 76	877 50	1,282 28	-	3,918 34	12,850 00	-
Franklin, North	-	540 00	-	214 63	947 43	3,700 00	2,405 70
Hancock County	508 52	587 50	689 19	22 00	2,228 01	5,000 00	-
Hancock, North	20 00	-	435 00	-	585 80	150 00	-
Hancock, North Ellsworth Farmers' Club	100 00	99 00	100 00	300 00	716 00	2,000 00	350 00
Hancock, Eden	-	-	241 70	-	337 90	1,000 00	-
Kennebec County	116 00	650 00	250 50	90 75	2,005 00	4,000 00	1,505 00
Kennebec, South	35 00	463 75	360 19	475 58	1,808 52	2,000 00	-
Knox, North	225 00	300 00	624 29	222 15	1,699 15	1,500 00	575 00
Lincoln County	289 76	312 25	483 78	-	1,405 84	2,000 00	400 00

Lincoln, Bristol	27 71	–	105 18	32 50	269 34	1,200 00	115 84
Oxford County	496 91	1,337 48	723 44	748 78	5,470 91	12,000 00	400 00
Oxford, West	53 91	1,150 00	182 95	903 12	3,001 46	10,000 00	2,700 00
Oxford, North	–	375 00	100 00	–	648 46	2,500 00	–
Oxford, Androscoggin Valley	–	700 00	300 00	504 91	2,078 46	3,800 00	3,740 00
Oxford, Riverside Park Association	125 00	575 00	190 00	100 00	1,672 92	2,000 00	509 49
Penobscot, West	504 50	675 00	350 00	190 00	2,405 14	6,000 00	4,300 00
Penobscot, North	20 00	–	15 00	20 00	280 56	–	–
Penobscot, Orrington	25 60	227 50	50 00	130 80	547 10	1,000 00	30 00
Piscataquis County	35 00	85 00	150 00	359 65	996 90	–	500 00
Sagadahoc County	1,800 00	1,560 00	1,000 00	5,103 95	11,392 90	8,000 00	3,200 00
Sagadahoc, Richmond Farmers' and Mechanics' Club	1 00	–	26 00	45 55	162 00	100 00	56
Somerset County	–	325 00	146 65	37 57	753 52	800 00	–
Somerset, East	500 00	1,000 00	177 37	347 00	2,501 37	1,900 00	800 00
Somerset Central	50 00	262 00	323 95	–	816 70	2,500 00	1,350 00
Waldo County	440 10	1,760 00	221 84	331 40	3,000 49	6,000 00	1,460 10
Waldo and Penobscot	460 00	732 50	–	–	2,224 67	5,000 00	–
Waldo, Unity Park Association	75 00	497 00	242 00	–	1,177 45	–	234 72
Washington County	23 08	45 00	148 15	73 75	537 33	1,700 00	1,200 00
Washington, West	25 00	450 00	950 00	877 44	3,510 63	2,525 44	973 35
York, Shapleigh and Acton	–	–	17 50	12 60	376 85	2,000 00	–
York, Ossipee Valley Union	145 93	480 00	185 03	243 25	1,563 01	5,000 00	1,244 65
Total	$10,298 12	$20,716 73	$13,585 05	$13,061 92	$82,130 04	$137,875 44	$31,964 62

BULLETINS

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Bulletins 114 and 120 on Fertilizer Inspection, Bulletin 115 on Feeding Stuffs Inspection, and Bulletin 124 on Meteorology and the Treasurer's Report are not here included.

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

Agricultural Experiment Station,
Orono, Maine.

NOTES ON THE ROTTING OF POTOTOES DUE TO THE LATE BLIGHT FUNGUS.

(*Phytophthora infestans.*)

CHAS. D. WOODS.

During the past few years, in connection with experiments at this Station, considerable data have accumunlated on the rotting of potatoes due to the fungus that produces the late blight. Such as are believed to be of general interest are here reported.

ROTTING IN THE CELLAR DUE TO PREVIOUS INFECTION.

In 1902 a three-acre field of Green Mountain potatoes, which had been sprayed several times during the growing season and which had been kept practically free from the late blight, was harvested before the tops were dead, and stored in one bin in a cool cellar. The day of digging was warm and rather muggy. The tubers were fairly well dried off, however, before being put in the cellar. The following days were unusually warm for the season. At harvest there was very little evidence of rot. Perhaps there was one bushel of discolored potatoes in 100, but no really rotten potatoes were found. Early in November it was noticed the potatoes were rotting badly. They were carefully assorted and it was found that fully one-third of the crop was more or less affected with rot due to late blight.

As there were so few affected potatoes at harvest, and so much rot had developed in a few weeks, it was thought possible that the sound potatoes were infested after digging. To test this, two barrels of sound potatoes were selected at the time of assorting in November, and to each peck of sound tubers two potatoes showing unquestionable signs of incipient rot were added. To learn if the treatment of the tubers with different substances would tend to decrease the amount of infection, five lots of two barrels each of selected tubers were treated with (1) flowers of sulphur, (2) copper sulphate, (3) air slacked lime,

(4) Bordeaux mixture, and (5) a 3 per cent solution of formaldehyde. The 12 barrels were kept in the cellar until April. There was very little further rot in either the untreated or the treated barrels of potatoes. On the whole, about 90 per cent of the tubers were still perfectly sound and free from discoloration.

This seemed to justify the conclusion, which other tests have confirmed, that the danger of the transmission of rot due to the fungus which produces the late blight from one affected potato to another is remote. In this, as in other instances, the rot undoubtedly resulted from infection in the field. As the tops were kept green by the application of Bordeaux mixture and there were so little signs of the presence of the blight, the infection could hardly have been through the vines. The field was heavily dressed with stable manure only a short time before planting. There is little doubt that the fungus was carried to the field in the manure and that the tubers were directly infected, while the tops escaped the attack. This is in accord with the common experience so often noted before the use of Bordeaux mixture, that potatoes were more subject to blight and subsequent rot when grown on manure than on chemicals, or without the application of fertilizer of any kind. From the results of the experiments that follow, it is doubtful if there would have been anything like this loss from rot in the cellar, if the potatoes had been allowed to remain a few days in the ground after the tops had ripened, or after they had been killed by frost.

EFFECT OF TIME OF DIGGING UPON SUBSEQUENT DEVELOPMENT OF ROT.

In 1903 a variety test was conducted to study the differences in a few varieties in their abilities to resist blight. These results were given in detail in Bulletin 98 of this Station. Advantage was taken of this experiment to study the keeping qualities of the potatoes, comparing different varieties, sprayed with unsprayed, and early with late dug potatoes. At the distance these potatoes were planted and with a uniform stand, fifty-five hills almost exactly represents 1-300 acre. The yields at the time of digging are given in the following table.

Yields from fifty-five hills of ten varieties potatoes at time of digging.

Variety.	Date of harvesting.	UNSPRAYED.			SPRAYED.		
		Good—lbs.	Rotten—lbs.*	Small—lbs.	Good—lbs.	Rotten—lbs.*	Small—lbs.
Early Michigan	Sept. 8	55	19	4	78	3	7
	Oct. 7	52	21	7	78	1	7
Average		54	20	6	78	2	7
Bovee	Sept. 8	45	33	6	60	12	8
	Oct. 7	59	28	5	57	11	7
Average		52	31	6	59	12	......
Early Ohio	Sept. 8	18	40	5	49	22	6
	Oct. 7	32	38	3	68	16	8
Average		25	39	4	59	19	7
Gem of Aroostook	Sept. 8	46	24	5	71	20	9
	Oct. 7	74	36	5	72	13	5
Average		60	30	5	72	17	7
Irish Cobbler	Sept. 8	95	20	9	111	12	5
	Oct. 7	66	13	7	107	6	6
Average		81	17	8	109	9	6
Hulett's Rust Proof	Sept. 8	......	......	......	......	......	......
	Oct. 7	81	1	7	99	......	6
Mill's Mortgage Lifter	Sept. 8	68	24	4	......	......	......
	Oct. 7	82	25	5	82	......	3
Average		75	25	5	82	......	3
Green Mountain	Sept. 8	68	37	4	......	......	......
	Oct. 7	84	18	5	153	11	4
Average		76	28	5	......	......	......
Polaris	Sept. 8	63	40	5	......	......	......
	Oct. 7	59	41	6	105	20	7
Average		61	41	5	......	......	......
Maggie Murphy	Sept. 8	55	28	2	......	......	......
	Oct. 7	51	52	2	87	14	2
Average		53	40	2	......	......	......
Average of 5 earlier varieties	Sept. 8	52	27	5	74	13	7
	Oct. 7	57	27	5	76	10	7
Average of 5 later varieties	Sept. 8	54	27	5	75	11	7
	Oct. 7	71	27	5	104	9	6

* All discolored potatoes are here included.

The potatoes as soon as dug were put in bags, and stored in a cool cellar, so as to be kept dry and not subject to heat. The very last of December and early in January the potatoes were carefully assorted, and any potatoes that showed the slightest indications of even incipient decay, were rejected. In this, as in all such work by the Station, many potatoes were rejected that in ordinary sorting would be sent to market. The pounds of apparently sound potatoes that were put into the cellar at the date of harvest, the pounds of sound potatoes that were found about January 1 when the potatoes were next examined, and the percentage of potatoes that had remained sound, are given in the table which follows.

Merchantable potatoes from fifty-five hills of nine varieties of potatoes at time of digging and after storing.

Variety.	Date of harvesting.	Weights and Per Cent Merchantable Potatoes.					
		Unsprayed.			Sprayed.		
		At harvest —lbs.	Jan. 1 —lbs.	Per cent.	At harvest —lbs.	Jan. 1 —lbs.	Per cent.
Early Michigan	Sept. 8	55	27	50	78	51	66
	Oct. 7	52	44	85	78	69	89
Bovee	Sept. 8	45	10	22	60	39	65
	Oct. 7	59	53	90	57	52	92
Early Ohio	Sept. 8	18	11	61	49	36	73
	Oct. 7	32	29	90	68	63	93
Gem of Aroostook	Sept. 8	46	10	22	71	26	54
	Oct. 7	74	58	78	72	55	76
Irish Cobbler*	Sept. 8	95	62	65	111	72	64
	Oct. 7	66	64	97	107	93	87
Mill's Mortgage Lifter	Sept. 8	68	49	72	......	......	......
	Oct. 7	82	75	92	82	81	91
Green Mountain	Sept. 8	68	35	52	......	......	......
	Oct. 7	84	80	95	153	130	85
Polaris	Sept. 8	63	33	52	......	......	......
	Oct. 7	59	53	90	105	94	90
Maggie Murphy	Sept. 8	55	9	16	......	......	......
	Oct. 7	51	44	86	87	75	86
Average of 4 early varieties	Sept. 8	41	15	39	74	45	54
	Oct. 7	54	46	86	76	66	87
Average of 4 later varieties	Sept. 8	64	32	48	75	......	......
	Oct. 7	69	63	91	104	95	90
Average of 8 varieties	Sept. 8	54	23	43	......	......	......
	Oct. 7	62	55	88	......	79	88

* Omitted from averages.

Experiments made at the Vermont Station * showed that in the case of potatoes dug every 12 days, August 25 to September 30 in 1902, and every 7 days, August 31 to September 28 in 1903, there was a much larger weight of potatoes still sound at the time of the later digging than from the earlier diggings. This is in accord with the experiments here reported, except that

* The relation of date of digging potatoes to the development of rot; L. R. Jones and W. J. Morse, Proceedings Society for Promotion of Agricultural Science, 1904.

in the latter case the potatoes were subjected to the much severer test of three months storage.

CONCLUSIONS.

From experiments on the keeping of potatoes and upon the development of rot due to the late blight fungus, the following conclusions appear warranted:

The infection of the potatoes with the fungus occurs chiefly, if not entirely, in the field before digging.

The infection is usually the result of diseased vines.

The disease is transmitted, in the majority of cases, not directly through the vine, but indirectly through the soil.

Potatoes may be infected directly in the field from spores introduced in the manure, or from rotten potatoes spread upon or left in the land the preceding year.

Jones and Morse* conclude that the mycelium which produces the rot normally passes into a dormant stage after infesting the potato, but that abnormal conditions of moisture or temperature may cause abnormal activity in the fungus, and hence the rotting of the tubers.

Whatever may be the explanation, these experiments all agree in showing that, whether the vines have or have not been protected with Bordeaux mixture, there is far less liability of loss from rotting in the cellar in the case of late dug potatoes.

* Loc. cit.

EXPERIMENTS WITH DRY BORDEAUX.

CHAS. D. WOODS.

For a number of years dry Bordeaux has been upon the market. The best known is that made by Leggett and Brother, New York, and first sold under the trade name of fungiroid. This is made by using equal weights of lime and sulphate of copper. As used by us the past season, this dry Bordeaux carried practically the amount of copper claimed by the makers. It would therefore take 10 pounds of the dry Bordeaux mixture to furnish the same weight of copper as carried in 50 gallons of Bordeaux mixture prepared in accordance with the directions of this Station. Dry Bordeaux has been used successfully upon fruit trees, particularly in the middle west and southwest. Thus used it is greatly reduced with dry powdered lime. For potatoes the manufacturers recommend that it be reduced with one part of fine lime to 2 parts of dry Bordeaux. While it can be wet up and applied with a spray, it is designed to be used dry and applied with a powder gun.

In some localities it is a difficult problem to obtain the needed water for spraying and this, because of the labor involved, is, at times, the most expensive part of spraying. For this reason it was deemed of value to test dry Bordeaux applied as a dust against the ordinary Bordeaux mixture applied as a spray. Since it would be impracticable to use it on a large field while the foliage was still wet from dew, it was in this test applied in bright sun with the tops perfectly dry and even when the wind was quite strong. If it would not protect under these conditions, however valuable it might be for the garden where it can be applied on vines wet from dew or rain, it would be of no value for extended field use.

THE EXPERIMENT.

Two acres planted to Green Mountain potatoes, on the farm of John Watson, Houlton, were selected for the experiment. The field was planted about the twentieth of May and at the time it was selected there was a good even stand, and the field had been sprayed once, on June 28, with Bordeaux mixture and Paris green. One acre was dusted with 8 pounds of dry Bordeaux mixture on the following dates: July 5, 13, 20 and 28; August 3, 10, 16, and 22. July 5 and 13, Paris green was used with the Bordeaux. At no time were there potato bugs of any amount on the vines, nor did the flea beetle do any appreciable damage. Late in August there were more plant lice than usual, but not enough to damage the vines at all seriously. During the growing season there was no appreciable difference in the appearance of the dusted from the sprayed, except the dusted were lighter in color and the vines were less broken in the latter part of the season by the man walking through than by the horses on the sprayer. The darker color of the sprayed acre was more conspicuous at a distance and was doubtless due to the adhering Bordeaux mixture. At digging, the vines were dead on both plots from frost. At no time was there blight of any amount upon either acre. The yields were as follows:

Yield of potatoes upon one acre sprayed with regular Bordeaux and a corresponding acre dusted with dry Bordeaux. The fungicides were applied nine times during the season.

	Large bbls.*	Small bbls.	Rotten bbls.†
Regular Bordeaux mixture...........	122	17	none
Dry Bordeaux mixture...............	114	17	5

From the above results it would seem that the dry Bordeaux applied to dry vines is not effective in preventing blight and subsequent rot. It will be tested another season on damp vines to see if it is of value as a fungicide in garden culture of potatoes.

A Kansas manufacturer of dusting apparatus claims that ready prepared Bordeaux mixture is inert and that satisfactory results can be obtained by dusting on a mixture of finely pulverized copper sulphate and lime. The claim is made that these materials react as soon as moistened by dews and that the Bordeaux mixture thus freshly formed is as effective as the regular Bordeaux mixture applied as a spray. This will also be tested another season.

* One barrel is 2¾ bushels or 165 pounds.

† All discolored potatoes are included under rotten.

SOLUBLE BORDEAUX FOR POTATO BLIGHT.

CHAS. D. WOODS.

In the preparation of Bordeaux mixture from slacked lime and sulphate of copper, a chemical change takes place whereby hydrate of copper and sulphate of lime (gypsum) are formed. Both of these materials are insoluble in water, and Bordeaux mixture consists of these materials mechanically suspended in water. The gypsum is so heavy that, unless the mixture is kept thoroughly stirred, it will speedily separate out and bring down with it the lighter hydrate of copper. This necessitates the use of an agitator, and much of the unsatisfactory work of the spray as applied by some of the outfits on the market is due to imperfect agitation. Commercial Bordeaux mixtures have been made in which part of the gypsum has been taken out. Such mixtures are more easily kept in suspension, but there has not been sufficient gain to compensate for the extra labor involved in the preparation of such Bordeaux mixtures. For many years it has been known that the addition of sugar would render the hydrate of copper soluble. If the sugar is added to the slacked lime and allowed to stand for some time before adding it to the sulphate of copper solution, hydrate of copper, soluble in water, with only a trace of gypsum results.

Obviously Bordeaux in solution would present many desirable features. The director of the Wisconsin Experiment Station wrote that they were to experiment during the season of 1904 with such a Bordeaux mixture and invited the co-operation of this Station to test its efficacy upon potatoes in order that data might accumulate faster. Some of the possible merits of this new Bordeaux mixture were pointed out as follows:

"It is believed, on account of the soluble condition of the copper hydrate in this preparation, that its efficiency as a fungicide will be much greater than in the ordinary Bordeaux mixture, and consequently that it may be diluted at least ten and possibly fifty times and still protect plants from the ordinary fungus diseases. In addition to this advantage, the absence of solid particles permits the use of a much finer spray than is now employed, and it is evident that with a fine spray much more surface can be covered with the same amount of material. In these two ways it is hoped that the expense for the materials used in spraying may be greatly reduced."

The soluble Bordeaux used in the experiments here reported was prepared in accordance with the following directions furnished by Dr. S. M. Babcock, chemist to the Wisconsin Agricultural Experiment Station.

PREPARATION OF SOLUBLE BORDEAUX.

1. Copper sulphate solution—Dissolve 1 tb. of copper sulphate in 2 gallons of cold water. Will keep indefinitely.

2. Solution of sucrate of lime—Slake 10 tbs. fresh lime in 30 tbs. of water, strain the milk of lime through a wire strainer and add a solution of 25 tbs. of granulated sugar in 50 tbs. of water. Stir thoroughly at frequent intervals, and after two or three hours decant or siphon the clear liquid from the undissolved lime. The lime and sugar solution can be conveniently mixed in a revolving barrel churn.

The quantities named are sufficient for about 8 gallons of standard solution of sucrate of lime.

The solution will keep indefinitely if placed in well stoppered bottles, but if open to the air will gradually absorb carbonic acid gas and the lime will separate.

After siphoning off the clear solution, the residue still contains some sugar which may be recovered by adding considerable water and allowing the residue to settle a second time. The clear solution obtained may be used in place of an equal quantity of water in the preparation of the next lot.

SOLUBLE BORDEAUX.

Take equal parts of solution 1 and 2 and add three parts of water. Agitate until the copper hydrate which is at first precipitated is entirely dissolved. Upon standing, a slight deposit of gypsum is formed, leaving a deep blue solution of hydrate of copper. If desired, the spray may be applied immediately after preparation, as the small amount of finely divided gypsum will not interfere. Prepared in this manner, the solution contains about the same amount of copper hydrate as the ordinary Bordeaux mixture. It may be diluted indefinitely with water without a precipitate forming. The solution should be kept in well stoppered bottles and is best if used within 48 hours after preparation.

In case complete solution of the copper hydrate is not obtained, add a little more of solution No. 2 of sucrate of lime. As prepared, the soluble Bordeaux is, because of the sugar, much more expensive than regular Bordeaux carrying the same amount of copper. In the experiments here reported the soluble Bordeaux carried about one-half, one-fourth and one-seventh as much copper as the usual mixture.

The field of potatoes selected for the experiment was upon the farm of Mr. Clarence A. Powers, Maple Grove. It was planted to Green Mountains, and the rows were of such length that 12 rows made about an acre. The rows ran east and west. The field was apparently quite uniform, and sloped slightly toward the south and east. The potatoes were liberally fertilized, and thoroughly cared for during the growing season. The soluble Bordeaux as well as the regular Bordeaux mixture was applied with a one-horse Getchell sprayer that was provided with a powerful pump and an agitator that kept the solutions thoroughly stirred. Vermorel nozzles were used, so that with the pressure obtained the materials were all applied in a fine spray.

The arrangement of plots and their treatment was as follows:

Plot A. Twelve rows (one acre) on south side of field, sprayed with regular Bordeaux mixture.

Plot B. Twelve rows (one acre) next north were treated with soluble Bordeaux at such a rate that the copper applied at each application was equivalent to about 2⅔ pounds of sulphate of copper to the acre.

Plot C. Twelve rows (one acre) next north were treated with soluble Bordeaux equivalent to 1⅓ pounds of sulphate of copper each application.

Plot D. Twelve rows (one acre) next north were treated with soluble Bordeaux equivalent to 2/3 pounds of sulphate of copper per acre each application.

Plot E. Twelve rows (one acre) next north were sprayed with the regular Bordeaux mixture.

DATES OF SPRAYING AND NOTES.

July 8. (The soluble Bordeaux experiment had not at this time been planned.) The whole field was sprayed with regular Bordeaux mixture. The plants were in early bloom.

July 15. Plots A and E sprayed with 2-3 pound Paris green and 3 pounds lime. Plots B, C and D sprayed in both directions with soluble Bordeaux and 2-3 pound Paris green.

July 22. Plots A and E sprayed in both directions with regular Bordeaux mixture and 2-3 pound Paris green per acre. Other plots sprayed as the 15th.

July 27. All plots sprayed on the 22d, except that no Paris green was used.

July 29. All plots in fine shape. No signs of disease.

August 5. Potatoes in full bloom. No signs of blight. Very few rumors of any blight in the county.

August 10. All plots sprayed as before, but without Paris green.

August 13. Quite a few plant lice on some plants on all the plots.

August 20. Possibly a little blight on soluble Bordeaux plots. Plant lice are doing some damage.

September 1. Quite a heavy frost. But little damage on this field.

As will be observed from the notes, this field was sprayed only 4 times, or about half the number that is desirable. As it proved in this particular year, it was apparently sufficient to keep off blight and rot. At digging there was no sign of rot upon the potatoes from the plots treated with regular Bordeaux mixture.

YIELDS.

Through a misunderstanding, the potatoes on plot E were dug in the absence of a Station representative, and while the yield was taken, it is so much larger than that on the other plots that it may have been an error. There were so few small potatoes and practically no rotten ones that no separation was made in the field.

Yield plot A, regular Bordeaux, 103 barrels.

Yield plot B, soluble Bordeaux 2 2/3 pounds copper sulphate, 102 barrels.

Yield plot C, soluble Bordeaux 1⅓ pounds copper sulphate, 97 barrels.

Yield plot D, soluble Bordeaux ⅔ pound copper sulphate, 91 barrels.

Yield plot E, regular Bordeaux, 120 barrels.*

The potatoes on plot D were smaller than on the other plots and the skins of many of them darkened somewhat, resembling rot. Still, only a very few were rotten.

The experiments at the Wisconsin Station, through unavoidable complications, were a failure. In experiments upon potatoes made at the New York (Geneva) Experiment Station in 1903 the yields per acre were as follows: Unsprayed, 107 bushels per acre; soluble Bordeaux, 118 bushels per acre; soda Bordeaux mixture, 160 bushels per acre; regular Bordeaux mixture, 175 bushels per acre.

CONCLUSIONS.

The soluble Bordeaux of equal strength to regular Bordeaux mixture costs much more, both in materials and labor, than regular Bordeaux mixture. The yields were smaller and the quality inferior from the plots sprayed with soluble Bordeaux. For both of these reasons its use is not recommended.

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* Yield not taken by a station officer.

EXPERIMENTS WITH POTATOES ON HOME MIXED FERTILIZERS.

CHAS. D. WOODS.

In answer to numerous inquiries for a formula for potatoes in which tankage could be used, the following newspaper bulletin was sent out and generally printed in the papers of the State in the early spring.

A crop of 300 bushels of potatoes removes from the soil about 55 pounds of nitrogen, 25 pounds phosphoric acid and 85 pounds potash. A formula on this basis would carry five parts nitrogen, two parts phosphoric acid, and eight parts potash.

In preparing a field for a crop, the needs of the soil to render it fertile are, however, of greater moment than the special needs of a particular crop. The results of numerous field experiments indicate that the potato does best in a soil abundantly supplied with all fertilizing elements.

If a farmer has not experimented with his soil so as to know to what fertilizing elements it most readily and profitably responds, he must use a formula, and one carrying about 3 to 3½ per cent nitrogen, 5 to 6 per cent available phosphoric acid, and 4 to 5 per cent potash will usually be found as profitable as any. Bearing in mind that there is no such thing as a "best" fertilizer and that different conditions make different demands, some such formula as the following can be satisfactorily used per acre until, by experimental knowledge of his own soil requirements, the individual farmer has learned a better one.

One hundred pounds nitrate of soda, 200 pounds cottonseed meal, 500 pounds fine bone tankage, 400 pounds acid phosphate, and 200 pounds muriate, or perhaps better, sulphate, of potash. These goods are very concentrated and would probably be more evenly applied if mixed with 500 pounds dry loam, muck, or some similar fine material. This weight of materials would carry 62 pounds nitrogen, of which about two-fifths is water soluble, 158 pounds phosphoric acid, of which two-thirds is available, and 102 pounds potash.

While the 100 pounds of available phosphoric acid in this formula is about four times the amount removed by the crop, the best experimental evidence indicates that a liberal application of available phosphoric acid is profitable for potatoes. Since phosphoric acid does not leach from the soil, the excess will be available for the following grain and grass crops. Following a crop of potatoes manured as above, usually a good crop of clover could be grown by the use of 200 pounds per acre of a complete fertilizer for a "starter," and 200 pounds of muriate of potash. This last with the phosphoric acid left in the soil would furnish the needed minerals, and the clover would obtain its needed nitrogen from the air.

Nitrate of soda carries about 16 per cent nitrogen, all of which is water soluble. High grade cottonseed meal, carrying 43 per cent of protein, has about 7 per cent nitrogen, 2 per cent phosphoric acid and 1 per cent potash. High grade finely ground bone tankage carries 5 to 6 per cent nitrogen, about one-third of which is water soluble, and about 15 per cent phosphoric acid, one-half of which is available. Muriate or sulphate of potash each carry about 50 per cent potash.

As the result of correspondence on this subject, the writer assisted farmers in Brunswick, Houlton and Fort Fairfield in mixing goods for use with potatoes. The formula used at Brunswick was: Portland Rendering Company's screened tankage 500 pounds; cottonseed meal 200 pounds; nitrate of soda 100 pounds; acid phosphate 400 pounds; and sulphate of potash 200 pounds. This 1,400 pounds of materials carried nitrogen 55 pounds; available phosphoric acid 103 pounds; total phosphoric acid 154 pounds; and potash 103 pounds. The percentage composition as found by analysis was water soluble nitrogen 1.39 per cent; insoluble nitrogen 2.52 per cent; total nitrogen 3.91 per cent; water soluble phosphoric acid 4.51 per cent; citrate soluble phosphoric acid 2.84 per cent, making the available phosphoric acid 7.35 per cent; insoluble phosphoric acid 3.67 per cent and total phosphoric acid 11.02 per cent; and potash 7.38 per cent. This was used by several farmers in Brunswick. The fields were not visited by the writer. Mr. W. S. Morrill, Brunswick, who was especially interested in having the formula for his own use, wrote relative to the yields as follows: "The yield as compared with last year (1903) was light—on the whole about 50 per cent of that crop. This was due to the season and not the fertilizer. Only one (Mr. Hill) tried the home mixed in comparison with regular ready mixed goods. The difference between the two, while not very marked, was slightly in favor of the home mixed. All that used the formula are perfectly satisfied with their crop, taking all things into consideration, and will surely use the home mixed goods next season."

Mr. J. W. West of Auburn used the home mixture and reports as follows: "It gives me pleasure to reply to your letter of the 19th inst., in regard to the "home mixed fertilizer" compounded by the formula that you published in the Station bulletin last spring.

"I used 500 pounds bone takage from the Portland Rendering Company, 400 pounds plain phosphate, 200 pounds sulphate or potash, 200 pounds cottonseed meal, and 100 pounds nitrate of soda, thoroughly pulverized and mixed without any carrier. The materials cost at the average rate of about $1.50 per 100 pounds.

"One-half ton of it was used for potatoes on five-eighths of an acre. The soil is a sandy loam, recently cleared and seeded to grass. A portion of the plat was a black loam and rather wet. It was broken up last fall and harrowed thoroughly with a spring tooth and disc harrow. About 500 pounds of the fertilizer were spread broadcast and harrowed in. The ground was then furrowed, and the balance scattered in the hill and mixed with the soil before dropping the seed. This was planted the last of May, using the Green Mountain and Carmen No. 1 varieties. They were sprayed three times with Bordeaux mixture and Paris green. They should have been sprayed once or twice more to kill the bugs which were very plenty, but the press of other work prevented. The vines remained green until the heavy frosts in September. They were dug soon after, yielding 150 bushels full measure (or at the rate of 240 bushels to the acre). There was not over a bushel rotten at the time of digging, but they have rotted some since."

Mr. O. Y. Russell of Danforth used the home mixture and reports as follows. "The formula for potatoes, as I used it, was

100 pounds nitrate of soda, 500 pounds bone tankage, 400 pounds acid phosphate, 200 pounds sulphate of potash, 200 pounds cottonseed meal. I planted four barrels of potatoes, and when I hoed them I estimated that nearly one-third of the seed did not come on account of the wet. I used 1,200 pounds of the mixture on the piece and I got 80 barrels of good ones, and 10 barrels of small ones. I used no barn dressing. I broke up the piece late last fall. It has been down to grass about eight years, and cut about ½ ton to the acre last year. I did not use it in comparison with any other fertilizer, but I think it gave me better results than any other fertilizer I ever used. Several of my neighbors will use it next year."

Several others who used the formula made more or less complete reports to the Station. None of them seemed to have experienced any difficulty in the preparation and application of the home mixed goods. The nearest to a complaint as to the effect of the fertilizer was from a man who called the writer up by telephone at the time of digging and said " the potatoes are so large and the yeild so great that the work of digging is greatly increased because of the fertilizer."

These cases are typical of the results obtained outside of Aroostook county. While the formula gave satisfaction, the writer believes that the modifications suggested on pages 140 to 143 of Bulletin 107 would in most instances be found advantageous.

The materials for the home mixed goods used at Houlton and Fort Fairfield were bought at one time and were all mixed at Houlton. The formula was: Portland Rendering Company's (rescreened) tankage 420 pounds; acid phosphate 400 pounds; cottonseed meal 200 pounds; sulphate of potash 200 pounds; and nitrate of soda 100 pounds. Analysis showed the mixed goods to have the following composition: Water soluble nitrogen 1.37 per cent; available nitrogen 2.72 per cent; total nitrogen 4.09 per cent; available phosphoric acid 7.01 per cent; total phosphoric acid 9.87 per cent; and potash 7.61 per cent.

It was designed to apply this at the rate of the 1,320 pounds per acre, but it was actually used quite differently by the different co-operative experimenters. One acre or more was grown upon this formula by John Watson, Houlton, W. S. Blake, Houlton, A. H. Porter, Houlton, E. L. Cleveland, Houlton, R. S. Hoyt, Fort Fairfield, C. A. Powers, Fort Fairfield, F. H. Haines, Fort Fairfield.

The field at Mr. Watson's was planted, grown and harvested under the oversight of the Station. Mr. Powers' and Mr. Hoyt's fields were frequently visited during the growing season and most of the haresting was under the care of a member of the Station staff. The other fields were, as shown by the yields, well cared for and the data are believed to be accurate. The results at harvest, so far as returns have been obtained, and extracts from the notes taken at different times, follow. Beyond these data, the results are briefly discussed.

At Mr. Watson's, 3 acres were grown upon the home mixed in comparison with the same number of acres grown on Watson's Improved High Grade Potato Manure. The whole formula (1320 pounds per acre) was used, about 1100 at time of planting and the remainder at first cultivation, when the potatoes were breaking through the ground. About the same weight of Watson's Improved High Grade Potato Manure was used, about 1200 pounds at planting and the remainder when the potatoes were breaking through the ground. The potatoes were well cared for during the season. They were sprayed 9 times with Bordeaux mixture, to which at the first 3 sprayings Paris green was added. The field was free from the potato bug, was not damaged by the flea beetle and only slightly by plant lice. There were no signs of blight and no rot at harvest. The whole field was too immature when killed by frost, and the home mixed plots were not as mature as the Watson Improved plots. The comparison would have been fairer if the field had been planted a fortnight earlier, or frost had held off longer. The potatoes on the home mixed plots were all smaller and less matured than on the Watson Improved plots. Each plot contained one acre. The details are given in the table on the top of page 22.

Yields of potatoes grown on home mixed fertilizers compared with a standard potato fertilizer.

	Barrels of Potatoes.		
	Large.	Small.	Total.
Home Mixed Fertilizer.			
Plot 1	109	15	124
Plot 3	101	20	121
Plot 5	112	18	130
Average	107	18	125
Watson's Improved Manure.			
Plot 2	118	15	133
Plot 4	120	15	135
Plot 6	122	17	139
Average	120	16	136

Mr. Blake grew 4 plots upon home mixed and 4 plots upon Watson's Improved. The plots were 1-20 acre in area. On the home mixed the fertilizer was used at the rate of 975 pounds per acre and on the other plots Watson's Improved was used at the rate of 1450 pounds per acre. The field was quite early planted, and the potatoes were well along when frost came. It was sprayed 5 times and was free from blight, and no rot. There were practically no small potatoes.

The yield from the home mixed plots were, per acre, as follows: 102, 107, 107, 109, average 106 barrels per acre. The yield from the Watson's Improved plots were, per acre, as follows: 107, 111, 111, 113, average 110½ barrels per acre.

Mr. Porter grew two acres on home mixed, using it at the rate of 1300 pounds per acre in the midst of a field of 27 acres planted with 1700 to 1800 pounds per acre of Watson's Improved. The rows were 32 inches apart, and the plants 12 inches apart in the row. The land was very uniform, was early planted, well cultivated and kept free from weeds. It was sprayed 6 times. There was no blight and no rot at digging. There were practically no small potatoes. The yield from the 27 acres was 3800 barrels or at the rate of a little over 140 barrels per acre. Mr. Porter did not measure the yield from the home mixed portions, but states that "there was no perceptible difference in appearance or yield."

Mr. Powers at Maple Grove grew several acres on home mixed compared with Darling's Blood, Bone and Potash. The plots alternated. On the home mixed there was used 960 pounds per acre, against 1,000 pounds of Darling's. The yields from the home mixed plots ran from 115 to 123 barrels, with an average of 119. The yields from the two of the plots where Darling's Blood, Bone and Potash were used were 118 and 119 barrels per acre. One plot ran considerably below this, but it was evidently due to the condition of the land. There was practically no difference in the yield with the different fertilizers. The potatoes were quite early planted and while at the first killing frost the home mixed were greener, they were sufficiently matured so as not to materially affect the yield or the appearance of the tubers.

Mr. Hoyt at Maple Grove grew three acres, one each of White Elephant, Dakota Red, and Green Mountain, on home mixed fertilizer in a large field where Crocker's fertilizer was used. The home mixed was applied at the rate of 975 pounds per acre, and the Crocker's at the rate of 1000 pounds. The field was well cared for, including spraying. There was neither blight nor rust. The yields were as follows per acre:

White Elephant	On home mixed, 96 barrels large, 8 barrels small. On Crocker's, 100 barrels large and 6 barrels small.
Green Mountain	On home mixed, 118 barrels large, 9 barrels small. On Crocker's, 124 barrels large, 10 barrels small.
Dakota Red	On home mixed, 113 barrels large, 3 barrels small. On Crocker's 118 barrels large, and no small.

The potatoes were smaller on the home mixed and the vines were tenderer and were killed by frost earlier than on Crocker's.

CONCLUSIONS.

In general, large crops were obtained on the home mixed goods. On early planted potatoes, and where the season was long enough for the crop grown on the home mixture to mature, the yields were as large as where the standard commercial fertilizers were liberally used. The tops kept greener in color during the last half of the growing season with the home mixture. September 1, there was a severe frost all over Northern Maine. The late potatoes grown upon the home mixture had greener and more succulent vines than those upon the standard fertilizers and in consequence were damaged much more by the frost. In fact, the vines of the late planted potatoes on the home mixed goods were practically killed at this time, while the same varieties planted at the same time upon the standard potato fertilizer continued to grow after this frost. As a result, the potaoes were larger and better ripened with these than upon the home mixed plots. For quick maturing, the home mixed goods apparently carried too much slowly available nitrogen and too little available phosphoric acid—a condition that can be readily remedied in a formula. This is discussed on pages 140 to 143 of Bulletin 107 of this Station.

SUMMARY OF EXPERIMENTS IN PRACTICAL HORTICULTURE.

W. M. MUNSON.

In the horticultural work of the Experiment Station two distinct lines are kept in view: a study of the principles and laws affecting plant growth; and practical investigations for immediate guidance in the culture of fruits and vegetables. Mere variety testing, as such, has never occupied a leading place in the plan.

To be of value, work must extend uninterruptedly over a series of years, and general principles can be established only after repeated efforts; so that immediate "practical" results are not always possible. The following notes represent, in brief, a summary of the more immediately practical phases of the work which has received attention, with references to the particular bulletin or annual report where the details are published in full.

VEGETABLE GARDENING.

Vegetable gardening, while not of the commercial importance of some other lines of horticultural work in Maine, is nevertheless of interest and direct value to every citizen of the State—whether farmer or laborer or professional man. The leading questions considered have to do with the tomato, cabbage, cauliflower, egg plant, corn, radish and celery; also with the forcing of vegetables under glass.

Tomato.

With the tomato, the following questions were considered: The effect of trimming the vines; effect of bagging the fruit to produce early ripening; the effect of crossing; the cumulative effect of culture under glass.

It was found that a chill to tomato plants after setting is not necessarily fatal to success, and that, other things being equal, the earliness and productiveness of tomatoes were in direct ratio with the earliness of setting in the field. Unless conditions are very unfavorable, the plants should be in the field by June 1st. Trimming the plants after a part of the fruit had set, increased the yield by more than one-third. The results from bagging the fruit were in general of a negative character, but this treatment reduced the loss from rot. Crossing between small fruited plants of prolific habit and the ordinary large fruited type was found to be a promising method of securing a valuable type for localities where the season is short, and for securing a productive sort for forcing under glass. The increase in yield of the Lorillard-Peach cross over that of the pure Lorillard was nearly 50 per cent. A derivative hybrid between Lorillard and Currant produced a type of special excellence for forcing. In some instances seed from plants grown under glass gave better results in house culture than did seed of the same variety grown in the field. Results were not uniform, however, and there appeared to be distinct varietal differences. (Reports for 1891-5.)

Cabbage.

Cabbage studies included investigations as to the importance of deep setting of the plants; the effect of trimming at the time of setting; the frequency of transplanting; the effect of mulching.

Contrary to the general notion concerning the treatment of "leggy" plants, it was found that depth of setting had very little influence upon the size of the heads. Plants handled three or four times invariably gave better results than those handled once or twice before transfer to the field. Frequent transplanting increased the average size of the heads. Handling the plants in pots before setting in the field increased the percentage of marketable heads; but trimming the plants at the time of setting appeared to be of no special importance. The practice of mulching instead of cultivating was found to give very satisfactory results. (Reports for 1891-5.)

Cauliflower.

Work with the cauliflower included studies of the relative influence of pot and box culture of young plants; the effect of trimming at time of setting in the field; the effect of mulch as compared with frequent cultivation; a comparison of varieties.

Plants handled in pots were kept at a more nearly uniform rate of growth, and produced a higher percentage of marketable heads; this difference in some cases amounting to 20 per cent. As a result of trimming it was found that there was practically no difference in earliness nor in size of head, while as a rule the per cent of heads formed was greater from plants not trimmed. In no case were as satisfactory results obtained from the mulching as from frequent cultivation.

Nearly all the leading varieties have been grown, and it is evident that the cauliflower may be successfully cultivated in this region. The most valuable sorts are of the Dwarf Erfurt and Snowball types, with Algiers for late in the season. (Report for 1893 and Bulletin 10.)

Egg Plant.

Egg plant studies included methods of culture; varieties; and crossing.

It was demonstrated that with careful treatment the egg plant may be successfully grown in central Maine, the most important requisites being: early sowing; vigorous plants; late removal to the field; warm, rich soil. Most of the well-known varieties are too late for this climate, but Early Dwarf Purple, Early Long Purple and Long White were satisfactory. Several crosses were made between white-fruited and black-fruited types. After four years of breeding it was found that no type sufficiently constant in color to be of value commercially was produced. There was, however, a marked increase in vigor and productiveness as a result of crossing. In the first generation the purple-fruited types seem stronger in their power to transmit color to the offspring than do the white-fruited types; and this law appears to hold whether the purple type is used as the male or the female parent. In later generations the inherent strength of the white-fruited types appears stronger than in the first. In all cases the white-fruited types appear stronger than the purple in the power to transmit form and productiveness. (See Annual Reports, 1891-3.)

Radish.

With the radish, the principal questions considered have been, the relative value of large and small seed; the effect of sub-watering in the greenhouse; the influence of different temperatures upon the period of maturity.

Large seeds were found to produce from 30 to 50 per cent more first-class roots than did small seed from the same lot. Sub-watering produced 12 to 15 per cent more first-class radishes on a given section of the greenhouse bench than did surface-watering on an equal area of the same bench. There was a much greater loss from damping off on the surface-watered section. Contrary to the usual notion, the crop matured earlier, and was of better quality, when grown in the tomato house, with a night temperature of 60 degrees, than when grown at a lower temperature. (See Annual Report, 1898.)

Celery.

The work with celery was mainly in the way of demonstration, and for the purpose of calling attention to this very useful garden plant. The questions of soil, fertilizers, planting, handling, blanching and storing were considered. (See Annual Report 1897 and Bulletin 40.)

WINTER GARDENING.

Principles and methods of building, heating, and ventilating greenhouses, and of managing the more important crops grown under glass, were discussed. In brief, it may be said, constant watchfulness and the exercise of good judgment are of more importance than adherence to set rules. One good man with occasional help should be able to do all of the work in houses covering 4,000 square feet of ground surface. In general, solid beds are advocated for plants requiring no bottom heat, such as cauliflower, lettuce and radishes, while for semi-tropical plants, like melons, beans, and tomatoes, benches are preferred. For large commercial houses, steam is the best method of heating, but for smaller houses hot water is preferable. (Annual Report, 1896.)

ORNAMENTAL GARDENING.

The ornamentation of rural homes is of the highest importance to the people of Maine, not only as a means of adding to the comfort and pleasure of home life, but as an attraction for the increasing number of summer visitors and as a means of enhancing the value of the property. For this reason suggestions were made concerning the location of buildings; construction of walks and drives; making of lawns; what, when and how to plant; native trees and shrubs valuable for planting; the best hardy sorts to get from nurseries; trees and shrubs tried and found wanting. (Annual Report 1897, and Bul. 42 and 46.)

FRUIT GROWING.

Fruit growing undoubtedly offers better opportunities than any other line of commercial horticulture in Maine, and its increasing importance demands more special attention on the part of the Experiment Station in the future. From the nature of the case, results are necessarily slow; but a large amount of work has been done, and partial reports have been made. Briefly summarized, the following statement indicates the nature and scope of this work:

Since 1890 the Station has had under observation, both at the home orchard and in northern Maine, hardy fruits from Russia and from the Northwest. All of these varieties are hardy and most of them are productive; very few of them, however, are worthy of general dissemination in those parts of Maine where the well known varieties of English and American origin will thrive. In the extreme northern part of the State some of them are valuable, and a few are worthy of culture under any conditions. (See Annual Reports, 1891, '92, '96, and Bulletin 82.)

Many fruits of unknown, or of doubtful value in this State, are sold by agents every year. For the information of growers, a catalogue of the leading sorts was prepared with a statement as to their character, quality and value for home use or for market, both for the northern and for the southern counties. (Annual Report 1893 and Bulletin 6.)

For a study of the comparative effect of cultivation and mulching, as well as for experiments with fertilizers, a young orchard in Kennebec county was selected in 1898. In the same region an old orchard is the basis of work in orchard renovation; and more recently another young orchard has been chosen for experiments in top-grafting. Studies in the use of cover crops are made in the Station orchard at Orono, and in orchards in other sections of the State. From data thus far published, it is found that, in the case of the Gravensteins, the number of trees producing some fruit was nearly 50 per cent greater on the cultivated than on the mulched land; while the average yield was as 72 and 59 respectively.

The use of different forms of potash as a factor in preventing apple scab gave negative results, agreeing in the main with results published elsewhere.

In the work of orchard renovation, the effect of cultivation was visible a half mile distant, the foliage being large, dark and healthy, as compared with the small, pale, sickly leaves on the adjacent check trees. The plot receiving complete fertilizer presented the best appearances at the end of the growing season. (For details see Bulletin 89.)

SPRAYING.

Spraying with fungicides and insecticides has received considerable attention, especially in the years 1891-5. Among the questions studied are the following: The effectiveness of the treatment in producing perfect fruit; the relative number of windfalls on sprayed and unsprayed trees; the preparation of spraying mixtures; the best time for spraying.

All trees sprayed with arsenical poisons had a smaller percentage of wormy fruit than did the unsprayed. Paris green was found less injurious to the foliage than was London purple or white arsenic. A mixture of one pound Paris green in 250 gallons of water was effective in reducing the amount of wormy fruit, but a stronger mixture (one pound to 100 gallons) was required to kill the tent caterpillar. The number of windfalls was greatly lessened by spraying with Paris green and the proportion of wormy fruit among the windfalls was also smaller from the sprayed trees. It was observed that most of the wormy fruits from sprayed trees are entered from the side or base, while in fruits from unsprayed trees the entrances at the calyx were largely in excess. Spraying three times with an ammoniacal solution of copper carbonate destroyed the apple scab fungus and resulted in saving 52 per cent of the crop, but the foliage and fruit were slightly injured. The most satisfactory and effective fungicide used was Bordeaux mixture and this is now generally used throughout the State. The effectiveness of Bordeaux mixture as a fungicide, and of Paris green as an insecticide for the orchard, was fully established by the work of the Station in 1891-3. (Reports for 1891-3, Bulletins 8 and 52; and How to Fight Apple Enemies.)

THE BLUEBERRY.

There are vast areas in Maine which, while bearing a considerable number of blueberry bushes and yielding a profitable return to the few people who make a practice of gathering the wild fruit, are not utilized as they might be. Systematic treatment in the way of burning, planting and managing might with profit be given to these lands and extended to other sections.

Another phase of the subject which is worthy of careful attention is that of domestication and the improvement of types by selection and crossing. The fruit in its wild state is superior to that of most other small fruits, and is very susceptible to the influence of environment. Systematic experiments in this direction are in progress at the Station. The most promising species for this work is the high-bush blueberry, *Vaccinium corymbosum.* (Report for 1898 and Bulletin 76.)

PLANT BREEDING.

The general question of the improvement of plants, or "plant breeding," is a perennial one. Much of the work done at the Station has never been published, but certain phases have been touched upon. A general statement of the problem is given in the Annual Report for 1893.

From evidence at hand it appears that the secondary results of crossing may be of fully as much importance as are directly inherited qualities. Among these secondary effects are: The possible immediate influence of pollen upon the mother plant; the stimulating effect of pollen upon the ovary; and the influence of varying amounts of pollen. In a few important species there may be an immediate apparent effect of foreign pollen on the female organism of the current generation, but the greater portion of the food plants studied do not exhibit such effect. That pollen has a direct stimulating effect upon the ovary, independently of its action upon the ovules, seems a well established fact. Variations in the amount of pollen available may, to a large extent, determine the form and consequent value of the fruits of some species. (Annual Report 1892.)

RED CLOVER FROM VARIOUS SOURCES.

W. M. MUNSON.

During the seasons of 1902 and 1903 a coöperative study of red clover was made in connection with the United States Department of Agriculture. The object of this study was to determine, if possible, the best source from which to obtain seed for general farm purposes. To this end, seed obtained from various parts of the world, by the Department of Agriculture, was sent to this Station and careful notes were made as to rate and per cent of germination; date of blooming and consequent earliness of crop; date of cutting; yield per acre; general condition of the stand; and characteristics of the plants.

GERMINATION TESTS.

The sprouting of seeds in a "seed tester" or on blotting paper often gives erroneous impressions as to the real value of the seed. With this fact in mind, seeds of each lot were placed upon blotting paper under a bell jar, and two duplicate lots were planted in soil in the greenhouse. The comparative results, as also the percentage of germination obtained in case of each at Washington, before the seeds were sent out, are shown in the accompanying table.

In many cases seed which showed a high percentage of sprouting when placed under favorable conditions, both at Washington and at the Experiment Station, did not possess sufficient vitality to insure a heavy stand of plants when covered with soil, a fact which would indicate the necessity of heavy seeding and of light covering in such instances.

In most cases, the best results in the germination tests were obtained from seed grown in the higher regions of central Europe—though two lots of seed from Bohemia showed rather low vitality in the soil tests. The most vigorous seeds seemed to be those from Upper Austria, Styria, Hungarian Transylvania, and Russia; while one lot from England and that from Denmark were specially low in vitality. Seed from Brittany showed a high percentage of germination (sprouting) at Washington, but was rather low both in the blotting paper and in the soil tests at the Station. Of the American seed tested, that from Ohio and Illinois were, in this trial, the strongest.

Results of Germination Tests.

Accession number.	Source of Seed.	Per cent germination Washington.	Per cent germination blotting paper.	Per cent germination in soil, 1st test.	Per cent germination in soil, 2d test.
10964	Oregon	89	90	41	30
10965	Tennessee	89	93	40	-
10990	Missouri	95	97	25	33
11911	Iowa	93	84	37	-
11813	Michigan	95	95	49	-
12010	Ohio	93	97	47	60
12090	Indiana	96	90	35	35
12165	Illinois	–	93	39	75
12169	Russia	91	93	55	80
12170	Brittany	96	72	27	40
12171	England	81	71	13	34
12172	Denmark	96	92	17	20
12173	New Zealand	77	72	27	40
12174	England	78	95	49	-
12175	Bohemia	96	93	34	38
12186	Nebraska	80	71	19	38
12223	Wisconsin	92	94	71	64
12540	Russia	96	91	45	80
12541	Minnesota	94	92	51	60
12635	Italy	88	90	29	35
12663	Upper Austria	97	94	75	83
12664	Silesia	88	89	77	48
12665	Hungarian Mountain Region	95	94	57	80
12666	Styria	91	93	78	85
12667	Galizia	85	89	77	40
12668	Hungarian Plains	97	85	81	42
12669	Bohemia	95	80	33	45
12670	Hungarian Transylvania	95	92	85	70

The above facts are presented for consideration. Only the most general inferences can be drawn, however, from a single sample, or even from two or three samples from any given source.

FIELD WORK, 1902.

Duplicate plats of twenty-nine different lots of seed were sown, May 19, on plats of two square rods each, at the rate of 12 pounds standard seed per acre. The location of the plats has a slightly northeastern aspect. The soil is a rich sandy loam, with a strong clay subsoil. A crop of buckwheat was grown upon the land in 1901, and there was much trouble from young buckwheat plants, as well as from witchgrass and *Gnaphalium* which infested the ground. In general, however, the plats were kept free from weeds and the clover plants were given the best possible chance for growth.

The soil was in excellent condition at the time of planting. With the exception of very light showers, there was no rain until May 24. Between May 24 and 28, however, several inches of rain fell, and there was an abundance of rain thereafter.

Plants in all plats began to appear May 26. On the 28th no marked difference was observed in the appearance of the several plats. It was to be expected that seed from the far northern regions would germinate more rapidly than that from other parts of the world, but such difference was not detected. One plat, from Michigan seed, seemed rather behind the others at first, but this condition was attributed to a possible difference in depth of covering the seed.

The season as a whole was cool and moist, and in most cases growth was luxuriant. Marked differences were noted, however, and some of these differences are very significant. A particularly noticeable feature of the plants from European seed was an almost invariable absence of hairiness of stem and leaves, while all American grown seed produced very hairy plants. This characteristic may be of importance as affecting the amount of dust in the clover hay, though we have not as yet had sufficient quantity of hay to determine positively this point.*

The plants from northern Europe were, as a rule, later in maturing than were those from farther south and from American seed.

On August 30, or 3½ months after seeding, plats 17 and 19, from Indiana and Bohemia respectively, were in prime condition for hay. Plats 18 and 20—duplicate plants from the same sources—were slightly less mature, but in accordance with the plan, one plat from seed of every source was cut and weighed at this time.

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*Since this paper was ready for the press a personal communication to the writer from Professor N. E. Hansen of South Dakota Experiment Station confirms this observation. While travelling in Russia, Professor Hansen found that because of a shortage in the Russian crop of clover seed, American seed had been imported, and there was a very general complaint of the dustiness of the hay from such seed.

Relative yield and shrinkage of red clover grown in 1902 from seed from different localities.

Plat number.	Source of Seed.	Date of Cutting.	Yield green —lbs.	Yield dry —lbs.	Shrinkage in drying —per cent	Yield per acre —lbs.
1	Illinois	August 30	150	39	74	3120
2	Illinois	September 3	135	37	73	2960
3	Hungarian Mountain Region	August 30	138	36	74	2880
4	Hungarian Mountain Region	September 3	126	33½	73	2680
5	Bohemia	August 30	91	23	74	1840
6	Bohemia	September 3	101	27	73	2160
7	Wisconsin	August 30	81½	21	73	1680
8	Wisconsin	September 3	146	45	69	3600
9	Russia	August 30	98½	26	73	2080
10	Russia	September 12	115½	29	74	2320
11	Styria	August 30	122½	30	75	2400
12	Styria	September 12	134	34	80	2720
13	Galizia	August 30	107	27	74	2160
14	Galizia	September 12	95½	21½	76	1720
15	Hungarian Plains	August 30	129	31	75	2480
16	Hungarian Plains	September 3	142	37½	73	3000
17	Indiana	August 30	138½	35½	74	2840
18	Indiana	September 3	173	49	70	3920
19	Bohemia	August 30	160½	40	75	3200
20	Bohemia	September 3	160	50½	68	4040
21	Minnesota	August 30	159½	41	74	3280
22	Minnesota	September 3	164½	50½	69	4040
23	Oregon	August 30	154	35½	76	3440
24	Oregon	September 3	164½	44	73	3520
25	Denmark	August 30	131	32	82	2560
26	Denmark	September 12	134½	31	76	2480
27	England	August 30	85	22½	72	1800
28	England	September 12	113	26½	77	2120
29	Norway	August 30	65	13	80	1040
30	Norway	September 12	63½	17	71	1560
31	Ohio	August 30	174½	42	74	3360
32	Ohio	September 9	151	37	75	2960
33	New Zealand	August 30	158	36	77	2880
34	New Zealand	September 3	128	36½	71	2920
35	Brittany	August 30	188½	44	75	3520
36	Brittany	September 3	133	36½	72	2920
37	Michigan	August 30	110	27	75	2160
38	Michigan	September 12	118½	27½	76	2200
39	Hungarian Transylvania	August 30	147½	35	77	2800
40	Hungarian Transylvania	September 12	128	34½	73	2760
41	Nebraska	August 30	128	31	75	2480
42	Nebraska	September 9	112	29	74	2120
43	England	August 30	124	33	73	3520
44	England	September 3	119	32	73	2560
45	Russia	August 30	141½	34	75	2720
46	Russia	September 9	153	34½	77	2760
47	Italy	August 30	145	33	77	3520
48	Italy	September 9	153½	35½	76	2840

Relative yield and shrinkage of red clover grown in 1902 from seed from different localities.

Plat number.	Source of Seed.	Date of Cutting.	Yield green —lbs.	Yield dry—lbs.	Shrinkage in drying —per cent.	Yield per acre —lbs.
49	Missouri	August 30	182	40½	78	3240
50	Missouri	September 9	132½	31	77	2480
51	Iowa	August 30	151	32½	78	2600
52	Iowa	September 12	131	32½	75	2600
53	Tennessee	August 30	137	31½	78	2520
54	Tennessee	September 9	135	32	76	2560
55	Silesia	August 30	156	34½	71	2760
56	Silesia	September 12	130	33	74	2740
57	Upper Australia	August 30	192	42	70	3360
58	Upper Australia	September 12	127	35	71	2800

RELATIVE YIELDS OF DIFFERENT PLATS.

While conclusions cannot be drawn from a single season's work, a comparison of the yields and of the different lots is of interest. As already stated, one plat from every lot of seed was cut at the time the earliest plats—which happened to be Numbers 17 and 19—were ready for harvest. The duplicate plats were cut as they matured or, in a few cases, at the end of the season, to save them from destruction by rust.

The preceding tables give the results in detail.

The largest yields were obtained, in the order given, from plats with seed from Minnesota, Bohemia, Indiana, Wisconsin, Brittany and Ohio.

The shrinkage in drying ranged from 68 per cent on plat 20 (Bohemia), to 82 per cent on plat 25 (Denmark). The mature crop from Wisconsin and Minnesota plats each shrank 69 per cent, and from Indiana 70 per cent. The usual shrinkage, however, was about 73 to 75 per cent. In considering weights and shrinkages it should be borne in mind that green clover leaves are more numerous and in the aggregate heavier than the mature stalks, because of the greater amount of water contained. For this reason the weight of the undried product of some plats, which were late and very immature, appears greater than that of other plats which were in every way superior; the shrinkage in drying is, however, correspondingly greater.

All plats were very uneven in maturing, but the cutting was done so as to get as nearly as possible average conditions. Recovery after cutting was uniformly rapid, because of the favorable season.

FIELD NOTES, 1903.

The winter of 1902-3 was exceptionally favorable for clover seeding, as the ground was almost continuously covered with snow. In March, however, heavy rains and subsequent freezing caused some of the plats to suffer. But, with the exception of those indicated in the table, all plats were in excellent condition in the spring of 1903.

The early part of the season was exceptionally unfavorable to growth. Sharp frosts, which occurred May 23 and 24, severely checked the young growth, and the prolonged drought which prevailed throughout New England caused the first crop to mature early, with a very light yield.

The earliest plats to mature were those from Indiana, Hungarian Mountain Region, and Ohio, which were ready to cut June 29. These were closely followed by plats from Bohemia, Italy, Illinois and Wisconsin. As in the previous year, one plat of each lot was cut at the time the first one was ready, June 29, and the duplicate plats were cut as they matured.

Abundant rains soon after the first cutting insured rapid recovery and a vigorous growth for the second crop. The first plats ready for the second cutting were Nos. 1, 17, and 31, from Illinois, Indiana and Ohio, respectively, on August 13.

Relative yield and shrinkage of red clover in 1903, seeded in 1902 with seed from different localities.

		First Cutting.					Second Cutting.						
Plat.	Source of Seed.	Date of cutting.	Yield green, pounds.	Yield dry, pounds.	Shrinkage in drying, per cent.	Yield per acre dry, pounds.	Date of cutting.	Yield green, pounds.	Yield dry, pounds.	Shrinkage in drying, per cent.	Yield per acre dry, pounds.	Total yield per acre, pounds.	Remarks.
1	Illinois	June 29	101½	28	72	2240	Aug. 13	216½	46½	78	3720	5960	One of the best plats; vigorous, erect, height 23 inches, conspicuously hairy.
2	Illinois	July 1	74	22½	69	1800	Aug. 21	201½	44½	78	3560	5560	
3	Hung. Mt. Region..	June 29	70½	20½	70	1640	Aug. 13	201½	43½	78	3480	5120	Very good; stems smooth; very little rust.
4	Hung. Mt. Region..	July 1	73	20	72	1600	Aug. 21	200	46	77	3680	5280	Same as No. 3. Considerable rust.
5	Bohemia	June 29	90	26½	70	2120	Aug. 13	215½	45	79	3600	5720	Good stand; little rust; nearly smooth stem, recovery irregular.
6	Bohemia	July 1	52½	16	69	1280	Aug. 21	168½	41½	76	3300	4580	Same as No. 5; but recovery very slow.
7	Wisconsin..........	June 29	87½	26½	69	2120	Aug. 13	188	37	70	2960	5080	
8	Wisconsin..........	July 1	94	30¾	67	2460	Aug. 21	207	46	77	3680	6140	
9	Russia	June 29	80½	22½	72	1800	Aug. 13	202	38	81	3040	4840	
10	Russia	July 1	45	14½	69	1160	Aug. 21	199	42	78	3360	4520	
11	Styria	June 27	63	16½	73	1320	Aug. 13	204	40	80	3200	4520	
12	Styria	July 7	43½	24	44	1920	Aug. 21	179½	56	69	4480	6400	Some witch grass.
13	Galizia............	June 27	64½	25½	60	2040	Aug. 13	188¾	39½	74	3160	5200	
14	Galizia............	July 7	27½	7¾	74	620	Aug. 13	177½	56	69	4480	5100	Somewhat weedy.
15	Hung. Plains.......	June 29	46¾	14	74	1120	Aug. 13	165½	35½	79	2840	3960	
16	Hung. Plains.......	July 1	92	27	70	2160	Aug. 21	192	47½	75	3800	5960	
17	Indiana............	June 29	114	31	72	2480	Aug. 13	193½	43½	77	3480	5960	
18	Indiana............	July 1	185	45	75	3600	Aug. 21	215½	52½	80	4200	7800	The best plot.
19	Bohemia	June 29	105½	32½	69	2600	Aug. 13	232½	49½	79	3960	6560	
20	Bohemia	July 1	84	28¾	65	2300	Aug. 21	192½	46½	76	3720	6020	
21	Minn...............	June 29	73	21	71	1680	Aug. 13	148	34½	70	2760	4440	
22	Minn...............	July 1	74½	20	73	1600	Aug. 21	187½	43	77	3440	5040	
23	Oregon	June 29	78	24½	69	1980	Aug. 13	167½	34	79	2720	4700	
24	Oregon	July 1	63	20½	67	1640	Aug. 21	65½	28½	56	2280	3920	

18

25	Denmark...........	June 29	76	20½	73	1640	Aug. 13	158	28	82	2240	3880	
26	Denmark...........	July 7	58½	18	69	1240	Aug. 28	108	44½	59	3560	4800	
27	England	June 29	46½	14½	70	1160	Aug. 13	107	20	81	1600	2760	Badly killed out.
28	England	July 29	89	30½	65	2440	....	......	......	....	......	2440	Discarded; very weedy.
29	Norway............	June 29	......	......	....	......	... .	......	......	....	......	......	Winter killed.
30	Norway............	July 28	85	28	67	2240	Aug. 28	175	57	68	4560	6800	
31	Ohio	June 29	103	31	69	2480	Aug. 13	173	34	79	2720	5200	
32	Ohio	July 1	101½	35	65	2800	Ang. 28	131	38	70	3040	5840	Exceptionally good.
33	N. Zealand	June 29	105½	19	82	1520	Aug. 13	192½	38	80	3040	4560	
34	N. Zealand	July 1	83½	27½	67	2200	Aug. 28	134	50	62	4000	6200	Considerable witch grass.
35	Brittany...........	June 29	58½	17½	74	1400	Aug. 13	192	38	80	3040	4440	
36	Brittany...........	July 1	50	17	66	1360	Aug. 28	143	51	64	4080	5440	Considerable witch grass.
37	Michigan	June 29	65½	20	60	1600	Aug. 13	166	31½	81	2520	4120	
38	Michigan	July 7	44½	13	70	1040	Aug. 28	141	50	64	4000	5040	
39	Hung.Transylvania	June 29	62	13½	78	1080	Aug. 13	164	32½	80	2600	3680	
40	Hung.Transylvania	July 7	35½	10½	70	840	Aug. 28	140	48½	65	3880	4720	
41	Nebraska......	June 29	53½	15	71	1200	Aug. 13	146	31	78	2480	3680	
42	Nebraska...........	July 7	36½	10½	71	840	Aug. 28	158½	50	68	4000	4840	
43	England	June 29	28½	6½	77	520	Aug. 13	91½	18½	89	1480	2000	
44	England	July 7	17½	6	64	480	Aug. 28	94½	31½	65	2520	3000	
45	Russia	June 29	41½	7½	81	600	Aug. 13	149½	28½	80	2280	2880	Weedy; clover partly killed out.
46	Russia	July 7	78	24	79	1920	Aug. 28	149½	51½	66	4120	6040	One of the best.
47	Italy	June 29	36½	12	69	960	Aug. 13	69½	14	79	1120	2080	
48	Italy	July 7	32½	10½	67	840	....	......	......	....	......	......	Winter killed.
49	Missouri	June 29	80½	16	80	1280	Aug. 13	164½	32½	80	2600	3880	
50	Missouri	July 1	68	23½	66	1880	Aug. 28	154½	56½	63	4520	6400	Probably not quite dry.
51	Iowa	June 29	62	22½	63	1800	Aug. 13	139¾	24⅓	82	1960	3760	
52	Iowa	July 29	108½	46	58	3686	....	......	......	....	......	3680	Injured by drought; failed to recover.
53	Tennessee..........	June 29	44½	14½	60	1160	Aug. 13	141	27	80	2160	3320	Winter killed in spots.
54	Tennessee	July 29	48	16½	65	1320	....	......	......	....	......	1320	Badly winter killed.
55	Silesia	June 29	20	4½	75	360	....	......	......	....	......	......	Badly winter killed.
56	Silesia	July 28	51	18½	63	1480	....	......	......	...	......	......	Badly winter killed.
57	Upper Austria	June 29	37½	10	73	800	....	......	......	....	......	......	Badly winter killed.
58	Upper Austria	July 28	29	10½	63	840	....	......	......	....	......	......	Badly winter killed.

Plat No. 18 with seed from Indiana, and cut both times when in the best condition for hay, gave the highest total yield for the season; the amount being 3.9 tons per acre. Plat 19, seed from Bohemia, stands second in the list with a record of 3.28 tons. Plat 46, Russia, third with 3.02 tons, and Plat 20, Bohemia, fourth with 3.01 tons. Plats 1, Illinois, and 17, Indiana, follow with 2.98 tons each, while 32, Ohio, and 5, Bohemia, come next with 2.92 and 2.86 tons respectively.

It is interesting to note that with the exception of plat 17, Indiana, and plat 20, Bohemia, those which proved best in the long run are not included in the list of those giving the highest yields the first year. Nor are those lots which showed the highest per cent of germination in laboratory tests the ones which give the best final returns. Both Indiana and Bohemia seed showed a relatively low vitality in the soil test in the laboratory. Ohio, Illinois and Russia, however, were among those showing the best results in the laboratory.

LOW GRADE AND HIGH GRADE COTTONSEED MEAL COMPARED.

J. M. BARTLETT.

The work here reported was undertaken in order to compare the value of the low grade cottonseed meals, which are sometimes found on the market, with that of high grade goods, and to point out to the consumer the desirability and economy of purchasing only the best of this class of foods.

Cottonseed meal is a highly nitrogenous feed, manufactured from the decorticated seed in the cotton growing regions of the South. The best meal is of a light yellow color, quite free from lint and hulls, and has a fine nutty flavor.*

COTTONSEED MEAL AS A FEED.

Cottonseed meal has been extensively fed to cows in the New England States for the past 20 years and stands pre-eminent among nitrogenous feeds as the most economical source of protein. Practical experience, supplemented by carefully conducted experiments, both in the United States and Europe, has demonstrated the high feeding value of this material for all kinds of farm animals, with the possible exception of horses, calves and pigs. Its value for producing meat, milk and butter have long been established. It is the most highly nitrogenous of the feed stuffs on the market, and is, therefore, the most economical for balancing rations of feeds deficient in protein, such as corn silage, timothy hay, corn meal, etc. The price has advanced considerably of late years, owing partly to its more extensive use in the South and West for fattening steers, and partly to the advance in price of other feed stuffs.

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* For a full description of the process of manufacture of cottonseed meal see Farmers Bulletin No. 36 of the U. S. Dept. of Agriculture, which can be obtained free from Members of Congress.

EFFECT ON THE HEALTH OF ANIMALS.

The injurious effects of feeding cottonseed meal to pigs and calves have been observed and the cause has been made a subject of careful investigation. It is still an open question whether the injurious principle is an original constituent of the cottonseed products, whether it is developed as the result of decomposition before feeding or of a change within the animal body. There is always danger of injurious or poisonous principles being produced in materials rich in protein when they undergo fermentation, and on this account fermented materials of high nitrogen content should be avoided.

All experience goes to show that fresh cottonseed meal can be safely fed to beef cattle, milch cows, and sheep, but on account of its extreme richness it should be used only in connection with less concentrated feeds and should never be fed in large quantities. Two to 4 pounds per day, fed with silage or bran and corn meal, is as much as a milch cow should receive.

FERTILIZING VALUE.

Cottonseed meal is used quite extensively in some sections of the country as a fertilizer. A good grade meal will carry about 6.8 per cent nitrogen, 2.9 per cent phosphoric acid and 1.8 per cent potash. Based upon the valuations that will be used by New England experiment stations in 1905 for computing the value of commercial fertilizers, a meal analyzing as above will be worth about $29 a ton as a fertilizer. Notwithstanding its high value when used directly in this way, it will usually be found more economical to use it as a feed for stock and to apply the resulting manure to the land. When thus used, from 80 to 95 per cent of the nitrogen and phosphoric acid and practically all of the potash will be contained in the manure.

HOW CAN THE FARMER DISTINGUISH BETWEEN GOOD AND POOR MEAL?

As the demand increases and the price advances, the temptation to adulterate or put inferior goods on the market becomes greater. Consequently from time to time there appear in our eastern markets inferior lots of cottonseed meals, and probably many more would be found if the inspection laws did not drive them out. In spite of the laws, occasionally bad lots may appear, and it is essential that the farmer should be able in a measure to tell the quality of goods himself. The first thing for him to look for is the guarantee tag, required by law, giving the name of the manufacturer and composition of the goods. A first-class cottonseed meal should contain over 40 per cent protein and about 9 per cent fat. It should be a light yellow color. If it is dark in color with many fine black specks, it indicates that ground hulls have been added. If it is a rusty brown color, it indicates that the meal is old or the material has at some time undergone fermentation. Such meals are not safe to use. The texture of the meal should be about the same as finely ground corn meal, and it should be practically free from cotton lint. The presence and amount of lint can be determined by sifting a portion in a flour or meal sieve. The cotton fiber will remain in the sieve. The lint and hulls are also quite easily detected by stirring the meal up with water. Put one teaspoonful in half a glass of water, mix thoroughly and allow the mixture to stand a few minutes to settle. The black hulls will be found on the bottom and can be seen through the glass. The good meal will be in the next layer and the lint on top. A first-class meal should show only a few black hulls and scarcely any lint.

An expert can judge very well of the quality of cottonseed meal by means of tasting. The best fresh meals have a very agreeable nutty flavor not found in inferior goods. The presence of much fiber is readily noted by the sense of touch in the mouth. The absence of the nutty flavor and the presence of a rancid taste indicates that the meal is old.

DIFFERENT GRADES OF COTTONSEED MEAL.

Roughly speaking, the meals which are in the market can be divided into four groups.

A. The high grade meal, carrying 43 or more per cent protein; bright yellow in appearance, free from cotton and hull, and with a sweet nutty flavor.

B. A dark colored cottonseed meal, analyzing not very differently from the preceding, but made from seed that has undergone more or less fermentation.

C. A medium grade goods which carries considerable cotton and some hull, very good in color, but of poor flavor. Such meal will usually carry about 35 per cent protein.

D. A cottonseed meal of very good appearance, with the hulls and cotton so finely ground as not to be readily detected. This class is, however, lacking in the good flavor of high grade meals. Such meal will usually carry about 25 per cent protein and because of its good appearance is the most dangerous adulterated meal in the market.

COMPOSITION OF THE COTTONSEED MEAL USED IN THIS EXPERIMENT.

When this study was undertaken, the two grades of cottonseed meal referred to as A and B in the preceding paragraph were readily found. About this time a jobber received several car loads of a meal of "grade C" and because of its poor appearance sent samples to the Station for analysis. These goods proved so poor that they were shipped out of the State, but the jobber kindly furnished us with enough for the purpose of this investigation. It was only after considerable correspondence that we were able to obtain from a Massachusetts house enough of the poorest grade ("D") cottonseed meal for the experiments here reported.

COMPOSITION OF THE COTTONSEED MEALS STUDIED.

The description of the samples and the analyses of the four grades of cottonseed meal follow.

Cottonseed meal A was prime meal in color, taste and composition.

Cottonseed meal B was of good texture and carried but little lint or hulls. It was, however, dark in color. This together with its higher water content indicates that it had undergone some, probably slight, fermentation.

Cottonseed meal C was a medium grade goods with considerable lint and hulls. It was of good color, but poor flavor.

Cottonseed meal D appeared at first glance to be fairly good. It was of good color and apparently contained but little lint or hulls. It was lacking in the nutty flavor of the high grade meals and was, as the analysis shows, very low grade goods.

Composition of the samples of the four grades of cottonseed meal here reported upon.

	Station number.	Water—per cent.	Ash—per cent.	Protein—per cent.	Crude fiber—per cent.	N-free extract—per cent.	Ether extract—per cent.
A—Very high grade	4311	8.01	7.59	46.75	6.23	21.64	9.78
B—Dark colored	4423	12.72	7.05	42.50	7.67	14.64	8.62
C—Medium grade	4424	11.60	6.50	34.13	13.58	19.83	8.90
D—Very low grade	4425	9.52	4.70	23.81	21.43	30.53	6.20

As cottonseed meal is chiefly used in this State to supplement feeding stuffs poor in protein, this constituent is of the first importance. The very low grade meal (D) carried about one-half as much protein as the best grade. The uniform relation between the protein content of the meal and that of woody fiber is noteworthy; as the crude fiber increases, the protein decreases.

THE DIGESTIBILITY OF DIFERENT GRADES OF COTTONSEED MEAL.

The chemical analysis of a feeding stuff helps to an understanding of its food value, but the real value is more clearly brought out by actual feeding trials. The four grades of meal were fed to sheep and their differences in digestibility and feeding values are shown in the tables which follow.

The digestion coefficients obtained on the different grades of cottonseed meal with sheep.

	Station number.	Dry matter—per cent.	Organic matter—per cent.	Protein—per cent.	Crude fiber—per cent.	N-free extract—per cent.	Fat—per cent.
A—Very high grade	4311	90.0	95.3	83.3	....	95.9	100
B—Dark color	4423	85.8	89.0	82.2	....	94.7	97.2
C—Medium grade	4424	73.0	78.0	83.6	43.5	82.1	94.6
D—Low grade	4425	61.4	64.1	72.6	37.8	67.8	90.1

Pounds of digestible nutrients in 100 pounds of the different grades of cottonseed meal and their comparative money values as a source of protein.

	Organic matter—pounds.	Protein—pounds.	Nitrogen-free ext.—pounds.	Fat—pounds.	Value per hundred.
A—Very high grade	80.4	39.0	20.8	9.8	$1 40
B—Poor color	72.2	35.0	13.9	8.4	1 25
C—Medium grade	63.9	28.5	16.3	7.3	1 02
D—Low grade	55.0	17.3	16.5	5.6	0 62

According to the analyses alone, the low grade goods would be worth about half as much as the high grade, but as a matter of fact they are worth less than half, for the reason that the protein is of poorer quality and less digestible than that of the high grade goods. The coefficients for the organic matter and protein of the low grade goods are only 64.1 and 72.6 per cent respectively, while those of high grade are 95.3 and 83.3 per cent. The pounds of digestible protein in 100 pounds of the low grade goods is considerably less than half that of the high grade, and if the high grade meal is assumed to be worth $1.40 per 100 pounds on the basis of its digestible protein, 100 pounds of the low grade meal are worth only 62 cents. As the difference in price on the market for the different grades of goods is only slight, rarely more than one or two dollars per ton, the above results show how very necessary it is for a buyer of cottonseed meal to know the quality of the goods he is getting. To the ordinary observer meal classed as "D" would look nearly as good as that called "A." The excess of hulls it contains are so finely ground that they do not show unless separated by mixing with water, so the color is very good and many buyers would be tempted to purchase it if the price were 10 or 15 cents a hundred lower than that of the high grade.

Such figures as those of the tables are at least suggestive to the users of cottonseed meal. They point out the importance of care in the purchase and use of this class of goods and justify the feeding stuffs inspection laws which have almost entirely driven the lowest grades out of the State.

POULTRY EXPERIMENTS.

G. M. Gowell.

[The poultry work of the Experiment Station was undertaken primarily to study breeding for egg production and has been in progress for several years. A year ago the Bureau of Animal Industry of the U. S. Department of Agriculture desired to cooperate in the work and is now contributing $1,000 per year to assist in the carrying forward of the breeding experiments. Considerable unpublished data from these experiments have accumulated, but it has been decided to hold this matter for another year before it is published, at which time it will probably be issued as a bulletin of the Bureau of Animal Industry.

The following papers on poultry experiments have been published. With the exception of Bulletin 100, these are no longer available for distribution.

Number of Laying Hens that can be profitably kept in one Pen, Annual Report for 1898.
Feeding Chickens for Growth, Bulletin 64.
Breeding for Egg Production, Bulletin 64.
Feeding Chickens for Growth, Bulletin 79.
Experiments in Incubation, Bulletin 79.
Breeding for Egg Production, Bulletin 79.
Breeding for Egg Production, Bulletin 93.
Floor Space, etc., in relation to Egg Production, Bulletin 93.
Poultry Management as practiced at the Maine Station, Bulletin 100.

This bulletin (117) presents some of the results of the breeding work and supplements Bulletin 100 by outlining the methods of housing and handling our stock that have been adopted since that bulletin was issued.—C. D. W.]

Investigations Relating to Breeding to Increase Egg Production in Hens.

SUMMARY OF RESULTS OBTAINED.

In order to select good producing hens for foundation breeding stock, we constructed 52 trap nests and placed them in the laying pens where 140 April and May hatched pullets commenced using them November 1, 1898.

In one year forward from that date the 140 birds laid an average of 120 eggs each. Twenty-five laid over 160 each and 22 less than 100 each. Hen No. 36 laid 201 eggs; No. 101 laid 204; and No. 286 laid 206 eggs. The eggs of No. 36 were light in color and she was therefore rejected as a breeder.

At the commencement of the next breeding season,—1900—Nos. 101 and 286 were mated with males that were unrelated to them, or to each other. The cockerels raised from the eggs of these two birds were the first males produced for use in this work.

In the early spring of 1901, several sons of hen No. 286, raised the previous year, were mated with the 24 two-year-old hens that laid 160 eggs and over, each, during 1899, and 25 others that laid 160 or over during the 1900 test. That season hen No. 303, that had laid 208 eggs during 1900, was bred to a son of 286. Hen No. 326 had laid 211 eggs during 1900 and she was bred to a son of No. 286 also. No. 318 had laid 237 good brown eggs in 1900. After she had laid 200 eggs the next dozen she laid weighed 1 lb. 11¼ ounces. She was bred to a son of No. 101 that season. The sons of No. 101 and 286 were in service only during the year 1901.

During 1902 one hundred pullets were tested for additional foundation stock. They yielded an average of 132 eggs each. Twelve birds laid over 200 eggs each; the highest number being 251 eggs laid by hen No. 617. In the same pens were six others that laid only from 23 to 70 eggs each. Thirty-seven laid over 160 each. No hens were used as breeders that had not laid 160 eggs, and all, as in the previous year, were bred to males whose dams had yielded over 200 eggs.

Males were raised this year, (1902) for the male breeding pens of the next year, from hens No. 635, record 201 eggs, and

No. 676, record 209 eggs. The eggs from both of these hens were very large and dark brown. They were mated to sons of No. 303 and 318 before spoken of. Males for the pullet breeding pens of the next year were bred from other matings of hens, that had produced 200 eggs, with males whose mothers had yielded over 200.

That year (1902-3) we were crowded for room and could accommodate only 53 pullets for testing. They were the first pullets that we tested that were sired by males bred from 200 egg producing hens and show the first results of the breeding practiced. They had been laying quite heavily out on their summer range during September and October, although they were not hatched until April and May. The 53 birds laid 7,952 eggs in the year forward from November 1st, a little better than 150 eggs each. Could they have been in quarters where their eggs could have been traced to them a month earlier, when they were laying so well, they would have shown a better year's work, as the twelfth month of their testing was really the thirteenth month of their laying, and the record sheets show it to be nearly bare of eggs. As it was, however, seven of the 53 show records of from 201 to 240 eggs each in the year, and 23 of the 53 laid over 160 eggs each.

During the breeding season of 1903, hens No. 1,001, record 213 eggs; No. 1,003, record 240 eggs; No. 1,005, record 222 eggs and No. 1,140, record 211 eggs, were bred to male birds raised the year before whose dams had yielded over 220 eggs each, for the purpose of procuring males, for the male breeding pens of 1904.

All pullets raised that year (1903) were, as in the preceding three years, out of hens that had laid over 150 eggs in a year, and they had the advantage over their predecessors, in that their dams and maternal grand dams were sired by males whose mothers had yielded 200 eggs, or over, as they themselves also were.

That year (1903-4) 160 pullets were tested in the trap nests. They laid 21,202 eggs; an average of 132 each. Forty-four laid over 160 eggs each; 8 laid 200 or over, viz. 200-205-210-217-220-221-222 and 225 each. We have not to seek far for an explanation for the lower average yield than that of the last preceding year. The pullets were hatched in April and May, and thinking to have them mostly in readiness for laying early in November, we fed them rather more beef scrap than usual during the growing season, while they were out on the range, and before we were aware of their development they were laying,—in August. They were nearly all laying heavily during September, October and November. They were splendid birds, but almost every one of them moulted, completely, in December, and we got very few eggs from them for more than two months. The most of the eggs secured from them were laid after the middle of January. Could they have commenced laying in October and continued for a year, moulting would probably have been avoided and the showing would have been much better.

The breeding season of 1904 opened with 170 yearling hens in our houses that had laid above 160 eggs each the year before; 80 pullets and hens whose mothers had laid over 200 eggs per year; and 28 hens that had themselves laid over 200 eggs per year. These birds were in 24 different pens and they were bred to selected cockerels whose mothers had yielded above 200 large brown eggs per year.

Among the pullets tested during the last preceding year (1903) were found the following; No. 263a yielded 220 eggs; No. 225a, 220 eggs; No. 222a, 221 eggs; No. 224a, 222 eggs; No. 205a, 225 eggs. These birds were bred during 1904 to cockerels raised in 1903 from heavy producing mothers whose other sons were never used in our breeding operations. The mating of these five pairs of birds was to secure cockerels for our next year breeding operations.

At the usual time for the commencement of the yearly test of 1904, viz. October 30, we had 300 good pullets that were laying well out on the range. The construction of the building being erected for their quarters was interfered with by a question of labor, over which we had no control, and they remained out in their small summer homes during a wet, cold fall and early winter, until December sixth, when they were moved in. This more than a month's delay and exposure cut into the year's work heavily and the average production of the 300 birds was reduced to 131 eggs each during a little less than eleven months. Eight birds yielded above 200 eggs each before the close of the following October.

All of the breeding females we are now carrying are tested hens that have laid from 160 to 251 eggs in a year; and 150 pullets and hens whose mothers produced 200, or over, eggs per year. All males used in breeding these two classes since 1901 had mothers that had laid 200 or more eggs in a year.

This season (1905) six hundred pullets out of hens that have laid above 160 eggs per year, and whose fathers, grandfathers and great grandfathers were out of hens that yielded above 200 eggs per year are being tested by the trap nests for additional breeding stock. All of the mothers of these pullets had fathers and grandfathers that had 200 egg producing mothers.

The stock is strong and vigorous and but few chickens that hatch are lost. The hardihood of the stock is shown by the fact that many cockerels have been sold to farmers and poultrymen in and out of the State during the past two years and this fall many of them have ordered again, with the frequent comment that their pullets are laying earlier in the season and giving better eggs than they have ever done before.

The numbers of the breeding stock now secured makes practicable the avoidance of in-breeding and this is strictly guarded against, as it is doubtful if the inbred hen has sufficient constitution to enable her to withstand the demands of heavy egg yielding. During only one season have birds as closely related as first cousins been bred together. Line breeding is followed, the matings now being only with distantly related birds. These breeding investigations have now been in progress for six years. The first year was consumed in testing pullets to find foundation stock. The second year cockerels were raised from the large laying hens for future breeding, and the third year, the first lots of pullets were raised from the selected stock; so that we have only the last three years in which to note results and these three years can only show the first changes that have taken place. The stock that we commenced with was well bred, as flocks generally go. The hens were averaging about 120 good brown eggs a year, and had been doing so for several years. Three years ago they averaged 150 eggs and the last two years, with the great setbacks caused as above indicated, which was no fault of the stock, the average was 131½ eggs. It must be borne in mind that 1902 was the first year we had pullets from the 200 egg stock to collect eggs from. In the records, only the eggs laid in the nests are accounted for. Had those found on the floor been reckoned in, the average per bird would have been slightly increased.

As the housing, treatment and food, have been as nearly alike as we could make them during the last five years, there seems to be reason for assuming that the flock yields of 1902, 1903 and 1904 over those of previous years are the results of the breeding practiced.

Sufficient time has not yet elapsed since beginning these breeding tests to establish claims of increased productiveness, but the outlook is certainly very encouraging.

The plans on which we are working are based on every-day common sense. We are rejecting the drones and breeding producers together to secure producers. It is known that the laws of inheritance and transmission are as true with birds as with cattle, sheep and horses, and when we consider the wonderful changes that have been made in the form, feather and egg production of hens since their domestication commenced, there is ample reason for assuming that a higher average egg production than the present can be secured, by breeding only from those birds that are themselves great producers.

The purposes of this work should not be misunderstood;—we are not trying to breed stock that shall average to yield 200 eggs per year. If the average yield of the hens of the breed should be increased to the extent of a dozen eggs per bird, the value of the work would be many times its cost.

OTHER METHODS OF SELECTING BREEDING STOCK.

During last August we found 29 of the pullets that were hatched the first of April were laying in the brooder houses out on the range. They were carried into the laying houses, banded and given access to trap nests. They were given our usual treatment and feed, and we commenced keeping records with them September first and will continue doing so through the year.

On April 30 the 29 birds had laid 3,317 eggs. Their individual records were as follows, viz. 95, 93, 91, 133, 115, 58, 102, 149, 130, 100, 76, 95, 114, 101, 110, 127, 149, 68, 107, 134, 126, 135, 135, 136, 125, 130, 164, 86, 133. The average number to each bird was practically 115. We have no special market for our eggs as we need to use them in large numbers in experimental work when occasions require. At the prices which we received from the commission house in Boston for eggs sent there from September to April the 3,317 above mentioned would have returned $87.57, an average of $3.01 per bird for the eight months' work.

The above is not cited as phenomenal work, but it is better than our birds average when all of them are accounted for. These 29 were not the only promising pullets we had, but they were all there were in that division. What returns they will make during the four months that remain from April to the close of August can not be learned until the year's work ends, which with them will be August 31.

While the egg yields of this group of birds were very satisfactory, the money returns from them were particularly so, for the reason that they did their work during that part of the year when prices were highest.

We are making our selections of breeding stock by aid of the reliable data secured by the use of trap nests. It is only investigators and occasional poultrymen who can afford the equipment and expense of operating trap nests. Every poultryman can, however, by closely observing his young stock during autumn, select the pullets that are commencing or preparing to lay and secure a pen of birds for the next season's breeding, that have the function of egg production so strongly developed in them that they give evidence of it by the early exercise of that function. Of course not all prospective layers prove satisfactory; some are not able to stand the demands of heavy work and so lay irregularly or fall out altogether. In this group of 29 birds, four proved to be low producers and should be rejected as breeders. Four others yielded from 90 to 100, but as the work was done during the time when the products were valuable they are worth breeding from. Six others yielded from 100 to 114 during the same period and they are still more valuable. Fifteen of this group of 29, selected in the field, laid from 115 to 164 each.

Although there are some poor yielders in this pen of 29, it is probable that as a lot they average considerably better than the whole flock from which they were selected. The small number of unprofitable birds and the large proportion of good ones would warrant the method of selection as the best, when trap nests, or equally reliable methods of selection are not practicable.

Early maturity in pullets is generally accompanied by physical vigor and when the function of such birds is to produce eggs, and they give evidence of it, they are certainly the best of their race to breed winter egg producers from, if we accept past experiences in breeding as our guides.

The records of a full year's laying in trap nests would be better as that would enable the rejection of all poor workers; and as the birds would not be bred from until the year following, they would be more mature and the chicks would be larger when hatched and would develop into larger birds at maturity than they would if their mothers were doing their first year's laying. The differences in size from these causes have been very noticeable in our work.

Poultry men are generally desirous of securing as many well bred pullets as possible and so use yearling hens as breeders, in addition to their two-year-olds. The work done by pullets from September to February or March is pretty good indication of their usefulness and their eggs are available for breeding during the pullet year. While the chickens from such eggs are not generally as large at maturity as those from older hens, we have not been able to discover any lack of constitution or vigor in them, and know no reasons why they are not desirable as workers.

THE PEDIGREE CHARTS.

In order to make clear our methods of breeding and registering, there are appended hereto two pedigree charts which illustrate the breeding of the two classes of birds which we designate as "registered" and "unregistered." We do not use these terms with reference to purity of blood, for ours is one of the oldest of the families of Barred Plymouth Rocks, having been bred by the writer for 25 years from the best Barred Rock stock which was procurable at the time of starting.

Every one of our birds is pure blooded in the same sense that all registered cattle, horses, sheep and swine are pure, and every one of our hens is numbered with duplicate bands, and individual book accounts are kept with each, whether she produces much or little. The same is true of all males so far as purity of blood is concerned.

In our work the term "registered" is used solely with reference to performance, which in work with Jersey or Holstein cattle would mean registered in the "advanced registeries" of those breeds. We have registered no female unless she had laid 200 or more eggs during the first 12 months forward from the day on which she laid her first egg. We have registered none of her daughters unless they themselves had laid at least 200 eggs per year.

We register all of the sons of registered hens, and designate them as registered males. They are no better bred than their own sisters which we reject from registry when they do not prove to be heavy performers. Were there some practicable means by which we could determine the ability of the male to transmit to his offspring the high egg producing function of his dam, we would apply the same rigid rule of selection to him that we do to his sisters.

There was no reason why we should select 200 as the number of eggs necessary to entitle a bird to advanced registration. It is a high record—much higher probably than large flocks will ever be made to average, in our time. Perhaps we might have taken 190 or 210 with equal propriety,—just as horse men might have selected some other time than 2.30 by which to determine a *standard horse.*

The unregistered cockerels and pullets are as well bred on their father's side as the registered ones are, but, while the registered ones have dams that produce 200 eggs or over, the mothers of the unregistered ones laid from 150 to 199 eggs in their first laying year. It is among these unregistered pullets that we have found the most of the 200 egg producers who are each year added to the foundation breeding stock.

The charts shown are only given as examples of the breeding. In the male breeding pens nearly 30 different hens are employed this year, which give as many different pedigrees. In the unregistered female breeding pens are several hundred breeding hens, each giving pedigrees to their progeny. In the chart illustrating the breeding of the registered males, it is shown that his mother and her mother were both producers of over 200 eggs. We have two similar instances where the daughters of 200 egg producers are themselves 200 egg producers. This has not generally been so, probably because the hen that laid heavily one year did not commence laying until so late the following year that their pullets came into laying too late in the year to make great records for themselves. Several hundreds of the unregistered cockerels have for each of the last three years been sold to poultrymen and farmers and a great deal of commendation has been expressed relative to the benefits derived from their use in securing earlier and increased egg yields.

The first chart shows the breeding of the registered males that were raised in the present breeding year of 1905. The registered males are designated by numbers. It will be noted that the mother and the grandmother of the registered males are registered birds in the sense in which we use the word, the mother having yielded 203 and the grandmother 213 eggs in their first laying years. Beyond that, while the birds are pure bred, we do not know their breeding except that their mothers laid not less than 150 and not more than 199 eggs in their first laying years. The breeding of the unregistered males and females raised in 1905 differs from the registered in that none of the mothers have laid over 199 eggs in their first laying year.

Diagram illustrating breeding of registered males raised in 1905.

- Registered males raised in 1905.
  - No. 304
    - No. 165
      - No. 66
        - No. 41
          - No. 44
          - No. 303 (208)
            - No. 286 (206)
        - No. 676 (209)
          - No. 29
          - No. — 150 to 199
            - No. 286 (206)
      - No. 1003 (240)
        - No. 52
          - No. 18
          - No. 326 (211)
            - No. 101 (204)
        - No. — (150-199)
          - No. 21
          - No. — (150-199)
            - No. 286 (206)
    - No. 205 A. (225)
      - No. 61
        - No. 40
          - No. 17
          - No. 318 (237)
            - No. 101 (204)
        - No. 635 (201)
          - No. 24
          - No. — (150-199)
            - No. 101 (204)
      - No. — (150-199)
        - No. 36, 37, 38 or 39
          - No. 17
          - No. 318 (237)
            - No. 101 (204)
        - No. — (150 to 199)
          - No. 24
          - No. — (150-199)
            - No. 286 (206)
  - No. 520 (203)
    - No. 166
      - No. 51
        - No. 40
          - No. 17
          - No. 318 (237)
            - No. 101 (204)
        - No. 635 (201)
          - No. 24
          - No. — (150-199)
            - No. 101 (204)
      - No. 1003 (240)
        - No. 52, 53, 54 or 55
          - No. 18
          - No. 326 (211)
            - No. 101 (204)
        - No. — (150-199)
          - No. 21
          - No. — (150-199)
            - No. 286 (206)
    - No. 1001 (213)
      - No. 62
        - No. 41
          - No. 44
          - No. 303 (208)
            - No. 286 (206)
        - No. 676 (209)
          - No. 29
          - No. — (150-199)
            - No. 286 (206)
      - No. — (150-199)
        - No. 45, 46, 47 or 48
          - No. 24
          - No. 318 (237)
            - No. 101 (204)
        - No. — (150-199)
          - No. 13
          - No. — (150-199)
            - No. 286 (206)

The figures in brackets below or at the right of the number of the hen indicate the egg yield for the first laying year.

Diagram illustrating breeding of unregistered males and females raised in 1905.

- Unregistered males and females raised in 1905.
  - No. 302
    - No. 160
      - No. 66
        - No. 41
          - No. 44
          - No. 303 (208)
            - .... No. 286 (206) ....
        - No. 676 (209)
          - No. 29
          - No. — (150-199)
            - .... No. 286 (206) ....
      - No. 1003 (240)
        - No. 52
          - No. 18
          - No. 326 (211)
            - .... No. 101 (204) ....
        - No. — (150-199)
          - No. 21
          - No. — (150-199)
            - .... No. 286 (206) ....
    - No. 224 (222)
      - No. 61
        - No. 40
          - No. 17
          - No. 318 (237)
            - .... No. 101 (204) ....
        - No. 635 (201)
          - No. 24
          - No. — (150-199)
            - .... No. 101 (204) ....
      - No. — (150-199)
        - No. 36, 37, 38, 39
          - No. 17
          - No. 318 (237)
            - .... No. 101 (204) ....
        - No. — (150-199)
          - No. 24
          - No. — (150-199
            - .... No. 268 (206) ....
  - No. — (150-199)
    - No. 159
      - No. 51
        - No. 40
          - No. 17
          - No. 318 (237)
            - .... No. 101 (204) ....
        - No. 635 (201)
          - No. 24
          - No. — (150-199)
            - .... No. 101 (204) ....
      - No. 1003 (240)
        - No. 52, 53, 54 or 55
          - No. 18
          - No. 326 (211)
            - .... No. 201 (204) ....
        - No. — (150-199)
          - No. 21
          - No. — (150-199)
            - .... No. 286 (206) ....
    - No. — (150-199
      - No. 62
        - No. 41
          - No. 44
          - No. 303 (208)
            - .... No. 286 (206) ....
        - No. 676 (209)
          - No. 29
          - No. — (150-199)
            - .... No. 286 (206) ....
      - No. — (150-199)
        - No. 45, 46, 47 or 48
          - No. 24
          - No. 318 (237)
            - .... No. 101 (204) ....
        - No. — (150-199)
          - No. 13
          - No. — (150-199)
            - .... No. 286 (206) ....

The figures in brackets below or at the right of the number of the hen indicate the egg yield for the first laying year.

Sizes of Flocks, Rooms and Individual Floor Spaces.

We are now using three large laying and breeding houses, and a smaller curtain front building known as the " Pioneer House."

House No. 1 is 16 feet wide and 150 feet long. This house is warmed by hot water and is always kept above the freezing point by the use of about four tons of coal each year. It has been in use seven years and the birds occupying it have laid well, and been in good health, but have not had as good color and were not as vigorous as their mates in the open front houses. The pens in this house are 10 by 16 feet in size and have been occupied by 20 hens, and during the breeding seasons generally by one or two males in addition.

House No. 2 is two years old. It is 12 feet wide and 150 feet long. Aside from the Pioneer house, this is the first curtain front elevated roosting closet house we built. It is fully described in Bulletin 100. The pens in this house are 12 by 20 feet in size and each one contains 50 hens, besides the cockerels at breeding time, which gives four and four-fifths square feet of floor space to each hen.

House No. 3 was constructed last fall. It is 16 feet wide and 120 feet long. It is of the same style as No. 2 except that it is wider. There are four pens in the building, each 16 feet wide and 30 feet long. Two of the pens are arranged for 100 hens each, and two of them for 150 each.

We have now used the Pioneer house four years with 50 pullets in it each year, the No. 2 house two years with 300 pullets each year and the No. 3 house one year. Besides these three houses, we have had the use of another house of the open front style of construction for three years with about 200 yearling, breeding hens in it each year.

These curtain front houses have all proved eminently satisfactory. Not a case of colds or snuffles has developed from sleeping in the warm elevated closets, with their cloth fronts, and then going directly down into the cold room, onto the dry straw, and spending the day in the open air. The egg yields per bird have been as good in these houses as in the warmed one. The purposes of the different sizes of rooms and flocks is to compare the results of the welfare and egg yields of the birds under the different conditions.

The conditions that were laid down years ago and accepted as imperative, that hens could only be kept profitably as layers in flocks not greater than 15, with allowances of at least 10 square feet of floor space per bird, required large space for small numbers of birds and was expensive. The small pen, even though sparsely populated, means close confinement to the occupants. If one hen was confined and compelled to remain on the generous allotment of a square yard, life would be very unsatisfactory to her. But give her 25 square yards of floor room to roam over at will and she will be happy, although she may meet 49 neighbors in her wanderings, and divide the room with them, yet the allotment to each individual is reduced to one-half a square yard.

The seven pens in House No. 2 each have 240 surface feet of floor and the 50 pullets in each pen averaged 150 eggs last year. The pullets this year, in the same pens, appear to be doing equally well.

In House No. 3 the pens are twice as large as those of No. 2, containing 480 square feet. In the first pen 100 pullets are kept, having four and eight-tenths square feet of floor per bird, just the same allotment as is given in the pens of 50 birds, in the No. 2 house. Some of the questions which it is hoped to get light upon by these comparisons are: Does the larger room have advantages over the smaller one when both are equally densely populated, by giving greater opportunities and freedom to the birds? Are there disadvantages when the numbers of birds in the flock are increased, the proportioned floor space per bird remaining the same?

Should the tests indicate that the greater liberties of the larger pens are advantageous, the question arises: are the advantages such that the number of birds in the large pens can be increased and the ratio of egg production be maintained, or; how far can the net profit from the pens be increased by increasing the number of birds in each pen, although the average egg yield be diminished by the denser population?

In House No. 3, pen No. 3 is a duplicate of pen No. 1 in size and construction, and in it 150 pullets were wintered. The floor allotment per bird in this flock is three and one-fifth square feet. Three roosts instead of two were required for the increased number of birds. The wider floor of the elevated closet makes the daily cleaning of the platforms, proportionately, a little greater, but not much so, as the roosts are elevated by a single rope pulley.

Although the cubic feet of air space per bird was the same in the flocks of 50, 100 and 150, the cloth covered fronts of the closets where 100 or 150 roosted were of the same size and it was very evident early in the winter that the supply of fresh air to the largest flock was not sufficient. It was not practicable to materially increase the cloth surface and allow more air to filter in, so three openings were made in the upper part of the curtain frame through which better ventilation could be secured. The openings were six inches wide and 30 inches long with wooden shutters provided for them. The shutters were kept entirely open into the outer room during mild nights, but when high winds prevailed and the temperature fell to 10 or 30 degrees below zero, the openings were partially closed, but never more than half so.

The walls of the elevated closet are packed with sawdust four inches in thickness, and the curtains fit very closely, leaving very small cracks. The ten ounce duck of which the curtains are made is not oiled, as was the case with those in the original house built by us. The supply of fresh air was mostly admitted through the cloth, while the worn out air passed off through the openings above. By this arrangement the birds were not in drafts or currents of air. Where three roosts are arranged abreast, instead of two, the openings are absolutely essential and for smaller flocks they are convenient during the mild nights, especially towards spring.

The health of the birds in this flock of 150 in comparison with those in the flock of 100, in like sized pens, was apparently as good. In the pens of 50, 100, and 150 birds, the proportional losses did not materially differ, being very small in all pens.

It is yet too early to draw conclusions from the results as we have only the data of one year from November to June to compare. Next year we expect to have seven pens of 50 pullets each with floor space of 4.8 square feet per bird, and two pens of 100 birds each, with floor space of 4.8 feet per bird to compare with them. Also two pens of 150 birds each with floor space of 3.2 feet per bird to compare with the flocks of 100 birds above mentioned.

With pens of the same style and arrangement and birds of our own raising, matched in age, development and breed, and with the same system of feeding and attendance, information should be secured regarding the sizes of rooms and numbers in flocks which may be of incalculable value to the poultry industry of the country.

Feeding the Hens.

For 25 years we have been at work with the same family of Barred Plymouth Rocks and have learned several ways to feed and handle them to secure eggs, and to avoid the losses which are so common to mature hens of that breed, from over fatness. Other methods of feeding may be as good or even better. While it is true that only the full fed hen can lay to the limit of her capacity, it is equally true that full feeding of the Plymouth Rocks, unless correctly done, results disastrously.

Several years ago we gave up the morning mash and fed it late in the afternoon with far better results than when fed in the morning. The full meal in the morning had produced laziness, fatness and soft shelled eggs in our Plymouth Rocks, but these bad conditions and results were not encountered when the birds were required to eat slowly, and exercise by digging the hard grains out of the straw bedding.

The birds were fed throughout the year daily as follows: Each pen of 22 received one pint of wheat in the deep litter early in the morning. At 9.30 A. M. one-half pint of oats was fed to them in the same way. At 1 P. M. one-half pint of cracked corn was given in the litter as before. At 3 P. M. in winter and 4 P. M. in summer they were given all the mash they would eat up clean in half an hour. The mash was made of the following mixture of meals: 200 lbs. wheat bran; 100 lbs. corn meal; 100 lbs. wheat middlings; 100 lbs. linseed meal; 100 lbs. gluten meal; 100 lbs. beef scrap. The mash contained one-fourth of its bulk of clover leaves and heads obtained from the feeding floor in the cattle barn. The clover was covered with hot water and allowed to stand for three or four hours. The mash was made quite dry, and rubbed down with the shovel in mixing, so that the pieces of clover were separated and covered with the meal. Cracked bone, oyster shell, clean grit, and water were before them all of the time. Two large mangolds were fed to the birds in each pen daily in winter. They were stuck onto large nails which were partly driven into the wall a foot and a half above the floor. Very few soft shelled eggs were laid and so far as known, not an egg has been eaten by the hens during the last five years.

The records of several years' feeding show that from 50 to 55 pounds of the dry meals, not including the clover leaves of which the mash was made up, were eaten by each hen per year. The quantity of grain fed in the litter was the same every day, winter or summer. The quantity of mash was variable, being all they would eat in an hour at the close of the day. They ate more in cold than in warm weather; also considerably more when they were laying heavily than when they were yielding few eggs.

The feeding above described was with hens in a house kept warm enough by hot water pipes, so that the temperature was above the freezing point at all times. The amount of food required by the birds kept in this house for several years was always less during the winter season, than where birds were kept in the colder houses.

In addition to the 50 to 55 tbs. of mash, the hens in this house have averaged each year 18.2 tbs. wheat; 6.4 tbs. cracked corn; 5.8 tbs. of oats; 5.9 tbs. oyster shell; 3.2 tbs. dry poultry bone; 2.9 tbs. mica grit; and 40 tbs. mangolds. The straw for litter has averaged 36 tbs. per bird.

The birds fed and housed as above described have averaged laying about 150 eggs each.

CRACKED CORN AND BEEF SCRAP SUBSTITUTE FOR THE MOIST MASH.

Last year 300 April and May hatched pullets were put in six pens in the open front house and the birds in all pens were selected so as to have the lots equal in quality. One hundred and fifty of the birds were fed on dry grains in the litter during the day and a full feed of moist mash was given towards evening. The mash was made as above described.

The other 150 birds were fed the same quantities and kinds of dry grains in the litter, but instead of moist mash they were given all they would eat of dry cracked corn in troughs at evening. Dry beef scraps were kept within their reach at all times. Both lots were constantly supplied with oyster shell, dry crushed bone, and mica crystal grit. Mangolds were fed through the winter and when the runs were bare in summer, other green food was supplied.

The materials used by each lot during the full year average per bird as follows:

Pounds of dry grain, straw, mangolds, etc., per bird for one year.

Lot 1 with mash—Mash, 53.3 pounds; wheat, 23.8 pounds; cracked corn in litter, 7.7 pounds; oats, 6.9 pounds; oyster shell, 8.5 pounds; bone, 4.4 pounds; grit, 4.2 pounds; beef scrap, —; mangolds, 40 pounds; straw, 36 pounds.

Lot 2 without mash—Cracked corn, 45.4 pounds; wheat, 23.8 pounds; cracked corn in litter, 7.7 pounds; oats, 6.9 pounds; oyster shell, 4.4 pounds; bone, 1.7 pounds; grit, 2.9 pounds; beef scrap, 14.7 pounds; mangolds, 40 pounds; straw, 36 pounds.

Cost of food and straw, Lot 1, $1.73; Lot 2, $1.69.

Cost of food without mangolds, Lot 1, $1.48, Lot 2, $1.43.

Eggs yielded, Lot 1, 151; Lot 2, 149.

Comparisons of the costs of the two rations and the egg yields of the birds fed upon them do not show very great advantages of one ration over the other. There were no marked differences in the appearances and health of the birds in the two lots. They were in good general health, aside from the difficulties that arise when birds are induced to overload their crops after a period of partial fasting. The free use of cracked corn cheapened the cost of the ration, and the egg yield was not depressed sufficiently to indicate that that ration was faulty in its production. When compared with the food required to feed a hen a year in the warmed house, which was about 95 pounds, the 109 pounds used in this test is an increase of nearly 15 per cent.

As the birds in each house laid about the same number of eggs, it seems reasonable to suppose that the excess of food was needed for maintenance in the colder house, where the birds were in out-of-door temperature during the most of the day time throughout the year.

Although as many eggs were yielded by the birds eating less food in the warmed house, the greater vigor and less losses among birds in the open-front house more than compensated for the excess cost of maintenance.

In Lot 2, where the birds helped themselves at will to beef scrap, they ate of it on the average, 14.7 lbs. during the year; while in Lot 1 each bird received 8.7 lbs. of the scrap in the mash. This leaves a difference of 6 lbs. in the amount of animal food consumed by individuals in the two lots. Was this difference supplied by the materials rich in vegetable protein which made up a part of the mash, viz., the linseed and gluten meals?

It will also be noticed that the quantity of oyster shell, bone and grit eaten by the birds having a constant supply of beef scrap was markedly less than when the supply of scrap was limited to that contained in the mash.

DRY FEEDING.

On the first of last November we began feeding 550 April and May hatched pullets wholly on dry food. They were in the curtain-front houses with warm elevated roosting closets and in flocks of 50, 100 and 150. At five o'clock in the morning the flocks of 50 birds were given two quarts of cracked corn; at half past ten o'clock they had one quart of wheat and one quart of oats. This dry material was all spread on the litter on the floor but was not raked in. Along one side of the pens were feed troughs with slatted fronts, in which was kept a supply of the dry material of which the moist mash, before described, was composed. These troughs were never allowed to remain empty when the supply was exhausted. The dry mash was constantly within the reach of all birds and they helped themselves at will. Oyster shell, dry cracked bone, grit and charcoal were accessible at all times. A moderate supply of raw mangolds and plenty of clean warm water was furnished them. When they were first put upon this ration they were not acquainted with the dry mixture in the troughs and ate of it sparingly, but in three or four days they were using as much of it as at any later time until they got to laying heavily. When the feeds of cracked corn, wheat and oats were given, the birds were always ready and anxious for them and would scratch in the litter for the very last kernel before going to the troughs where an abundance of food was in store.

It was very evident that they liked the broken and whole grains better than the mixture of the fine materials; yet they by no means dislike it, for they helped themselves to it,—a mouthful or two at a time—whenever they seemed to need it, and never went to bed with empty crops so far as we could discover. They apparently did not like it well enough to gorge themselves with it, and sit down, loaf, get over fat 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 troughs 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.

We cannot give the results of a full year's feeding in this way, as we have practiced it only from the first of last November to the close of June. The number of hens lost during the winter has been less than ever before, even when they were kept in the same style of houses. We can ascribe this to no other cause than that the birds did not overload with food at any time. We have never had so many eggs laid during the winter months by a like number of hens, but that may be due to better breeding, or to the open-front houses which the birds occupied.

During the 31 days of March the 550 birds consumed on the average, per bird, the following materials, viz.: Cracked corn, 2 lbs.; wheat, 1.09 lbs.; oats, .81 lbs.; mash, 5.68 lbs.; shell, .52 lbs.; bone, .25 lbs.; grit, .31 lbs.; mangolds, 3.30 lbs.

During the months when they were not laying so heavily the consumption of mash was but about four pounds and the demands for shell, bone and grit were less. It will be noticed that the proportion of wheat fed was less than in any former ration we have fed and that the cracked corn was increased, thus cheapening the ration.

The average yields of the 550 hens during March was 20.4 eggs per bird. The whole number of eggs laid by them during the six months from November 1st to April 30 was 42,126, an average of 76 per bird. It must be borne in mind that these birds were not selected but were the whole number of chickens reared last year.

Feeding the Chickens.

We used to bake bread * for the young chicks but have abandoned the practice, not because there is anything better for them, but we believe the work involved in preparing it is not necessary.

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, enough to break the egg into small pieces. This mixture is the feed for two or three days until the little things have learned how to eat. It is fed sparingly, in the litter and sand on the brooder floor.

About the third day we commence to feed a mixture of hard, fine broken grains, i. e., cracked corn, wheat, millet and pinhead oats as soon as the birds can see to eat in the mornings. This is fed in the litter, being careful to limit the quantity so they shall be hungry at ten o'clock. We have used several of the prepared dry chick foods and like them when they are made of good clean grains and do not contain grit. The grit and charcoal can be supplied at less cost and must be freely provided.

At ten o'clock the rolled oats and egg mixture is fed, in tin plates, with low rims. After they have had the food before them five minutes the dishes are removed and they have nothing to lunch on except a little of the fine broken grain which they scratch for. At 1 o'clock the hard grains are again fed as in the morning and at 4.30 to 5 o'clock they are fed on the rolled oats and egg mixture, giving all they will eat until dark.

When they are about three weeks old the rolled oats and egg mixture is gradually displaced by a mixture made up of two parts by weight of good clean bran, 2 parts corn meal, 1 part middlings or Red Dog flour, 1 part linseed meal and 1 part fine beef scrap. This mixture is moistened just enough with water 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 flat troughs with low sides.

The hard broken grains may be safely used all the way along and the fine meals left out, but the chicks do not grow so fast as when the mash is fed. There seems to be least danger from bowel looseness when the dry grains only are fed and it is very

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* Bulletin 100 this station, page 8.

essential that the mash be dry enough to crumble in order to avoid that difficulty. Young chicks like the moist mash better than though it was not moistened and will eat more of it. There is no danger from the free use of the properly made mash, twice a day, and being already ground the young birds can eat and digest more of it than when the food is all coarse. This is a very important fact and should be taken advantage of at the time when the young things 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 foods and the gizzard must not be deprived of its legitimate work and allowed to become weak by disuse.

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 with their contents of 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.

Until last season we had continued feeding two feeds of cracked corn and wheat and two of mash daily as long as the birds remained in the field. Last June we had 1,400 chickens well started and we changed the plan of feeding by keeping cracked corn, wheat, and beef scrap, in separate slatted troughs where they could help themselves whenever they desired to do so. Not more than one-fourth of the grain was wheat for the pullets, while in the cockerel division nothing but cracked corn and beef scrap were fed. Grit, bone and oyster shell were always supplied. There were no regular hours for feeding, but care was taken that the troughs were never empty.

The results were satisfactory. The labor of feeding was far less than that required by any other method we have followed. The birds did not hang around the troughs and over-eat, but helped themselves—a little at a time—and ranged off, hunting or playing and coming back again when so inclined to the food supply at the troughs. 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 over-eat of it.

During the range season—from June to the close of October—the birds ate just about one pound of the scrap to ten pounds of the cracked corn and wheat. They had opportunity to balance their rations to suit themselves by having the two classes of food to select from always at hand. It would seem that we had not been far wrong in our previous feeding, as the birds used just about the same relative amounts of scrap to other food, when they had liberty to do so that we had formerly mixed in for them.

We are not able to say whether this method is more or less expensive of material, than when we fed the four feeds each day at regular hours. As near as we could calculate, there were no appreciable differences.

The birds did well under this treatment. The cockerels were well developed and we never raised a better lot of pullets. The first egg was laid when the oldest pullets were four months and ten days old. For the last six years the pullets have been from four months and ten days to four months and twenty days old when the first eggs were found. This year we shall make another change by adding dry mash to the menu,—having a trough of that material beside the ones containing beef scrap and cracked corn. The difficulty of keeping the food clean and dry during continued exposure is nearly overcome by using troughs with slatted sides and broad, detachable roofs. We make them from six to ten feet long, with the sides five inches high. The lath slats are two inches apart and the troughs are sixteen inches high from floor to roof. The roofs project about two 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. The trough can then be filled and the roof drawn back into place without lifting it. This arrangement is the best of anything we have found for saving food from waste and keeping it in good condition. When dry mash is used in it there is considerable waste by the finer parts being blown away. When used for that purpose it is necessary to put it in a sheltered place out of the high winds.

CEREAL FOODS.

L. H. MERRILL.

[In cooperation with the Office of Experiment Stations of the U. S. Department of Agriculture, the Maine and Minnesota Experiment Stations have, during the past ten years, made special studies on the composition and digestibility of cereal foods. The technical results thus obtained are published chiefly in the bulletins of the Office of Experiment Stations. This Station has published two bulletins upon the composition of the breakfast cereal foods that were found in the Maine markets. In the present bulletin Professor Merrill presents many of the general results which have been obtained in the course of this work. While the results of these investigations have been freely used in this bulletin, yet for purposes of definite illustration he has drawn chiefly upon the analyses and digestion experiments made at this Station.—C. D. W.]

Few phases of our modern civilization furnish a more curious and interesting study than the rapid increase in the number and variety of our foods. Among the causes that have contributed to this development may be mentioned: The extension of our commerce, which has placed a constantly increasing range of food materials within our reach; the efforts of our national government, which is actively engaged in the introduction of new food plants, and the production of new varieties of old types; the ingenuity of manufacturers, who have been quick to see that their sales must depend to a great extent upon the variety and attractiveness of their output; and in no slight degree, to an increased knowledge of the functions of food—i. e., the demands of the body, and the methods by which these demands may be met. To these causes may also be added a more or less artificial demand, encouraged and stimulated by persistent advertising, for foods which may be quickly and easily digested. Perhaps it is a natural outcome of the strenuous age in which we live that the average business man is reluctant to devote the proper time and attention to his meals, with the result that dyspepsia in its various forms has become alarmingly prevalent. There has thus arisen a class of food products whose chief claim upon our attention is their alleged readiness to "slip into the tissues" of the consumer without the usual tax upon the digestive organs.

Just now we are passing through what might very properly be called the epoch of cereal breakfast foods. Never in our history have the cereal foods occupied so prominent a place in our dietaries. Twenty-five years ago practically the only cereal foods to be found upon our American market were wheat flour, corn meal, hominy, and hulled corn. Wheat and oats meals had been introduced by our Irish and Scotch immigrants, but their use was far from general. Barley, rye and rice were used only to a very limited extent. Today a half-hour's canvass of the shops of our large towns or cities would reveal fifty or more preparations of these cereals, most of which present special claims to our attention. Scarcely a week passes that does not see some new cereal claimant to the public favor and the list has grown to embarrassing proportions. Few of the brands appear to be long-lived and it is safe to say that of those on sale today fully one-half will disappear within three years or will survive only on the top shelf of the country grocery, a food for worms rather than for man.

A class of foods that has come to occupy so prominent a place in our dietaries certainly deserves more than a passing consideration. Many of these preparations have been analyzed at this Station and the results published in Bulletins 55* and 84. It is proposed here to study these foods from a more general standpoint. To do this, we must take into consideration not only their chemical composition, but their palatability, digestibility, ease of preparation, relative cost, the claims made for them, and the extent to which these claims are made good.

CLASSIFICATION.

Notwithstanding the large number and variety of the cereal breakfast foods, the most of them fall readily into one of three groups. In the first of these may be placed those which are prepared by simply grinding the decorticated grain. The sec-

* Bulletin 55 is no longer available.

ond group includes those which have been steamed or otherwise partially cooked, and then ground or rolled. The third group includes all those preparations which have been acted upon by malt, by the action of which a portion of the starch has undergone a chemical change.

The earliest of these foods to come into general use in this country were of the first class, oats being the most widely consumed. While the old fashioned oatmeal found favor with many, there is reason to believe that it was not always welcomed, and in the memories of many of us the morning bowl of "oatmeal mush" went far to temper the joys of childhood. Although the dish possessed many virtues that seemed to adapt it peculiarly to the needs of growing children, the results of its enforced use were not always happy, and it can scarcely be regretted that it has been so largely supplanted by other preparations of oats, wheat, or corn, some form of which is quite sure to appeal to the palate and furnish a pleasing variety. The use of coarsely ground, uncooked wheat, does not seem to have become so general. Corn meal, however, has been widely used, and hominy continues in public favor.

Following the manufacture of the uncooked cereal meals came the foods of the second group, especially the so-called "rolled" oats and wheats. By far the larger part of the breakfast foods consumed today are of this class. The superiority of these goods over those formerly in use is easily demonstrated and will be referred to later.

It is claimed that the malted preparations represent a still greater advance in the perfection of these foods. The methods employed in their manufacture vary somewhat, but they are all based upon the same principle. Barley malt is mixed with the cereal under conditions favorable to the action of the ferment present, the result being that a portion of the starch is converted into a soluble form.

Some of the cereal foods are fully cooked and may be eaten dry without further preparation, or, as many prefer, with the addition of cream and sugar. In a few cases the manufacturers cater still farther to the popular taste by wetting the cereal with a salted or sweetened solution, after which it is again dried and slightly browned. Within a few years a statement has been quite generally circulated that certain foods of this class contain arsenic. Compounds of arsenic are not uncommon in soils; and since plants are unable to exclude many salts which occur dissolved in the water of the soil, it may be readily believed that arsenic may thus find its way into growing crops. The amount of this element which can accumulate in the cereal grains by natural methods is, however, too small to excite our apprehension. On the other hand it is difficult to conceive any motive which should lead to its intentional introduction. The writer has examined a number of samples of goods which for some reason had fallen under suspicion, using the most delicate tests, but always with negative results.

COMPOSITION.

The value of any food must depend primarily upon the kind and amount which they contain of certain proximate principles which experience has taught us are absolutely essential to the maintenance of life and health. The composition of these foods is, therefore, a matter of great importance. The accompanying table gives the average composition of those preparations of corn, oats and wheat which have been collected in Maine markets and analyzed at this Station. For purposes of comparison there is given in the same table the composition of three kinds of flour, all prepared from the same hard spring wheat.

The terms employed here for the most part require no explanation. For the benefit of non-scientific readers a few words regarding the "heat of combustion" may not be out of place.*

One very important function of food is to supply energy to the body, where it is developed in the form of muscular activity, body heat, and probably in mental processes also. It may be stated in a general way that the energy furnished the body by the digested portion of our food is believed to be proportional to the heat produced when an equivalent amount of these foods is burned in the laboratory under such conditions that the heat can be accurately measured. We know that this is not quite true of protein; yet the difference between the physiological and the physical fuel values of this class of bodies is so slight that the latter, which is readily obtained by laboratory methods, serves as a very useful index of the energy-producing power of our foods.

The method employed for determining the heat of combustion consists in burning a carefully weighed portion of the food

* The reader is referred to Farmers' Bulletin No. 142, U. S. Dept. Agriculture, The Principles of Nutrition and Nutritive Value of Food.

examined and measuring the heat produced. The unit of measurement is the calorie—the amount of heat that will raise one kilogram of water (about two and one-half pounds) through one degree Centigrade; or, what amounts to nearly the same thing, one pound of water through four degrees Fahrenheit. Other things being equal, then, the food product yielding the highest heat of combustion will, if digested, yield the greatest amount of energy in the body.

Average composition of cereal breakfast preparations compared with wheat flour variously milled.

Number of analyses.		Water.	Protein.	Fat.	Carbohydrates.	Ash.	Heat of combustion.
		Per cent	Per cent.	Per cent.	Per cent.	Per cent.	Calories per gram.
14	Corn meal and hominy*	10.7	8.6	0.7	79.7	0.3	3.854
28	Rolled oats†	8.4	15.6	7.5	66.6	1.9	4.323
35	Rolled wheat†	9.9	12.0	1.9	74.8	1.4	3.966
1	Malted oats†	6.4	16.7	5.4	69.7	1.8	4.318
4	Malted wheat†	6.9	13.3	1.2	77.C	1.6	4.017
4	Graham flour	10.7	14.8	2.3	70.3	1.9	4.029
4	Entire wheat flour	11.4	14.1	2.0	71.5	1.0	3.967
4	Standard patent flour	11.4	13.9	1.4	72.8	0.5	3.959

* Uncooked preparations only.
† Cooked or partially cooked preparations only.

Of the unmalted cereal foods, the oats contain 25 per cent more protein than the wheat preparations, and nearly double that of the corn. The oats also furnish four times as much fat as the wheat and ten times as much as the corn. They are richer in ash constituents and furnish more energy (heat of combustion) than either of the other two grains. The only respect in which oats are excelled by the corn and wheat is in the amount of carbohydrates, the most abundant and least valuable of the nutrients named. Corn in its natural condition contains on the average over 4 per cent of fat. The small amount in the corn meal and hominy is due to the removal of the germ. The wheat products are intermediate in composition between the corn and oats.

The malted foods seem to have been more thoroughly dried than the other products, containing only from 6½ to 7 per cent of water. Otherwise their percentage composition does not vary greatly from that of the same cereals in the unmalted conditions, although there are other differences to be mentioned later.

Analyses made at different times of the same brand show great variations in composition. This is not strange when it is remembered that there are many varieties of these cereal grains, varying much in composition, and that even the same variety will show wide differences in composition according to the character of the season, soil and fertilizer used. In the manufacture of patent flours the variations are carefully offset by the miller, who first informs himself concerning the quality of the wheats at his disposal, and then by judicious blending of several grades is able to turn out a very uniform product. Equally exact results might be obtained with these goods if the manufacturer found it for his interest to give the matter his study and care. Variations in the composition of these goods are not as easily discoverable as with bread flours, and the composition of the output, except for the limits imposed by nature, becomes largely a matter of chance.

Graham flour is made by grinding the entire wheat kernel. It contains, therefore, everything found in the kernel, including the woody and indigestible outer coatings. The so-called "entire wheat flour" is usually prepared in precisely the same manner, except that it is afterward subjected to a bolting or sifting process by which some of the coarser bran is removed. It is sometimes claimed that only the least valuable portion of the bran is thus rejected, but a study of these products made at this laboratory does not substantiate this claim.* The composition of these flours is precisely what might have been expected. Starch attracts moisture much more than the woody bran. Hence we find the graham flour, which is rich in bran with a correspondingly less amount of starch, drier than the other flours. The aleurone layer, which forms a portion of the bran as usually milled, is very rich in protein. Hence the protein content is greatest in the graham and least in the patent flour. The germ is rich in fat and mineral constituents. Its removal in the patent flour brings down the percentage amount of fat and

* Bul. 103, Maine Expt. Station, pp. 68-69.

ash. The oxidation of fat produces more heat than that of any other constituent. Hence the same causes that reduce the amount of fat in the flour lower the heat of combustion. As the protein, fat, and ash fall, the amount of the remaining solids, the carbohydrates, must rise.

In looking over the table of composition one is likely to be impressed with the marked difference between the rolled oats and the other cereals in the amount of fat which they contain. Although corn in the kernel carries about 4 per cent of fat, most of this is in the germ, which in the manufacture of hominy is almost wholly removed, thus reducing the fat to about one-fifth of the original amount. Too much importance should not be attached to this difference in fat content, however, since fats and carbohydrates perform nearly the same function in the animal body, although the fats represent more than double the energy furnished by the carbohydrates.

Since the oxidation of the fats in the body produces heat, oats are often spoken of as "heating" food and their use in warm weather is sometimes discouraged by physicians. This fact might deserve more serious consideration if this cereal made up a larger part of our diet. As a rule they are eaten but once a day. An average serving of cooked rolled oats would be about 160 grams (5½ ounces), seven-eighths of which is water. The equivalent 20 grams of uncooked oats, containing 7½ per cent of fat, would furnish 1½ grams fat, or about one-twentieth of an ounce. If one were to take daily the amount of oats mentioned (160 grams cooked, or 20 grams dry) he would consume in eight months nearly as much fat as would be furnished by one pound of butter. If it be true that oats are a heating food, the fact cannot be due merely to the excess of fat which they carry.

DIGESTIBILITY.

The analyses of cereal foods show them to be rich in the compounds which are essential to life. It is evident, however, that the composition of our foods is a matter of little importance unless they can be converted into soluble and assimilable forms—that is, unless they are digestible. The experience of unnumbered generations, unassisted by any knowledge of chemistry, has led to the selection of foods which are both rich and digestible. In this list of time-approved foods the cereal grains occupy a deservedly prominent position. It still remains for us to ask if, in the light which modern research can cast upon the subject, it is possible to make a profitable discrimination in our selection from the large and increasing list of cereal products.

The cereals are no exception to the general rule that most vegetable foods require more cooking than those of animal origin. This is in part due to the fact that the composition of the animal foods more nearly approximates that of our bodies and they consequently require less change to fit them for absorption and assimilation. On the other hand, the nutrients of our vegetable foods are for the most part enclosed in small cavities (cells) the walls of which consist of woody matter (cellulose) upon which the digestive juices of man have but little action. The cellulose, therefore, is not only of no value as a food for man, but it prevents the digestive fluids from attacking the cell contents. In the crushing, rolling or flaking processes to which many of these preparations have been subjected, these insoluble cell walls have been ruptured and the cell contents are thus exposed to the action of the digestive juices. It is probable that this mechanical change in the grain is fully as important as the chemical changes which accompany the necessary preliminary softening of the grain by steam. The cereal foods contain from 60 to 80 per cent of carbohydrates, most of which is in the form of starch. Raw starch, while a valuable food for our farm stock, is digested by man with extreme slowness. This seems to be due in part to the very thin covering, apparently of cellulose, with which each kernel of starch is invested. When subjected to high temperature the starch grains swell and burst, very much as a grain of corn "pops" under similar conditions. At the same time a portion of the starch—the amount varying with the temperature and the duration of the heating process—undergoes a chemical change. Whereas raw starch is practically insoluble in cold water, prolonged heat converts it into dextrin, a soluble carbohydrate into which all starch must be changed before it is transformed into a sugar, in which form only it can be absorbed.

The conversion of starch into a soluble form may be accomplished by other means. During the germination of the cereal grains the large amount of starch there stored up is converted into maltose, a soluble sugar, through the action of a ferment (diastase) which is there produced for this special purpose. The amount of the ferment formed is much more than is required to transform the starch of the barley itself. Advantage is taken of this fact in the use of malt, so extensively employed in breweries. This malt is produced by causing barley to sprout, the germinating process being checked when the amount of the ferment is greatest. If a quantity of malt be mixed with a cereal food under conditions favorable to the action of the ferment, a "malted" or predigested food results.

It would appear from the advertising matter that many manufacturers attach great importance to the conversion of the cereal starches into soluble forms. No attempt has been made in these laboratories to determine how far the efforts to accomplish this end have been successful. The matter has received attention elsewhere,* however, and the results are of interest. The table given below shows the amount of dextrin found by McGill in eight different cereal products.

Perfectly sound and untreated cereal grains contain practically no dextrin or maltose. Their presence in these foods is due to the action of heat or malt upon the starch. McGill found that the Ralston Breakfast Food (a rolled wheat) and rolled oats contained but small amounts of dextrin; while in Force and Grape-Nuts from one-fifth to one-third of the total starch had been dextrinized.

Relative percentages of starch and dextrin in certain cereal breakfast foods.

	Starch.	Dextrin.	Extent of dextrinization.
	%	%	%
Corn meal	69.5	....	....
Oat meal	63.8	....	....
Rolled oats	60.5	3.6	5.6
Ralston breakfast food	67.9	2.6	3.7
Malt breakfast food	71.7	3.2	4.3
Malta vita	62.4	9.3	13.0
Force	55.4	14.5	20.7
Grape nuts	49.5	24.9	33.5

* A. McGill, Bul. 84, Laboratory Internal Revenue Department, Ottawa, Canada.

How far is the value of these foods proportional to the solubility of the carbohydrates which they contain? This is a difficult question to answer, since the operations that bring about the desired mechanical changes in the starch at the same time induce chemical changes. It is safe to say that the average person in good health is able to digest starches in which there has been but little dextrinization, provided the starch grains have undergone the exfoliation or "popping" previously alluded to. The figures just quoted reveal the presence of but little dextrin in the ordinary rolled wheat or rolled oats as purchased. In the cooking to which they are afterward subjected dextrin is produced in much larger quantities. We may conclude, therefore, that the dextrinization of these goods by the manufacturers is in itself of little importance, so far as the digestibility of the food is concerned, unless the preparations are to be eaten without further cooking.

There is no evidence that maltose as a food is of any more value than dextrin. So far as the writer is aware, the amount of this sugar in the malted foods has never been determined. It is probably not large, since the long continued action of the ferment by which it is formed would produce undesirable flavors.

The housewife finds a material gain in time in the use of cooked or partially cooked cereals. Do these preparations possess any advantage other than those already mentioned over the raw goods? In other words, if the purchaser obtains the uncooked cereals and devotes the necessary care and time to their preparation, does not the final product possess all the virtues of the prepared goods?

This, too, is a difficult question to answer, inasmuch as the opportunities for comparison are few. There are very few cereal breakfast foods now on the market that have not been subjected to some cooking process. Steaming, which results in a partial cooking, is a necessary preliminary to the rolling to which so many of our cereal foods have been subjected. Indeed, with the single exception of hominy, there is scarcely a wholly uncooked cereal breakfast food to be found upon the market. Out of 28 oat preparations examined at this station, only three were entirely raw, and one of these was an imported article. So far as relates to the difference between the old fashioned, wholly uncooked wheat and oat meals and the modern rolled articles, it may safely be stated that the important difference is mechanical rather than chemical.

During the past few years a series of experiments have been carried out at the experiment stations of Minnesota, Connecticut (Storrs), and Maine, for the purpose of determining the digestibility of certain cereal foods. In some of these experiments the food consisted exclusively of cereal foods, cream and sugar; in other cases the cereals were used with a mixed diet, including bread and meat, but in which the cereal still played a very important part. Since the digestibility of cream and sugar have been quite accurately determined, it is possible, where the simpler diet is used, to calculate the digestibility of the cereal alone with a considerable degree of accuracy.

The details of these experiments will be found elsewhere, but the general results of those obtained at this Station are given in the table below. This shows the digestibility of the organic matter of the food—i. e., the dry matter of the food less the ash or mineral constituents; the digestibility of the protein, one of the most important classes of the necessary constituents of our food; and the percentage of the heat of combustion utilized by the body.

Digestibility of cereal breakfast foods as determined by digestion experiments.

Diet.	Number of experiments.	Total organic matter.	Protein.	Heat of combustion.
		Per cent.	Per cent.	Per cent.
Rolled oats with a mixed diet	17	96.2	90.1	95.3
with a simple diet	16	95.4	84.7	94.2
alone	16	92.3	78.4	89.8
Rolled wheat with a mixed diet	3	96.2	93.2	95.3
with a simple diet	3	95.2	91.6	94.6
alone	3	92.4	85.0	90.7
Force with a mixed diet	3	95.7	92.7	95.2
with a simple diet	3	94.6	89.6	91.1
alone	3	90.4	76.1	88.3
Grape-nuts with a mixed diet	3	96.6	92.8	95.6
with a simple diet	3	94.0	87.6	93.1
alone	3	91.7	76.1	89.4
Shredded Whole Wheat with a mixed diet	3	95.5	92.1	94.5
with a simple diet	3	92.8	84.1	91.4
alone	3	87.7	57.7	84.1
Hecker's Hominy with a mixed diet	4	97.1	88.9	96.3
with a simple diet	4	97.3	83.6	96.4
alone	4	-	74.5	94.4
Granulated corn meal, mixed diet	2	97.2	89.0	96.9
with a simple diet	4	97.2	82.3	95.9
alone	4	-	73.2	93.1

An inspection of the table shows that where the cereals were used with a mixed diet, they had but little apparent effect upon the digestibility of the total food. As regards the digestibility of the total organic matter, the corn products made a very favorable showing. At the same time a larger proportion of the energy of the food was utilized by the body than where the wheat and oat products were used. On the other hand, the use of the corn foods seemed to depress the digestibility of the protein of the total food.

When the simple diet was used, the corn products again made a favorable showing as regards both total organic matter and energy, least favorable of all, however, in digestibility of protein. If we value these foods in proportion to the digestibility of their protein when used with a mixed diet, we must place rolled wheat first and the corn products last. When the digestibility of the cereals alone is calculated, more striking results are obtained. It will be noticed that the rolled wheat now ranks first, not only in the digestibility of the total organic matter, but the corn preparations, and shredded wheat the lowest of all.

One of the most noticeable differences in these cereal foods is found in the digestibility of the protein when the cereal is eaten with a simple diet. This difference is most marked in the various wheat products, especially when the results are calculated to the cereal alone. Thus, while the protein of rolled wheat is 85 per cent digestible, that of Force and Grape-Nuts is 76.1 per cent, and that of Shredded Whole Wheat only 57.7 per cent.

It is not claimed that the results given in the table for the cereal alone exactly represent the proportion of these foods which becomes available to the body when they are eaten under ordinary conditions. No one subsists on these cereals alone, and the conditions are therefore abnormal and the results exaggerated. It is fair to assume—and the assumption is quite in accordance with the results of other experiments recorded elsewhere—that most articles of food are more fully digested when eaten with a mixed diet than when eaten alone. On the other hand, there can be no doubt that these figures correctly indicate the *relative* digestibility of the foods studied. The brands named were chosen for these experiments merely because they were well known articles and representative of the groups indicated.

McGill found (see table, p. 78) that the rolled wheat which he examined contained only 2.6 per cent dextrin, while Force and Grape-Nuts contained 14.5 and 24.9 per cent respectively. These facts suggest that the processes to whichthese latter products have been submitted to render the starch soluble have at the same time diminished the digestibility of the protein.

This conclusion seems to be confirmed by Snyder in a study upon the comparatively digestibility of bread and toast.* He found that the toasting of bread "changes the form and solubility of the nutrients, particularly of the carbohydrates, to a much greater extent than it does the percentage amounts. During the toasting process, a portion of the starch was changed to dextrin, a soluble carbohydrate. The proteid compounds also suffered changes in composition, but opposite in character from the carbohydrates; tests showed that the proteids were rendered less soluble, while the carbohydrates were rendered more soluble."

Further confirmation is found in the work of Colby of the California Experiment Station upon toasted bread. He found that "brown toast made at 170° shows a sudden large increase of soluble matter, more than doubling that obtained at 150°. But there is at the same time a notable decrease in the amount of soluble nitrogenous matter as compared with the extract from the raw bread." †

While differences in the treatment may account for variations in the digestibility of the protein of the wheat products, it throws no light upon the difference noticed in the digestibility of the proteids of the various grains. These may be due to intrinsic differences in the nature of the proteids themselves.

Gudeman ‡ found that the raw cereals, if sufficiently cooked, were as quickly digested as the best malted cereals, more quickly than the prepared cereals and a large majority of the so-called malted cereals.

CLAIMS OF MANUFACTURERS.

The claims made for some of the cereal foods are so absurd that any mention of them seems almost superfluous. It may be said in general that there is but little waste or indigestible matter in the decorticated kernel of our cereal grains. Beyond the

* Minnesota Expt. Station, Bul. 74, p. 166.
† California Expt. Station, Rept. 1901-3, p. 101.
‡ Journal Am. Chem. Soc., 26 (1904), p. 323.

removal of the outer coatings and the expulsion of a possible excess of water, little or nothing can be done to condense them. There is no mysterious alchemy known to millers whereby the cereal grains may acquire the marvelous nutritive qualities ascribed to many of them. The various methods by which they are prepared may render the starch more soluble or convert it into other and more soluble forms. Whether at the same time the foods gain in digestibility is another question which has been already discussed.

The advocates of these foods lay much stress upon the large amount of mineral constituents (ash) which they are said to contain, and which are so largely lacking in white flour. Phosphorus is formed in the brain and other tissues; phosphorus and lime are especially abundant in the bones; iron occurs in the hemoglobin of the blood. These elements are much more abundant in the seed coverings and in the germ of the cereal grains than in the endosperm. The oat and wheat breakfast foods contain from 1½ to 2 per cent of ash constituents, graham flour carries an equally large amount, while patent flour contains only about one-half of one per cent. Hence it is said that we should eat the coarser flours; or, if we persist in eating bread of patent flour, we should supplement our diet by the use of cereal breakfast foods.

If there is any force in this argument, it lies in these two assumptions: First, that white flour as now milled no longer contains enough ash constituents to satisfy the needs of the body. Second, that bread flour and the cereal breakfast foods are the only sources from which the body may derive mineral matters. In point of fact, an average diet, even though it does not include coarse flour and cereal breakfast foods, probably carries the mineral salts in quantities largely in excess of our needs.

While the modern methods of milling cereal breakfast foods have changed the mechanical condition of the cereal, and in many cases the form of the carbohydrates as well, yet the actual nutritive value is for the most part a characteristic of the cereal itself, and is changed but little by its method of preparation. Comparisons made by the Storrs Experiment Station* showed that the average of 26 analyses of several different brands of rolled oats was almost exactly the same as that of 18 analyses of old fashioned oatmeal.

*Storrs (Conn.) Expt. Station, 16th Annual Report (1904), p. 122.

It has been claimed that cooked or partially cooked cereals possess superior keeping qualities. If this be true, it is probably due to the sterilizing effect of the heat employed in their preparation and the greater dryness of the product.

COST.

Although these foods differ greatly in composition, we find an even greater difference in cost. Of the rolled oats examined, the prices range from 4 to 7.8 cents a pound. The rolled and partially cooked wheats range from 4 to 9.8 cents. But it is in the malted and otherwise "predigested" foods that we find the widest variation, the price running in one instance to 27.2 cents per pound, and in other cases from 13 to 22 cents.

Some of the standard preparations of rolled oats and wheat, of known excellence, may be obtained in bulk. When purchased from reliable dealers who are handling large quantities and whose stock is consequently frequently renewed, such goods are not only fresh, but, next to white flour, they are among our most economical foods. These cereals may often be purchased at 4 cents a pound, or even at a less rate. The same goods put up in pasteboard cartons retail for 2 or 3 cents more per pound.

The investigations made at this station have thus far failed to discover any fixed relation between price and nutritive value. It is only fair to add, however, that, whatever the relative food values of malted and unmalted foods, the cost of the former to the manufacturer is greater, and the increased price is to this extent justified. The following table gives the cost of wheat, oats, and corn breakfast foods purchased in packages, excluding the uncooked and malted oat and wheat foods.

Maximum, minimum and average cost per pound of wheat, oat, and corn breakfast foods purchased in packages.

Number of samples.	Kind of cereal.	PRICE PER POUND.		
		Maximum—cents.	Minimum—cents.	Average—cents.
24	Wheat	11.4	4.9	7.8
17	Oats	7.8	4.1	6.0
10	Corn*	9.2	4.1	5.5

* Including only the hominies.

RELATIVE ECONOMY.

To find the relative economy of these goods, their cost should be considered in connection with their composition. By means of the data given in the tables on pages 74 and 84 it is easy to calculate the amount of nutrients which can be purchased for a given sum in any of these goods. This is done in the table below.

Pounds of nutrients and number of calories to be purchased for one dollar at the average price per pound.

	Average cost per pound.	Number of pounds for one dollar.	Pounds of Nutrients to be Purchased for One Dollar. Protein.	Fat.	Carbo-hydrates.	Ash.	Heat of combustion.
	Cents.		lbs.	lbs.	lbs.	lbs.	Cal.
Rolled Wheat	7.8	12.8	1.54	.24	9.57	.18	40.3
Rolled Oats	6.0	16.7	2.79	.90	11.64	.30	72.0
Hominy	5.5	18.2	1.56	.13	14.50	.05	70.2
Patent flour	3.5	28.6	3.98	.40	20.82	.14	113.2

At the prices given, flour is by far the most economical of the above named foods. It should be remembered, however, that few articles of food can compare with white flour in this respect. When it is possible to purchase rolled oats and wheat in bulk at prices scarcely exceeding one-half those given above, it will be found that they compare very favorably with flour as far as price is concerned, and present the double advantage of variety and ease of preparation. The latter consideration is one that should not be lost sight of. When it is found necessary to maintain a fire for the sole purpose of cooking food, the cost of preparation is largely increased and the consumer can readily afford to pay a reasonably higher price for goods the use of which will lighten his labors or effect a saving of fuel.

COOKING.

Too much cannot be said in favor of thorough cooking. The hominies and old fashioned oatmeals should be cooked an hour at least. It is asserted that some of the rolled products may be thoroughly prepared in from 10 to 20 minutes. In most cases it will be found advisable to use more time. Snyder attributes the difficulty in digesting imperfectly cooked oatmeal to "the large amounts of glutinous material which surround the starch grains and prevent their disintegration. When thoroughly cooked, the protecting action of the mucilagenous proteid material is overcome, and the compound starch granules are sufficiently disintegrated to allow the digestion juices to act."* The increased digestibility of fully cooked cereals he believes to be due largely to a physical change in the carbohydrates which renders them more susceptible to the action of the digestive solvents. In the digestion experiments carried on in the laboratories of this Station, the rolled oats and wheats were cooked 45 minutes in double boilers.

SUMMARY.

In selecting a cereal breakfast food the consumer may be guided by the claims of the manufacturers; by the chemical composition, as ascertained by a disinterested chemist; by the digestibility as determined by experimentation; by cost; by taste; by economy; or by their observed effect upon the individual.

Claims.—The claims printed upon the outside of the package are unfortunately not always to be relied upon. In some instances there can be but little doubt that they are intended to deceive the purchaser. In other cases the claims made are so reckless as to lead to a suspicion that their author was not familiar with the terms employed. Such claims are less harmful because less likely to deceive. The consumer has no difficulty in detecting the falsity of many of the statements made, and should be cautious in accepting those which appear too extraordinary.

Chemical Composition.—The chemical composition furnishes a more reliable guide, but should be considered in connection with digestibility and cost. Too much reliance should not be placed upon a single analysis, since wide variations have been observed in the composition of two or more samples of the same brand. The differences in composition between foods of the three common cereals, wheat, oats and corn, are sufficiently constant and furnish reliable evidence.

* Minnesota Expt. Station, Bul. 74. p. 153.

Digestibility.—Digestibility is of no less importance than composition. In the digestion experiments made upon human subjects the rolled wheat seemed to be somewhat more digestible than the rolled oats, and so far as relates to protein, the most valuable constituent, both rolled oats and rolled wheat are superior to corn. The attempt to increase the digestibility of starch seems to have had a contrary effect upon the protein.

Cost.—The corn products are the cheapest of these foods, the hominies examined costing on the average 5½ cents a pound. The rolled oats cost on the average 6 cents and the rolled and granulated wheats (partially cooked preparations) 7¾ cents.

Taste.—A food should never be selected by taste alone, since a very inferior article may be so disguised as to prove acceptable to the palate. At the same time, palatability is a quality which should not be overlooked, since it seems to have some effect upon digestibility and also upon the amount eaten. It seems especially desirable that such foods as experience and a mature judgment have shown to be most fitting should appeal directly to the palate of the child. With the great variety of products now available, there should be little difficulty in finding a food which should be at once palatable, nutritious, and digestible.

Economy.—Economy in the use of a cereal food involves a consideration of several qualities. It by no means follows that the cheapest food is the most economical. The best food is that which for a given sum supplies the largest amount of digestible nutrients in a palatable form.

Individual Peculiarities.—Except in a very general way it is impossible to predict the choice of these foods to be made by the individual, or the effects of their use. Individual tastes are exceedingly capricious. In a family of four the writer has recently found three cereal foods served at the same meal. Cases frequently arise in which it is found necessary to discontinue the use of a food which has proved palatable. A food which disagrees with the consumer is not cheap at any price.

THE COTTONY GRASS SCALE.

Eriopeltis festucæ (Fonsc.).

Edith M. Patch.

Economic Significance.—Until recently the cottony grass scale has not seemed to merit treatment from the economic standpoint, for the experience of this insect since it was first observed in America had led to the conclusion that it would be an intermittent thing very quickly brought under control by natural agencies.

During the summer of 1904, however, considerable consternation was caused in several localities in Maine by the presence of the egg sacs of this scale in enormous numbers. From Sedgwick and all along the Eggemoggin Reach; from the vicinity of Portland, especially at Gorham and Stroudwater; from Dresden and from Manchester, came persistent and alarmed reports. "My mowing lands look as though scattered with swollen rice grains," "A strange fungus has destroyed large plots in my grass lands," "The hay fields look as if a slight shower of snow pellets had fallen over them," were among the descriptive comments.

This infestation doubtless was not so sudden as it seemed. The scale is inconspicuous until the egg sac is secreted, thus for most of its life only a careful search would reveal its presence. The egg sacs themselves are only about one-fourth of an inch in length and these could be scattered along fence and road ways, over uncut grass near streams, unnoticed for years, and in view of the fact that comparatively few people are keen observers of little things not in their special line of interest, the statements that "we have never seen anything like this before," do not necessarily signify that the creatures have not been breeding within stone's throw for 40 years. However, the cottony grass scale is admirably fitted for rapid increase as the enormous number of eggs in a sac (600 to 700), the lively disposition of the young scales and their ability to travel, and the fact that there are at least two broods a season, all indicate.

The insidious approach of this insect may be illustrated by this experience. During the late summer and early fall of 1904 in the vicinity of Orono, careful searches were made for egg sacs over large areas, some of which appeared to be entirely free from the scale and others attacked in an exceedingly scattering manner. This fall, 1905, the increase in the places of scattering infestation is very marked, and even over some areas apparently free last season the egg sacs are a common though not yet a conspicuous occurrence. In one Orono meadow which contained an infested plot last fall, the egg sacs have increased certainly one hundred fold in a year's time.

NATURAL CHECKS.

Whether such increases are occasions for real alarm is a question involving a consideration of natural agencies as checks.

Weather.—While the eggs within the sacs are safe in ordinary climatic conditions, the young larvæ, minute, delicate, and unprotected, must be largely dependent upon favorable conditions between the time of leaving the sac and settling upon a promising blade. A heavy rain at this time must undoubtedly beat down and destroy myriads of the little creatures.

Rust.—In a meadow near Portland thickly infested with the scales, areas half a mile in length were observed to be attacked heavily by rust. This was the 25th of August, 1904, when many of the scales were from one to three weeks old. The situation of the rust spots along the leaf resembled so closely the position selected by the scales that it suggested the possibility of some relation between the rust and the scales. In view of the fact that fungi are predisposed to attack parts of plants wounded by insects or in other ways, it seems legitimate to conclude that the grass rusts in scale-infested meadows would be most likely to settle at places punctured by the scales. The development of rust could not but interfere with the scales upon the same leaf, and death of the scales result indirectly from the presence of the rust. It was an interesting, if not significant circumstance, that in the Portland meadow the rust was much more conspicuous in the places where there were most egg sacs of the grass scale and where the blades must have been freely punctured by the young scales. Yet on the blades most attacked by the rust no living scales remained. There seemed to be no practical way of obtaining reliable data in this case, but there would be nothing extraordinary in a reduction of scales through the weakening of the host plant by fungus agencies. Such a remedy, however, would prove a severe one for the hay crop.

Predaceous Insects.—Large numbers of fresh egg sacs were frequently observed (1904 and 1905) to be torn open near the end or at the side, and a considerable portion of the eggs in such cases would be missing. This seemed to be the work of some predaceous insects, but none were observed in the act.

Overcrowding.—Sometimes more young scales than one leaf could possibly support are found crowded upon a single blade. In such cases death of some of the scales must result, or a drying of the blade which would cause the death of all the scales upon it.

Parasites.—Nor are parasites lacking. For one test lot nearly two quarts of egg sacs were collected August 1, 1904, in a meadow near Portland. On August 3, such numbers of the minute larvæ hatched and swarmed over the jars that it seemed improbable that parasites were present to any appreciable extent. Two days later, however, parasitic hymenoptera began to emerge. There were more than 100 of these, among which a new species of *Eunotus* and a species of a new genus were about evenly represented, and there were a few of a new species of *Microterys*. About 30 parasitic dipterons, *Leucopis nigricornis* Egger., a European species, also emerged from this lot. Less than 150 parasites from many thousand sacs, however, would not mean an extended diminution of the scales for that generation.

The following year, 1905, about the middle of August, egg sacs were collected near Orono for greenhouse observations. These were too extensively parasited to yield a sufficient number of larvæ for the experiments planned. From 262 sacs collected about the same time from the Isle of Springs, 98 hymenopterous parasites emerged. No dipterous parasites appeared in this collection.

This will suffice to show that among the natural agencies that tend to check the increase of cottony grass scale, parasites are especially efficient. A list of the parasites reared during two years' observation of Maine material is given on a subsequent page.

NATURE OF INJURY.

Like plant-lice and other hemipterous insects, scales weaken their host plant by piercing the tissues with their sharp pointed beaks and sucking the sap. Sometimes as many as 10 or 12 egg sacs are found attached to one blade, which means that for weeks, 10 or 12 scales have been draining sap from that blade. Where the infestation is excessive the result is dead grass and brown plots here and there through the field. Where the infestation is less serious, it still means a shrinkage in the hay crop corresponding to the amount of grass which has been impoverished through the loss of sap. During 1904 and 1905 the places of worst infestation in certain Portland meadows were revealed by irregular brown areas of dead grass.

REMEDIAL MEASURES.

The point in regard to the life history of this insect which is most significant in view of remedial measures is that the scale passes the winter in the egg stage within the white egg sacs attached to the grass blades, well up above the ground. Thus a spring burning of the infested grass land will destroy the whole generation unhatched, without injury to the grass. In some instances this will mean a burning over of more than 50 acres, but in some the infestation is as yet restricted to spots a few rods square here and there in the meadows. It is advisable in districts where the scale has been especially conspicuous to burn the grass along roadsides and in neglected corners, either in the early spring or in the fall, so that such places will not serve as breeding places for the scale.

It is not improbable that if the fields should be left to themselves the parasites, or other natural agencies, would in time master the scales and the grass lands contain only scattered scales which would do practically no harm. As it is quite impossible to predict whether such an adjustment, were it to come about, would take 2 years or 20, it is certainly much safer to relieve the parasites of the responsibility and burn over the badly infested grass lands. Owners of grass lands can with comparative ease control the situation, and failure to destroy the pest is likely to place a heavy tax upon the hay crop in the infested districts.

A practical demonstration of the worth of this remedial measure was given on Deer Isle last spring (1905). The meadows there had been seriously attacked by the grass scale for several years. During the summer of 1904 the hay crop was reckoned at a third less than the usual amount and the hay was reported to be inferior in quality. Several of the fields were burned over the following spring. Concerning this, one of the meadow owners writes about October twentieth, "We have hardly seen a scale since burning the land last spring. The hay crop was unusually large and we think it did the land good to burn it over."

LIFE HISTORY NOTES.

Description and Habits.—The white egg sacs, appearing like "a strange fungus" attached to grass blades, are what have attracted attention to the cottony grass scale. This is not a stage of progressive injury, but of quiescence. The eggs deposited by the fall brood of scales winter in the protective oval cases. The active larvæ emerge during the warm spring days and seek a suitable grass blade. That they are able to travel for a considerable distance at this time was proven by the sprightly journeys of these microscopic creatures in the laboratory. In confinement as many as 50 have been observed to settle upon one grass blade. (Figures 2 and 3.) In the field a single blade with 12 full sized egg sacs is sometimes found, though the number is usually much less. Probably more than 12 could scarcely mature upon one leaf, but 20 to 30 young scales to the blade were not at all an unfrequent occurrence in Portland meadows. Once accepting a favorable location, the young scale must abide by its decision, for after piercing the blade with its minute beak the insect becomes stationary, the legs atrophy and a little clear delicate scale rests flat upon the blade, continuously draining the plant of sap. The scales invariably settle head down the blade, sometimes on the under side but more frequently on the upper surface. What the physiological effect would be of imbibing constantly for 6 to 11 weeks in this position might seem a trifle uncertain as a matter of conjecture, but it certainly works all right as a practical demonstration and when the time finally comes to secrete the egg sac, the advantages of this peculiar habit become evident. During July when the scale has attained full size, a snow white felty covering of curly filament is secreted, fitting closely over the entire body. If the secretion is removed before the female has begun to deposit eggs a plump, smooth, oval, slightly pink, object is found to be quite filling the closed sac. When it begins to deposit eggs, the female scale pushes the anterior end of its body through the sac in front, breaking open the end pointed downward. Then slowly contracting as the eggs are laid, the scale becomes, by the time the sac is filled with eggs, a shrivelled helpless object already nearly dead. Sometimes it remains in the opening forming a plug for the sac, but more often it drops to the ground.

The oval sac is usually slightly more than quarter of an inch in length. One fair sized sac contained 740 pinkish yellow eggs. The closed end being directed uppermost, the eggs are more thoroughly protected than otherwise would be the case. Enough filaments of the sac are scattered among the eggs to hold them in place.

The eggs of this summer generation hatch in July and August, and the scales mature in the fall, secreting before winter (in October and early November for Maine) sacs in which the eggs remain until spring.

The Male Scales.—No adult males were captured during the two seasons. Three male pupæ were found among 136 mounted scales taken from grass blades in Portland, August 17, 1904. The wing pads, antennæ and legs were distinct in all. One was more nearly mature than the others and seemed about to emerge. Most of the female scales mounted at this time range from 1½ to 3 millimeters. The male pupæ are less than 1½ millimeters long, while a full grown female scale often measures a little over 6 millimeters. The male scales would naturally be expected to appear before the females begin to secrete the cottony covering.

Number of Generations.—From the middle of July to August 4, 1904, freshly formed egg sacs as well as egg sacs from which larvæ were emerging were collected in great numbers at Gorham, Portland, Dresden, and along the Eggemoggin Reach. From the middle of October to November 3, 1904, the females were observed to be secreting egg sacs and depositing eggs in fields near Orono, Portland, and Sedgwick, and unhatched egg sacs were gathered in Portland, November 22, 1904.

Field data, and material sent to this station during 1904 were sufficient proofs of two generations, the first maturing and secreting egg sacs in July and the first of August, and the second depositing eggs (in sacs as before) during late October and early November. In this egg stage the insect winters, the young scales emerging in the spring.

Life Cycle.—On several occasions, from sacs gathered from different parts of large fields on the same day and kept in jars in the laboratory, all the larvæ emerged within a few days of each other. Thus it seemed probable that the life cycle was passed with considerable evenness and regularity. But this conclusion was contradicted by the circumstance that on August 1-4, 1904, there were found, within a few feet of each other, sacs in which the eggs were not yet hatched, others from which larvæ were emerging and scales of various sizes ranging apparently from one to three weeks in age.

There was no way to tell from field observations as to the exact length of the scale life, so April 12, 1905, egg sacs were gathered for laboratory observations. Many of these were hatched April 28 and the larvæ were liberated upon transplanted June grass sod in the greenhouse. They settled upon the grass readily, over 50 placing themselves upon single blades in some cases. In about two weeks when the scales were well established the sod was again transplanted to cold frames where the conditions were much as they would be in the open field. They were exposed to much cold weather and considerable rain. On July 12 nine plump sacs newly filled with eggs were picked. It had been 11 weeks from the hatching of the scale to the deposition of eggs within the sac. Some of the scales in this lot were not so far advanced and had not begun to deposit eggs, although the scales were covered with a thin cottony secretion.

An interesting check to these observations was found in a second lot which had developed in the greenhouse upon redtop. The newly hatched larvæ were liberated on June 16. On July 19, they were secreting the white sacs and were as far advanced as the slower portion of the cold frame lot, which were 11 weeks old.

As the foregoing observations show, the time required for development depends much upon the temperature, and it seems fair to conclude that a long hot season might give opportunity for 3 broods where the scales are favorably situated. A cold wet summer would probably preclude the development of more than two broods. This seems to be the usual number for Maine, but with such circumstances as scales within a few feet of each other ranging from one day to at least a month in age it would be difficult to be sure that 3 generations were not a frequent occurrence in warm sunny fields.

A simple test was made with 3 lots of eggs as to their power to withstand cold under unnatural conditions.

On April 28, two sealed jars containing egg sacs from which the larvæ were beginning to emerge were placed in a refrigerator. These were labeled No. 1 and No. 2. A third jar, No. 3, was filled the same day with egg sacs newly gathered which had not begun to hatch. These jars remained in the refrigerator until June 6 when they were placed in the greenhouse. June 16 the eggs in jar No. 3 began to hatch. The larvæ were liberated among red-top upon which they had settled. These developed, secreting egg sacs from the 19th to the last of July. Seven weeks retardation by cold did not injure these eggs. The eggs in jars No. 1 and No. 2 subjected to the same treatment did not hatch. These, however, were just on the point of hatching when they were placed in the refrigerator and were taken at an unfair disadavantage.

KINDS OF GRASSES INFESTED.

The egg sacs collected in Maine have been upon June grass, *Poa pratensis,* and red-top, *Agrostis alba.* Where specimens have been sent in on broken bits of grass, as is frequently the case, identification of the host was of course impossible; but so far as the oservations of the past two seasons have gone, these are apparently the only two infested grasses yet reported for Maine.

PARASITES.

A large number of egg sacs was collected from June grass in a meadow near Portland the first of August, 1904. For the most part the material was cut close to the sacs, with only a bit of the grass blade left attached. There was included, however, a little infested grass, cut stalk and all, a circumstance which will doubtless account for the presence (in the list appended) of *Lasioptera* and *Isosoma,* insects of grain, or grass-stalk inhabiting proclivities. The single specimen of *Eupelmus* may not necessarily, therefore, have been parasitic upon the grass scale itself. Considering the fact that some species of *Oscinis* are stem maggots and that the larvæ of many species of the same genus are reported as preying upon Coccidae,* the economic position of the two specimens of this insect may also be open to question at present. The remaining species, however, are bred from egg sacs of *Eriopeltis festucæ.* No. 11 and No. 12 were reared from material collected on Isle of Springs, August 9, 1905.

These insects were submitted to Dr. L. O. Howard, chief of Bureau of Entomology, U. S. Department of Agriculture, whose kindness in examining them makes this report possible. All of the Hymenoptera were examined by Dr. W. H. Ashmead, U. S. National Museum, to whom thanks is also due. The following insects are listed as Dr. Howard reported them, except for the addition of the number of specimens reared in each case.

No. 1. *Leucopis nigricornis* Egger. 30 specimens.
2. *Eunotus* n. sp. 36 specimens.
3. New genus near *Phaenodiscus* in Mirini. 32 specimens.
4. *Microterys* n. sp. 4 specimens.
5. Probably males of No. 3. 18 specimens.
6. *Lasioptera* sp. 1 specimen.
7. *Eupelmus* sp. 1 specimen.
8. *Isosoma* sp. 1 specimen.
9. *Lasioptera* sp. 1 specimen.
10. *Oscinis* sp. 2 specimens.
11. *Eunotus* n. sp. How. Many specimens.
12. *Eunotus* n. sp. How. Many specimens.

BIBLIOGRAPHY.

The published accounts of this insect are meagre, as little attention has been paid to it.

An interesting popular descripton of *Eriopeltis festucæ* given by Mr. E. A. Butler in Knowledge, July 2, 1894, p. 148, reads as follows:

"This forms little compact oval tufts, like pieces of cotton wool, attached to the stems and blades of certain grasses, and there is certainly nothing whatever in their external appearance to suggest any connection with insects, unless, indeed, they

*U. S. Dept. Agr., Div. of Ent., Bul. 32, p. 35.

might be cocoons of small ichneumon flies. But a close examination, revealing a number of separate threads standing out in all directions, would soon dispel this idea, and would leave their real nature as problematic as ever. Though apparently not uncommon, they have not long been generally known in this country (England) having previously, no doubt, been overlooked, partly because of the little attention that was until recently paid to the Coccidæ, and partly because of the completeness of their disguise. They seem to have been first noticed in this country in 1856, when there is a reference to them in the *Proceedings of the Entomological Society of London;* but that was soon forgotten, and they passed out of knowledge till 1885, when Mr. Q. C. Bignell again called attention to them."

Dr. James Fletcher, in his report of the Canadian Experimental Farms for 1895, (Ottawa, 1896) pp. 145-147, gives an account of an outbreak of the cottony grass scale with references to literature.

Following are references to the Genus Eriopeltis as corrected by Mrs. C. H. Fernald from her catalogue * of the Coccidæ of the World.

GENUS ERIOPELTIS Sign. Type, *lichtensteinii.*

Eriopeltis, Sign., Ann. Soc. Ent. Fr., (5), i. p. 429 (1871): Ckll., Can. Ent. xxxi, p. 332 (1899).

1. ERIOPELTIS BRACHYPODII Giard.

Eriopeltis brachypodii Giard, Bull. Soc. Ent. Fr., (7), iii, p. cxcix (1893).

Eriopeltis brachypodii Butler, "Knowledge," p. 148 (1894).

Eriopeltis brachypodii Fletcher, Rep. Can. Exp. Farms, p. 146 (1896).

Habitat.—France.

On Brachypodium pinnatum.

2. ERIOPELTIS FESTUCÆ (Fonsc.).

Coccus festucæ Fonsc., Ann. Soc. Ent. Fr., iv. p. 216 (1834).

Coccus fectucæ Kalt., De Pflanz., p. 747 (1874).

Eriopeltis festucæ Sign., Ann. Soc. Ent. Fr., (5), ix, p. 46 (1879).

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* Mass. Experiment Station, Bulletin No. 88.

Eriopeltis festucæ King, Can. Ent., xxxiii, p. 197 (1901).

Eriopeltis festucæ Butler, "Knowledge," p. 148 (1894).

Eriopeltis festucæ Fletcher, Rep. Can. Exp. Farms, p. 146 (1896).

Habitat.—Europe; Nova Scotia; Canada; Illinois; Indiana; Dakota.

On Festuca cæpitosa; F. phœnicioides.

3. ERIOPELTIS LICHTENSTEINII Sign.

Eriopeltis festucæ Sign. (non Fonsc.) Ann. Soc. Ent. Fr., (5), i, p. 430 (1871).

Eriopeltis lichtensteinii Sign., Ann. Soc. Ent. Fr., (5), vi, p. 607 (1876).

Eriopeltis lichtensteinii Sign., Bull. Soc. Ent. Fr., (5), vii, p. xxxvi (1877).

Eriopeltis festucæ Sign., Bull. Soc. Ent. Fr., (5), vii, p. xxxvi (1877).

Eriopeltis festucæ Bignell, The Entom., xviii, p. 286 (1885)

Eriopeltis lichtensteinii Dougl., Ent. Mon. Mag., xxiv, p. 166 (1887).

Eriopeltis lichtensteinii Newst., Ent. Mon. Mag., xxvii, p. 165 (1891).

Habitat.—France; Holland; England; Scotland.

On Festuca spp. and other grasses.

EXPLANATION OF PLATES.

Cottony Grass Scale. *Eriopeltis festucæ* (Fonsc.).

Figure 1. Egg sacs on Red-top.

" 2. Upper surface of June-grass blade. Enlarged. Showing the number and position of young scales on May 10, 1905, twelve days after the active larvæ were liberated in green-house.

" 3. Under surface of same blade on same date.

" 4. Active larva x 120. Ventral view. Showing normal insect appendages.

" 5. Young scale x 44. Ventral view. Scale taken August 17, 1904. Showing atrophied condition of antennæ and legs.

" 6. Egg x 80.

" 7. Full grown female scale. Natural size. Removed from sac before any eggs were deposited.

" 8. Pupa of male scale x 55. Taken August 17, 1904.

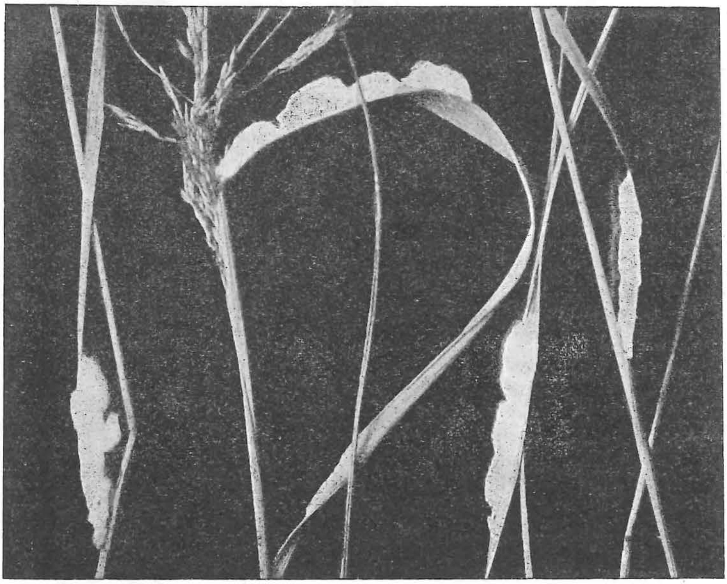

FIG. 1.

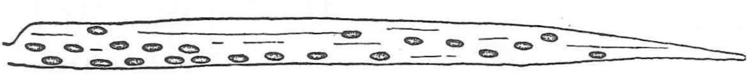

FIG. 2.

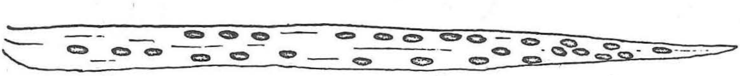

FIG. 3.

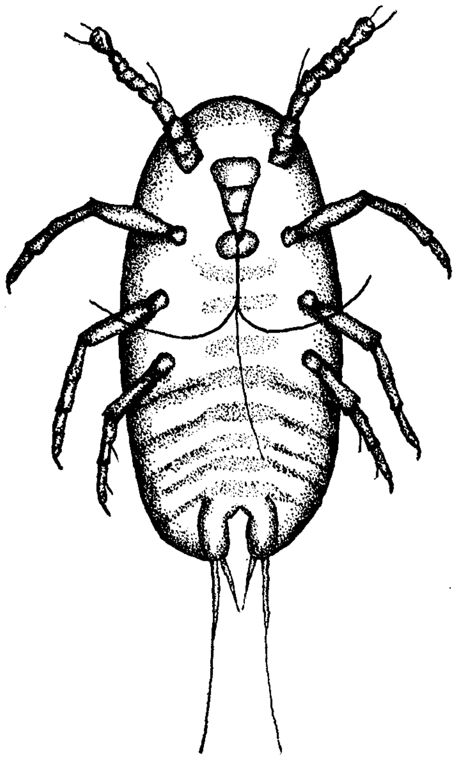

FIG. 4.

FIG. 5.

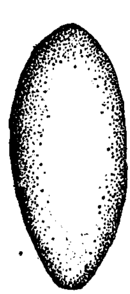

FIG. 6.

FIG. 7.

FIG. 8.

FOOD INSPECTION.

CHAS. D. WOODS, Director.

L. H. MERRILL, Chemist in charge of food analysis.

The legislature of 1905 enacted a law to regulate the sale and analysis of food. This is, however, by no means the pioneer attempt in food legislation. Several years ago Massachusetts, Connecticut, New York, Pennsylvania, North Carolina and other eastern states enacted laws looking to the prevention of adulteration of foods. Naturally many mistakes were made and these from time to time were corrected by special acts. Profiting by the experience of these eastern states, some states in the middle west, notably Ohio, Wisconsin, Kentucky and North Dakota, have since enacted laws which are simpler and yet more far reaching in their effects.

In the last few years there has been a large amount of agitation looking toward national legislation to regulate the interstate commerce as regards the purity of food. This discussion has crystalized into a bill, which has been before several Congresses, known as the Hepburn bill, because of its introduction by Senator Hepburn. Several moneyed trade interests have thus far prevented the passage of this national bill.

Profiting by all this experience, the agricultural committee of the Maine legislature of 1905 discussed this matter, and formulated a bill, which was introduced and after the customary hearing was reported unanimously and enacted. The text of the law follows.

CHAPTER 68 OF THE LAWS OF 1905.

An Act to Regulate the Sale and Analysis of Food.

SEC. 1. It shall be unlawful for any person, persons or corporation within this state to manufacture for sale, to sell, or to offer or expose for sale any article of food which is adulterated or misbranded within the meaning of this act.

SEC. 2. The term food, as used in this act, shall include every article used for food or drink by man, horses or cattle.

SEC. 3. For the purpose of this act an article of food shall be considered as adulterated or misbranded:

First. If any substance or substances be mixed or packed with it so as to reduce or lower or injuriously affect its quality or strength.

Second. If any inferior substance or substances be substituted wholly or in part for this article.

Third. If any necessary or valuable constituent of the article be wholly or in part abstracted.

Fourth. If it be in imitation of, or sold under the name of another article.

Fifth. If it be colored, coated, polished or powdered whereby damage is concealed, or if it be made to appear better or of greater value than it is.

Sixth. If it contains poisonous ingredients, or if it contains any antiseptic or preservative not evident or not known to the purchaser.

Seventh. If it consists wholly or in part of a diseased, filthy, decomposed or putrid animal or vegetable substance.

Eighth. If the package or label shall have any statement purporting to name any ingredient or substance as not being contained in the article, which statement shall be untrue in any particular.

Ninth. If the package or label shall bear any statement purporting to name the substance or substances of which the article is made, which statement shall not fully give the names of all substances contained therein.

Tenth. If it be labeled or branded so as to deceive or mislead the purchaser in any particular.

Provided, that any article of food which is adulterated within the meaning of this act, but which does not contain any poisonous or deleterious ingredient, may be manufactured or sold if the same shall be plainly labeled, branded or tagged so as to show the exact character thereof. Provided further, that nothing in this act shall be construed as requiring proprietors, manufacturers or sellers of proprietary foods which contain no unwholesome substances to disclose their trade formulas, except that in the case of baking powders each can or package shall be plainly labeled so as to show the acid salt or salts contained therein.

SEC. 4. The director of the Maine Agricultural Experiment Station shall analyze, or cause to be analyzed, samples of articles of food on sale in Maine, suspected of being adulterated, and at such times and to such extent as said director may determine. And said director, in person or by deputy, shall have free access at all reasonable hours to any place wherein articles of food are offered for sale, and upon tendering the market price of any such article may take from any person, persons or corporations samples for analysis.

SEC. 5. The results of all analyses of articles of food made by said director shall be published by him in the bulletins or reports of the Experiment Station, together with the names of the persons from whom the samples were obtained, and the names of the manufacturers thereof. The said director may also adopt or fix standards of purity, quality or strength when such standards are not specified or fixed by law and shall publish them, together with such other information concerning articles of food as may be of public benefit.

SEC. 6. Whoever adulterates or misbrands any article of food as defined in this act, or whoever sells, offers or exposes for sale any adulterated or misbranded article of food, shall be punished by a fine not exceeding one hundred dollars for the first offense and not exceeding two hundred dollars for each subsequent offense.

SEC. 7. Whenever said director becomes cognizant of the violation of any of the provisions of this act, he shall report such violation to the commissioner of agriculture, and said commissioner shall prosecute the party or parties thus reported.

SEC. 8. No action shall be maintained in any court in this state on account of any sale or other contract made in violation of this act.

SEC. 9. Sections ten, eleven, twelve, thirteen, fourteen, fifteen, sixteen and seventeen of chapter one hundred and twenty-nine of the revised statutes and all acts or parts of acts inconsistent herewith, are hereby repealed.

SEC. 10. This act shall take effect when approved.

Approved March 15, 1905.

Food Standards.

It is from the nature of the case impracticable for a legislature to establish food standards. This is a matter that calls for careful research on the part of experts. It has, therefore, become customary, both in state and national legislation, to place the responsibility of the establishment of standards upon the executive officer. Section 5 of the above cited law empowers the Director of the Maine Agricultural Experiment Station "to adopt or fix standards of purity, quality or strength when such standards are not specified or fixed by law and shall publish them, together with such other information concerning articles of food as may be of public benefit."

The Association of Official Agricultural Chemists of the United States has for some years been preparing definitions and schedules for such standards. The demand for these standards became so urgent as to lead Congress by an act approved June 3, 1902, to authorize the Secretary of Agriculture to cooperate with the above named association for the accomplishment of this work. As a result, although the work is still incomplete, standards for the more important food products have already been fixed and established by the Secretary of Agriculture, acting for the United States.

PRINCIPLES ON WHICH THE STANDARDS ARE BASED.

The general considerations which guided the committee of the Association of Official Agricultural Chemists in preparing the standards for food products are thus stated by them:

1. The standards are expressed in the form of definitions, with or without accompanying specifications of limit in composition.

2. The main classes of food articles are defined before the subordinate classes are considered.

3. The definitions are so framed as to exclude from the articles defined substances not included in the definitions.

4. The definitions include, where possible, those qualities which make the articles described wholesome for human food.

5. A term defined in any of the several schedules has the same meaning wherever else it is used in this report.

6. The names of food products herein defined usually agree with existing American trade or manufacturing usage, but

where such usage is not clearly established or where trade names confuse two or more articles for which specific designations are desirable, preference is given to one of the several trade names applied.

7. Standards are based upon data representing materials produced under American conditions and manufactured by American processes or representing such varieties of foreign articles as are chiefly imported for American use.

8. The standards fixed are such that a departure of the articles to which they apply, above the maximum or below the minimum limit prescribed, is evidence that such articles are of inferior or abnormal quality.

9. The limits fixed as standards are not necessarily the extremes authentically recorded for the article in question, because such extremes are commonly due to abnormal conditions of production and are usually accompanied by marks of inferiority or abnormality readily perceived by the producer or manufacturer.

As empowered in Section 5, Chapter 68 of the laws of 1905, the Director of the Maine Agricultural Experiment Station hereby adopts the following standards for purity of food products together with their precedent definitions as the official standards of these food products for the State of Maine. These are the standards above referred to as fixed by the Secretary of Agriculture of the United States.

I. ANIMAL PRODUCTS.

A. Meats and the Principal Meat Products.

a. MEATS.

1. *Meat* is any sound, dressed, and properly prepared edible part of animals in good health at the time of slaughter. The term "animals," as herein used, includes not only mammals, but fish, fowl, crustaceans, mollusks, and all other animals used as food.

2. *Fresh meat* is meat from animals recently slaughtered or preserved only by refrigeration.

3. *Salted, pickeled,* and *smoked meats* are unmixed meats preserved by salt, sugar, vinegar, spices, or smoke, singly or in combination, whether in bulk or in packages.

b. MANUFACTURED MEATS.

1. *Manufactured meats* are meats not included in paragraphs 2 and 3, whether simple or mixed, whole or comminuted, in bulk or packages, with or without the addition of salt, sugar, vinegar, spices, smoke, oils, or rendered fat. If they bear names descriptive of composition they correspond thereto and when bearing such descriptive names, if force or flavoring meats are used, the kind and quantity thereof are made known.

d. LARD.

1. *Lard* is the rendered fresh fat from slaughtered, healthy hogs, is free from rancidity, and contains not more than one (1) per cent of substances, other than fatty acids, not fat, necessarily incorporated therewith in the process of rendering.

2. *Leaf lard* is lard rendered at moderately high temperatures from the internal fat of the abdomen of the hog, excluding that adherent to the intestines, and has an iodin number not greater than sixty (60).

3. *Neutral lard* is lard rendered at low temperatures.

B. MILK AND ITS PRODUCTS.*

II. VEGETABLE PRODUCTS.

A. GRAIN PRODUCTS.

(a) GRAINS AND MEALS.

1. *Grain* is the fully matured, clean, sound, air-dry seed of wheat, maize, rice, oats, rye, buckwheat, barley, sorghum, millet, or spelt.

2. *Meal* is the sound product made by grinding grain.

3. *Flour* is the fine, sound product made by bolting wheat meal and contains not more than thirteen and one-half (13.5) per cent of moisture, not less than one and twenty-five hundredths (1.25) per cent of nitrogen, not more than one (1.0)

*The inspection of milk and other dairy products, and their imitations is intrusted by Chapter 39 of the Laws of 1905 to the Commissioner of Agriculture. The standard for milk is fixed by statute. Standards for other dairy products will be fixed by the Director of the Station on request from the Commissioner of Agriculture.

per cent of ash, and not more than fifty hundredths (0.50) per cent of fiber.

4. *Graham flour* is unbolted wheat meal.

5. "*Whole wheat flour*," "*entire wheat flour*," improperly so called, is fine wheat meal from which a part of the bran has been removed.

6. *Gluten flour* is the product made from flour by the removal of starch and contains not less than five and six-tenths (5.6) per cent of nitrogen and not more than ten (10) per cent of moisture.

7. *Maize meal, corn meal,* or *Indian corn meal* is meal made from sound maize grain and contains not more than fourteen (14) per cent of moisture, not less than one and twelve hundredths (1.12) per cent of nitrogen, and not more than one and six-tenths (1.6) per cent of ash.

8. *Rice* is the hulled and polished grain of *Oryza sativa.*

9. *Oatmeal* is meal made from hulled oats and contains not more than eight (8) per cent of moisture, not more than one and five-tenths (1.5) per cent of crude fiber, not less than two and twenty-four hundredths (2.24) per cent of nitrogen, and not more than two and two-tenths (2.2) per cent of ash.

10. *Rye flour* is the fine sound product made by bolting rye meal and contains not more than thirteen and one-half (13.5) per cent of moisture, not less than one and thirty-six hundredths (1.36) per cent of nitrogen, and not more than one and twenty-five hundredths (1.25) per cent of ash.

11. *Buckwheat flour* is bolted buckwheat meal and contains not more than twelve (12) per cent of moisture, not less than one and twenty-eight hundredths (1.28) per cent of nitrogen, and not more than one and seventy-five hundredths (1.75) per cent of ash.

C. Sugars and Related Substances.

a. SUGAR AND SUGAR PRODUCTS.

Sugars.

1. *Sugar* is the product chemically known as sucrose (saccharose) chiefly obtained from sugar cane, sugar beets, sorghum, maple, or palm.

2. *Granulated, loaf, cut, milled,* and *powdered sugars* are different forms of sugar and contain at least ninety-nine and five-tenths (99.5) per cent of sucrose.

3. *Maple sugar* is the solid product resulting from the evaporation of maple sap.

4. *Massecuite, melada, mush sugar,* and *concrete* are products made by evaporating the purified juice of a sugar-producing plant, or a solution of sugar, to a solid or semi-solid consistence in which the sugar chiefly exists in a crystalline state.

Molasses and Refiners' Sirup.

1. Molasses is the product left after separating the sugar from massecuite, melada, mush sugar, or concrete, and contains not more than twenty-five (25) per cent of water and not more than five (5) per cent of ash.

2. *Refiners' sirup* ("treacle") is the residual liquid product obtained in the process of refining raw sugars and contains not more than twenty-five (25) per cent of water and not more than eight (8) per cent of ash.

Sirups.

1. *Sirup* is the product made by purifying and evaporating the juice of a sugar-producing plant without removing any of the sugar and contains not more than thirty (30) per cent of water and not more than two and five-tenths (2.5) per cent of ash.

2. *Sugar-cane sirup* is sirup made by the evaporation of the juice of the sugar cane or by the solution of sugar-cane concrete.

3. *Sorghum sirup* is sirup made by the evaporation of sorghum juice or by the solution of sorghum concrete.

4. *Maple sirup* is sirup made by the evaporation of maple sap or by the solution of maple concrete.

5. *Sugar sirup* is sirup made by dissolving sugar to the consistence of a sirup.

b. GLUCOSE PRODUCTS.

1. *Starch sugar* is the solid product made by hydrolyzing starch or a starch-containing substance until the greater part of the starch is converted into dextrose. Starch sugar appears in commerce in two forms, anhydrous and hydrous. The former, crystallized without water of crystallization, contains not less than ninety-five (95) per cent of dextrose and not more than eight-tenths (0.8) per cent of ash. The latter, crystallized with

water of crystallization, is of two varieties—70 sugar, also known as brewers' sugar, contains not less than seventy (70) per cent of dextrose and not more than eight-tenths (0.8) per cent of ash; 80 sugar, climax or acme sugar, contains not less than eighty (80) per cent of dextrose and not more than one and one-half (1.5) per cent of ash.

The ash of all these products consists almost entirely of chlorids and sulphates.

2. *Glucose, mixing glucose, or confectioner's glucose* is a thick, sirupy, colorless product made by incompletely hydrolyzing starch, or a starch-containing substance, and decolorizing and evaporating the product. It varies in density from forty-one (41) to forty-five (45) degrees Baumé at a temperature of one hundred (100) degrees F. (37.7° C.), and conforms in density, within these limits, to the degree Baumé it is claimed to show, and for a density of forty-one (41) degrees Baumé contains not more than twenty-one (21) per cent and for a density of forty-five (45) degrees not more than fourteen (14) per cent of water. It contains on a basis of forty-one (41) degrees Baumé not more than one (1) per cent of ash, consisting chiefly of chlorids and sulphates.

3. *Glucose sirup* or *corn sirup* is glucose unmixed or mixed with sirup, molasses, or refiners' sirup and contains not more than twenty-five (25) per cent of water and not more than three (3) per cent of ash.

c. CANDY.

1. Candy is a product made from a saccharine substance or substances with or without the addition of harmless coloring, flavoring, or filling materials and contains no terra alba, barytes, talc, chrome yellow, or other mineral substances, or poisonous colors or flavors, or other ingredients injurious to health.

d. HONEY.

1. *Honey* is the nectar and saccharine exudations of plants gathered, modified, and stored in the comb by honey bees (*Apis mellifica*). It is laevo-rotatory, contains not more than twenty-five (25) per cent of water, not more than twenty-five hundredths (0.25) per cent of ash, and not more than eight (8) per cent of sucrose.

2. *Comb honey* is honey contained in the cells of comb.

3. *Extracted honey* is honey which has been separated from the uncrushed comb by centrifugal force or gravity.

4. *Strained honey* is honey removed from the crushed comb by straining or other means.

D. Condiments (except vinegar).

a. spices.

1. *Spices* are aromatic vegetable substances used for the seasoning of food and from which no portion of any volatile oil or other flavoring principle has been removed and which are sound and true to name.

2. *Allspice* or *pimento* is the dried fruit of *Pimenta pimenta* (L.) Karst. and contains not less than eight (8) per cent of quercitannic acid; * not more than six (6) per cent of total ash; not more than five-tenths (0.5) per cent of ash insoluble in hydrochloric acid, and not more than twenty-five (25) per cent of crude fiber.

3. *Anise* is the fruit of *Pimpinella anisum* L.

4. *Bay leaf* is the dried leaf of *Laurus nobilis* L.

5. *Capers* are the flower buds of *Capparis spinosa* L.

6. *Caraway* is the fruit of *Carum carui* L.

7. *Red pepper* is the red, dried ripe fruit of any species of *Capsicum.*

8. *Cayenne pepper* or *cayenne* is the dried ripe fruit of *Capsicum frutescens* L., *Capsicum baccatum* L., or some other small-fruited species of *Capsicum,* and contains not less than fifteen (15) per cent of nonvolatile ether extract; not more than six and five-tenths (6.5) per cent of total ash; not more than five-tenths (0.5) per cent of ash insoluble in hydrochloric acid; not more than one and five-tenths (1.5) per cent of starch, and not more than twenty-eight (28) per cent of crude fiber.

9. *Celery seed* is the dried fruit of *Apium graveolens* L.

10. *Cinnamon* is the dried bark of any species of the genus *Cinnamomum* from which the outer layers may or may not have been removed.

11. *True cinnamon* is the dried inner bark of *Cinnamomum zeylanicum* Breyne.

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* Calculated from the total oxygen absorbed by the aqueous extract.

12. *Cassia* is the dried bark of various species of *Cinnamomum,* other than *Cinnamomum zeylanicum,* from which the outer layers may or may not have been removed.

13. *Cassia buds* are the dried immature fruit of species of *Cinnamomum.*

14. *Ground cinnamon* or *ground cassia* is a powder consisting of cinnamon, cassia, or cassia buds, or a mixture of these spices, and contains not more than eight (8) per cent of total ash and not more than two (2) per cent of sand.

15. *Cloves* are the dried flower buds of *Caryophyllus aromaticus* L. which contain not more than five (5) per cent of clove stems; not less than ten (10) per cent of volatile ether extract; not less than twelve (12) per cent of quercitannic acid; * not more than eight (8) per cent of total ash; not more than five-tenths (0.5) per cent of ash insoluble in hydrochloric acid, and not more than ten (10) per cent of crude fiber.

16. *Coriander* is the dried fruit of *Coriandrum sativum* L.

17. *Cumin* seed is the fruit of *Cuminum cyminum* L.

18. *Dill seed* is the fruit of *Anethum graveolens* L.

19. *Fennel* is the fruit of *Fœniculum fœniculum* (L.) Karst.

20. *Ginger* is the washed and dried or decorticated and dried rhizome of *Zingiber zingiber* (L.) Karst. and contains not less than forty-two (42) per cent of starch, not more than eight (8) per cent of crude fiber, not more than eight (8) per cent of total ash, not more than one (1) per cent of lime, and not more than three (3) per cent of ash insoluble in hydrochloric acid.

21. *Limed* or *bleached ginger* is whole ginger coated with carbonate of lime and contains not more than ten (10) per cent of ash, not more than four (4) per cent of carbonate of lime, and conforms in other respects to the standard for ginger.

22. *Horse-radish* is the root of *Roripa armoracia* (L.) Hitchcock either by itself or ground and mixed with vinegar.

23. *Mace* is the dried arillus of *Myristica fragrans* Houttuyn and contains not less than twenty (20) nor more than thirty (30) per cent of nonvolatile ether extract, not more than three (3) per cent of total ash, not more than five-tenths (0.5) per cent of ash insoluble in hydrochloric acid, and not more than ten (10) per cent of crude fiber.

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*Calculated from the total oxygen absorbed by the aqueous extract.

24. *Macassar* or *Papua mace* is the dried arillus of *Myristica argentea* Warb.

25. *Bombay mace* is the dried arillus of *Myristica malabarica* Lamarck.

26. *Marjoram* is the leaf, flower, and branch of *Majorana majorana* (L.) Karst.

27. *Mustard seed* is the seed of *Sinapis alba* L. (white mustard), *Brassica nigra* (L.) Koch (black mustard), or *Brassica juncea* (L.) Cosson (black or brown mustard).

28. *Ground mustard* is a powder made from mustard seed, with or without the removal of the hulls and a portion of the fixed oil, and contains not more than two and five-tenths (2.5) per cent of starch and not more than eight (8) per cent of total ash.

29. *Nutmeg* is the dried seed of *Myristica fragrans* Houttuyn deprived of its testa, with or without a thin coating of lime, and contains not less than twenty-five (25) per cent of nonvolatile ether extract, not more than five (5) per cent of total ash, not more than five-tenths (0.5) per cent of ash insoluble in hydrochloric acid, and not more than ten (10) per cent of crude fiber.

30. *Macassar, Papua, male,* or *long nutmeg* is the dried seed of *Myristica argentea* Warb. deprived of its testa.

31. *Paprica* is the dried ripe fruit of *Capsicum annuum* L., or some other large-fruited species of *Capsicum*.

32. *Black pepper* is the dried immature berry of *Piper nigrum* L. and contains not less than six (6) per cent of nonvolatile ether extract, not less than twenty-five (25) per cent of starch, not more than seven (7) per cent of total ash, not more than two (2) per cent of ash insoluble in hydrochloric acid, and not more than fifteen (15) per cent of crude fiber. One hundred parts of the nonvolatile ether extract contain not less than three and one-quarter (3.25) parts of nitrogen. *Ground black pepper* is the product made by grinding the entire berry and contains the several parts of the berry in their normal proportions.

33. *Long pepper* is the dried fruit of *Piper longum* L.

34. *White pepper* is the dried mature berry of *Piper nigrum* L. from which the outer coating or the outer and inner coatings have been removed and contains not less than six (6) per cent of nonvolatile ether extract, not less than fifty (50) per cent of starch, not more than four (4) per cent of total ash, not more

than five-tenths (0.5) per cent of ash insoluble in hydrochloric acid, and not more than five (5) per cent of crude fiber. One hundred parts of the non-volatile ether extract contain not less than four (4) parts of nitrogen.

35. *Saffron* is the dried stigma of *Crocus sativus* L.

36. *Sage* is the leaf of *Salvia officinalis* L.

37. *Savory* or *summer savory* is the leaf, blossom, and branch of *Satureja hortensis* L.

38. *Thyme* is the leaf and tip of blooming branches of *Thymus vulgaris* L.

E. Beverages and Vinegar.

c. COCOA AND COCOA PRODUCTS.

1. *Cocoa beans* are the seeds of the cacao tree, *Theobroma cacao* L.

2. *Cocoa nibs,* or cracked cocoa is the roasted, broken cocoa bean freed from its shell or husk.

3. *Chocolate, plain or bitter,* or *chocolate liquor,* is the solid or plastic mass obtained by grinding cocoa nibs without the removal of fat or other constituents except the germ, and contains not more than three (3) per cent of ash insoluble in water, three and fifty hundredths (3.50) per cent of crude fiber, and nine (9) per cent of starch, and not less than forty-five (45) per cent of cocoa fat.

4. *Sweet chocolate and chocolate coatings* are plain chocolate mixed with sugar (sucrose), with or without the addition of cocoa butter, spices, or other flavoring materials, and contain in the sugar- and fat-free residue no higher percentage of either ash, fiber, or starch than is found in the sugar- and fat-free residue of plain chocolate.

5. *Cocoa or powdered cocoa* is cocoa nibs, with or without the germ, deprived of a portion of its fat and finely pulverized, and contains percentages of ash, crude fiber, and starch corresponding to those in chocolate after correction for fat removed.

6. *Sweet* or *sweetened cocoa* is cocoa mixed with sugar (sucrose), and contains not more than sixty (60) per cent of sugar (sucrose), and in the sugar- and fat-free residue no higher percentage of either ash, crude fiber, or starch than is found in the sugar- and fat-free residue of plain chocolate.

e. VINEGAR.

1. *Vinegar, cider vinegar,* or *apple vinegar* is the product made by the alcoholic and subsequent acetous fermentations of the juice of apples, is lævo-rotatory, and contains not less than four (4) grams of acetic acid, not less than one and six-tenths (1.6) grams of apple solids, and not less than twenty-five hundredths (0.25) gram of apple ash in one hundred (100) cubic centimeters. The water-soluble ash from one hundred (100) cubic centimeters of the vinegar requires not less than thirty (30) cubic centimeters of decinormal acid to neutralize the acidity and contains not less than ten (10) milligrams of phosphoric acid P_2O_5).

2. *Wine vinegar* or *grape vinegar* is the product made by the alcoholic and subsequent acetous fermentations of the juice of grapes and contains, in one hundred (100) cubic centimeters, not less than four (4) grams of acetic acid, not less than one and four-tenths (1.4) grams of grape solids, and not less than thirteen hundredths (0.13) gram of grape ash.

3. *Malt vinegar* is the product made by the alcoholic and subsequent acetous fermentations, without distillation, of an infusion of barley malt or cereals whose starch has been converted by malt, and is dextro-rotatory and contains, in one hundred (100) cubic centimeters, not less than four (4) grams of acetic acid, not less than two (2) grams of solids, and not less than two-tenths (0.2) gram of ash. The water-soluble ash from one hundred (100) cubic centimeters of the vinegar requires not less than four (4) cubic centimeters of decinormal acid to neutralize its alkalinity and contains not less than nine (9) milligrams of phosphoric acid (P_2O_5).

4. *Sugar vinegar* is the product made by the alcoholic and subsequent acetous fermentations of solutions of a sugar, sirup, molasses, or refiners' sirup, and contains, in one hundred (100) cubic centimeters, not less than four (4) grams of acetic acid.

5. *Glucose vinegar* is the product made by the alcoholic and subsequent acetous fermentations of solutions of starch sugar, glucose, or glucose sirup, is dextro-rotatory, and contains, in one hundred (100) cubic centimeters, not less than four (4) grams of acetic acid.

6. *Spirit vinegar, distilled vinegar, grain vinegar* is the product made by the acetous fermentation of dilute distilled alcohol

and contains, in one hundred (100) cubic centimeters, not less than four (4) grams of acetic acid.

ANALYSIS OF FOOD PRODUCTS.

The law regulating the sale and analysis of foods apparently contemplates two things: the proper and truthful branding of all articles of food, and the exclusion from the markets of deleterious food materials. The law does not seek to prevent the sale of any article of wholesome food; but in case a food material is other than it appears to be, it "shall be plainly labeled, branded or tagged so as to show the exact character thereof."

Broadly speaking, the adulterants of food are of two types: those which do not particularly affect the nutritive value of a food; and those which either lower the nutritive value or actually add deleterious articles. The common adulterant of maple sugar is cane sugar, the sweetening quality of which is identical with that of the maple. Molasses is often adulterated with glucose, a cheaper, and somewhat less sweet, but equally nutritious food material. Cottonseed oil is frequently sold for olive oil. The market price of such substituted commodities is below that of the article imitated. Such adulterations are frauds upon the pocketbook. On the other hand, some baking powders contain alum. Sausages frequently carry borax. Ketchups usually contain questionable preservatives and coloring matters. Such adulterants are a greater or less menace to public health. Since the limited funds available for the analysis of foods makes it impossible to inspect them all, greater attention will be given to adulterations injurious to health than to those concerning the pocketbook alone. Because of the expense involved it will be impracticable for the inspector to visit any considerable number of the towns of the State. Dealers and consumers are invited to send by prepaid express original and unbroken packages of food materials on sale in Maine of whose purity they are for any reason suspicious. Such samples should be accompanied by a full description of the goods, including the name and address of the dealer and of the sender, together with other known data not given on the package. As prompt free analysis will be made of these samples as circumstances will allow. In case more samples are received than can be analyzed, preference will be given to the examination of food materials the purity of which affects the public health.

FOOD INSPECTION.

CHAS. D. WOODS, Director.

L. H. MERRILL, Chemist in charge of food analysis.

The law regulating the sale and analysis of foods, enacted by the legislature of Maine in 1905, apparently contemplates two things; the proper and truthful branding of all articles of food, and the exclusion from the markets of deleterious food materials. The law does not seek to prevent the sale of any article of wholesome food, but in case a food material is other than it appears to be, it "shall be plainly labeled, branded or tagged so as to show the exact character thereof." Bulletin 116 of this Station contains the full text of the law and food standards so far as they have been fixed for Maine. Copies of this bulletin may be had on application to the Station.

BAKING POWDERS.

As baking powders are the only food material mentioned by name in the law, it was decided to include them in the first trip of the inspector in order to see in how far the powders offered for sale in the State conformed to the requirements of the law, which demands that such powders "shall be plainly labeled so as to show the acid salt or salts contained therein." As is pointed out on page 118 beyond, all three classes of baking powder leave objectionable residues in the resulting breads, and there is great dispute as to which are the least objectionable. The food law of this State does not attempt to in any way answer the question as to which is best. They are all put on the same footing of correctly stating the source of the acid constituent. A baking powder is adulterated under the law only when the label does not truthfully name the kind of acid salt it contains; when it is falsely labeled in any particular; when it contains useless, inert foreign matter, mineral or otherwise.

There are practically three classes of baking powders on the market, differing chiefly in the source of the acid.

Tartrate powders, in which the acid is either cream of tartar (bi-tartrate of potash) or tartaric acid.

Phosphate powders, in which calcium or sodium acid phosphate is the acid constituent.

Alum powders, in which the acid constituent is the sulphate of aluminum as it occurs in the various alums.

There are of course many complex baking powders on the market which are made up of mixtures of two or more of the three classes above named. Of these mixtures, phosphate-alum powders are the most common. Indeed, phosphate-alum powders are far more common than straight alum powders.

Whether the acid principle be tartaric acid, calcium phosphate or aluminum sulphate, there is always a residual product which is undesirable as a food.* Cream of tartar powders leave a residue of Rochelle salt, the active principle of Seidlitz powders; tartaric acid powders leave a residue of sodium tartrate; phosphate powders leave a residue of sodium and calcium phosphates; and alum powders leave a residue of ammonium, potassium or sodium sulphate, in accordance with the kind of alum used. The residues of the phosphate-alum powders differ somewhat from those of either alum or phosphate powders and vary with the proportion of the different acid constituents used. When the ingredients are properly proportioned in the baking powder, neither alum or alum phosphate powders leave any considerable amount of alum in the resulting bread or cake.

The per cent of available carbonic acid gas furnished by the different classes of baking powders is, according to Wiley,† as follows:

Cream of tartar baking powder, 12 per cent available carbonic acid gas.

Phosphate baking powder, 13.0 per cent available carbonic acid gas.

Alum baking powder, 8.1 per cent available carbonic acid gas.

* Many people seem to believe that the chemicals used in baking powders completely or nearly completely disappear. Cream of tartar baking powders belong to one of the best classes and yet, according to Wiley, the amount of Rochelle salt formed as a residue from a teaspoonful and a half of a cream of tartar baking powder equals that of one Seidlitz powder.

† The figures are quoted from Bul. 13 of Div. of Chemistry, U. S. Dept. of Agr.

Phosphate-alum powder, 10.4 per cent available carbonic gas.

The alum powders would require a half more than the tartrate or phosphate powders to produce the same leavening effect. There are however very few straight alum powders on the market. Because of the greater leavening effect of the mixed powders and the supposed less harmful residues, nearly all the alum now used is in the phosphate-alum powders.

The samples here collected and reported upon have not been tested for strength, but merely for correctness of labeling. Many of the less common brands were found by correspondence with the manufacturers to be three or four years old. Naturally such powders would not be nearly as effective as leavening agents as when they were fresher. As soon as it is possible to do so with the limited funds at our disposal, new samples will be tested for strength. The manufacturers so far as heard from are ready and anxious to conform to the law. The makers of mixed powders are apparently as desirous of selling their goods on what they claim to be their merits as are the makers of tartrate or phosphate powders.

The list of the brands collected and comments follow.

CREAM OF TARTAR AND TARTARIC ACID POWDERS.

7009. *Cleveland Superior Baking Powder,* made by Cleveland Baking Powder Co., N. Y. Purchased from A. A. Gilbert, Orono, March, 1905. In tin can. Price per can 25 cents. Cost of powder 3.1 cents per ounce. "A pure cream of tartar powder." "Free from alum, ammonia, lime or other adulterant." The acid salt is correctly named.

7012. *Cream Baking Powder,* made by Price Baking Powder Company, New York and Chicago. Purchased from W. L. Wilson & Co., Portland, April, 1905. In tin. Price per can 30 cents. Cost per ounce 1.8 cents. "A pure cream of tartar powder." "Free from aluminum, ammonia, lime or any other adulterant." The acid salt is correctly named.

7017. *Mrs. Lincoln's Baking Powder,* made by Mrs. Lincoln Baking Powder Company, Boston, Mass. Purchased from F. E. Plummer, Portland, April, 1905. In tin. Price per can 15 cents. Cost per ounce, 4 cents. The label states it to be a cream of tartar baking powder. The acid salt is correctly named.

7033. *Plume Baking Powder,* made by Plume Baking Powder Co., Malden, Mass. Purchased from Andrews & Harrigan, Biddeford, April, 1905. In tin. Price per can 40 cents. Cost per ounce 2.5 cents. The label states that it is a cream of tartar and tartaric acid powder. The acid salt is correctly named.

7022. *Royal Baking Powder,* made by Royal Baking Powder Company, New Jersey. Purchased from J. C. Norton & Co., Bangor, April, 1905. In tin. Price per can 25 cents. Cost per ounce 3.1 cents. The label states it to be a cream of tartar and tartaric acid powder. The acid salt is correctly named.

7021. *Schilling's Best Baking Powder,* made by A. Schilling & Co., San Francisco, Calif. Purchased from Morrill and Ross, Portland, April, 1905. In tin. Price per can 25 cents. Cost per ounce 1.8 cents. The acid salt was not named on the label. The company state that these were old goods and that all goods now sent out are labeled cream of tartar baking powder. The acid salt is as claimed.

7020. *Shaw's Baking Powder,* Geo. C. Shaw and Co., Portland. Purchased from Geo. C. Shaw & Co., Portland, April, 1905. In tin. Price per can 43 cents. Cost per ounce 2.6 cents. The package bears two certificates of analyses which state it to be a cream of tartar baking powder. The acid salt is correctly named.

7011. *Slade's Congress Yeast Powder,* made by D. & L. Slade Co., Boston, Mass. Purchased from W. L. Wilson and Co., Portland, April, 1905. In tin. Price per can 35 cents. Cost per ounce 2.1 cents. "Cream of tartar baking powder." The acid salt is correctly named.

7023. *Solar Baking Powder,* made by Fidelity Manufacturing Co., N. Y. Purchased from A. A. Gilbert, Orono, April, 1905. In tin. Price per can 25 cents. Cost per ounce 2.6 cents. "Made of absolutely pure cream of tartar." The acid salt is correctly named.

7024. *Wilde's Baking Powder,* made by Samuel Wilde & Sons, N. Y. Purchased from A. A. Gilbert, Orono, April, 1905. In tin. Price per can 50 cents. Cost per ounce 2.6 cents. No statement on label as to nature of acid salt, and the company when written to did not reply. It is a cream of tartar powder.

PHOSPHATE POWDERS.

7010. *Boston Baking Powder,* made by Boston Baking Powder Co., Boston, Mass. Purchased from W. L. Wilson & Co., Portland, April, 1905. In tin. Price per can 10 cents. Cost per ounce 1.3 cents. The label did not state the nature of the acid salt. The company write that all goods hereafter sent into the State will bear their formula. It is a straight phosphate powder.

7015. *Horsford's Self Raising Bread Preparation,* made by Rumford Chemical Works, Providence, R. I. Purchased from W. L. Wilson & Co., Portland, April, 1905. In paper. Price per package 20 cents. Cost per ounce 1.7 cents. The label states that it is a phosphate powder. The acid salt is correctly named.

7008. *Rumford Baking Powder,* made by Rumford Chemical Works, Providence, R. I. Purchased from A. A. Gilbert, Orono, March, 1905. In tin. Price per can 25 cents. Cost per ounce 3.1 cents. "A strictly pure phosphate powder." The acid salt is correctly named.

ALUM POWDER.

7031. *J. C. Grant's Bon Bon Baking Powder,* made by J. C. Grant Chemical Co., East St. Louis, Ill. Purchased from John F. Hannaway, Biddeford, April, 1905. In tin. Price per can 10 cents. Cost per ounce .7 cents. The label states that the powder is made from "double sulphate of sodium and aluminum." The claim that it is an alum powder is correct.

PHOSPHATE ALUM POWDERS.

7030. *Biskit Baking Powder,* made by Biskit Baking Powder Company, Boston, Mass. Purchased from J. L. Sullivan and Sons, Biddeford, April, 1905. In tin. Price per can 10 cents. Cost per ounce 2.5 cents. The label states that the powder contains calcium phosphate and alumina sulphate. The acid salts are correctly named.

7013. *Davis O. K. Baking Powder,* made by R. B. Davis, New York, and Hoboken, N. J. Purchased from F. E. Plummer, Portland, April, 1905. In tin. Price per can 20 cents. Cost per ounce 2.6 cents. The label on this can did not state the acid salt. On the labels now used this powder is stated to contain acid phosphate and sodium aluminic sulphate. The acid salts are correctly named on the new label.

7034. *Diamond Baking Powder,* made by J. Smith Brockway & Co., Boston. Purchased from S. L. Somerville, Houlton, April, 1905. In tin. Price per can 50 cents. Cost per ounce 3.2 cents. The label did not state the nature of the acid salt. The labels now used state that the powder contains phosphate and basic alumina sulphate. The acid salts are correctly named on the new label.

7014. *Grand Union Tea Company Baking Powder,* made by the Grand Union Tea Company, Brooklyn, N. Y. Purchased from the Grand Union Tea Company, Portland, April, 1905. In tin. Price per can 50 cents. Cost per ounce 2.8 cents. The label did not state the nature of the acid salts. The label now in use states that the powder contains acid phosphate and calcined aluminum sulphate. The acid salts are correctly named on the new label.

7016. *I. C. Baking Powder,* made by Jacques Manufacturing Company, Chicago, New York and Kansas City. Purchased from Morrill and Ross, Portland, April, 1905. In tin. Price per can 25 cents. Cost per ounce 0.9 cents. The label did not state the acid salt. The label now used states that the powder contains calcium acid phosphate and basic aluminum sulphate. The acid salts are correctly named on the new label.

7032. *Pilgrim Baking Powder,* made by Pilgrim Baking Powder Co., Boston, Mass. Obtained from Murphy Bros., Biddeford, April, 1905. In tin. Price not given. The Pilgrim Baking Powder is no longer made. The Puritan Baking Powder Company are their successors and make an alum-phosphate powder. The label on this powder states that it contains acid phosphate and basic alumina sulphate.

7019. *Reliable Baking Powder,* put up for Boston Tea and Butter Co., Portland. Purchased from Boston Tea and Butter Co., Portland, April, 1905. In tin. Price per can 25 cents. Cost per ounce 2.8 cents. The label did not state the nature of the acid salt. The company write that all goods hereafter will be labeled in accordance with the requirements of the law. It is an acid phosphate and alum powder.

TARTRATE-PHOSPHATE POWDERS.

7018. *Purity Baking Powder,* made by Purity Baking Powder Company, Boston. Purchased from Boston Tea and Butter Store, Portland, April, 1905. In tin. Price per can 30 cents. Cost per ounce 1.7 cents. The label states that the powder contains cream of tartar and phosphate of calcium. The acid salts are correctly named.

7035. *The Pure Baking Powder,* made by the Pure Baking Powder Company, Albany, N. Y. Purchased from Fisher and Crocker, Bangor, April, 1905. In tin. Price per can 10 cents. Cost per ounce 3.2 cents. The label states it to be a pure cream of tartar baking powder. This is false as it also contains acid phosphate.

TARTRATE-ALUM-ACID-PHOSPHATE POWDER.

7238. *Superb Baking Powder,* made by Hudson Valley Preserving Co., Glens Falls, N. Y. Purchased from W. J. Elbridge, Foxcroft. In tin. Price per can 8 cents. Cost per ounce 2 cents. "An absolutely pure compound being wholly composed of chemically pure cream of tartar and bicarbonate of soda with the addition of a little starch or flour." The label is false in that while the powder contains some tartaric acid it also carries alum and acid phosphate.

VINEGARS.

When alcohol is placed under favorable conditions it takes up oxygen from the air and is converted into acetic acid,—the acid that gives the sour taste to vinegar. Whatever the source of the vinegar, and however it is made, the acetic acid is the same.

When a fruit juice, such as cider, is allowed to ferment, its sugar is changed into alcohol by natural yeast-like ferments that are in the juices. Under the influence of another organism that is always present in old vinegar and in "mother of vinegar," this alcohol is changed into acetic acid. In the old process of vinegar making, which is still followed by many farmers, the apple cider is put into barrels with open bungs and kept in a warm cellar or other suitable place until both the alcoholic and acetic fermentations have taken place. This is a slow process and two or three years are needed to complete it. The addition of old vinegar or mother of vinegar hastens the process somewhat. While some vinegar is still made in this way, the quick process, used first for malt and distilled vinegars, is now generally employed by manufacturers of cider vinegar. In this process the fermented cider or other alcoholic solution is made to pass slowly through beech shavings which have been previously saturated with old vinegar, and at the same time a current of air is forced through the shavings. The shavings are used to increase the surface exposed to the air. Beech is commonly employed because it is an odorless and tasteless wood. Under proper conditions two or three days are sufficient to complete the process.

Besides acetic acid, vinegar always contains more or less of other substances which vary widely with the source from which the vinegar was made. It is because of these foreign matters, characteristic of vinegar of the same kind, that it is possible for the chemist to quite readily distinguish one variety of vinegar from another. The sour taste of a vinegar is due to its acetic acid, the other flavors are due to foreign matters in solution. The standards which have been adopted take these other foreign matters into account.

The following standards for vinegars were adopted and published as directed by law in May, 1905.

VINEGAR STANDARDS OF MAINE.

1. *Vinegar, cider vinegar,* or *apple vinegar* is the product made by the alcoholic and subsequent acetous fermentations of the juice of apples, is lævo-rotatory, and contains not less than four (4) grams of acetic acid, not less than one and six-tenths (1.6) grams of apple solids, and not less than twenty-five hundredths (0.25) gram of apple ash in one hundred (100) cubic centimeters. The water-soluble ash from one hundred (100) cubic centimeters of the vinegar requires not less than thirty (30) cubic centimeters of decinormal acid to neutralize the acidity and contains not less than ten (10) milligrams of phosphoric acid (P_2O_5).

2. *Wine vinegar* or *grape vinegar* is the product made by the alcoholic and subsequent acetous fermentations of the juice of grapes and contains, in one hundred (100) cubic centimeters, not less than four (4) grams of acetic acid, not less than one and

four-tenths (1.4) grams of grape solids, and not less than thirteen hundredths (0.13) gram of grape ash.

3. *Malt vinegar* is the product made by the alcoholic and subsequent acetous fermentations, without distillation, of an infusion of barley malt or cereals whose starch has been converted by malt, and is dextro-rotatory and contains, in one hundred (100) cubic centimeters, not less than four (4) grams of acetic acid, not less than two (2) grams of solids, and not less than two-tenths (0.2) gram of ash. The water-soluble ash from one hundred (100) cubic centimeters of the vinegar requires not less than four (4) cubic centimeters of decinormal acid to neutralize its alkalinity and contains not less than nine (9) milligrams of phosphoric acid (P_2O_5).

4. *Sugar vinegar* is the product made by the alcoholic and subsequent acetous fermentations of solutions of a sugar, sirup, molasses, or refiners' sirup, and contains, in one hundred (100) cubic centimeters, not less than four (4) grams of acetic acid.

5. *Glucose vinegar* is the product made by the alcoholic and subsequent acetous fermentations of solutions of starch sugar, glucose, or glucose sirup, is dextro-rotatory, and contains, in one hundred (100) cubic centimeters, not less than four (4) grams of acetic acid.

6. *Spirit vinegar, distilled vinegar, grain vinegar* is the product made by the acetous fermentations of dilute distilled alcohol and contains, in one hundred (100) cubic centimeters, not less than four (4) grams of acetic acid.

INTERPRETATION OF THE LAW.

While there have been no court decisions in Maine, the executive officer will, until he is better informed, be guided by the following statements in the enforcement of the law concerning vinegar.

The standards above named, adopted under section 5 of the law, are part of the pure food law.

The word vinegar, as defined in section 1 of the standards, unless otherwise qualified, always mean cider vinegar. To sell anything else than cider vinegar when vinegar is asked for, is prohibited by the law.

No vinegar whether cider or otherwise, carrying less than 4 per cent of acetic acid, can legally be sold unless the per cent of acid is stated on the package.

The use of the trade term "white wine vinegar" defined in section 2 of the standards is an adulteration unless the vinegar thus designated is made from grapes. The vinegars commonly called white wine vinegars should be labeled white vinegar, distilled; pickling vinegar, distilled; spirit vinegar; grain vinegar; or some such term that clearly states the nature of the goods.

Distilled vinegars colored so as to resemble cider vinegar must carry a statement showing that they are colored. In case caramel (burnt sugar) is the coloring matter, the exact nature of the coloring matter need not be stated. Thus "distilled vinegar, colored" would come within the requirements of the law.

In case a dealer furnishes a customer with vinegar other than cider vinegar, or one that carries less than 4 per cent acetic acid, he must so notify the purchaser. Failure to do so is a violation of the law, and bills therefor are uncollectable (section 8 of law).

RESULT OF THE INSPECTION.

Samples of vinegar were taken from the stock of retail dealers in several cities and large towns in the State in the months of May and August, 1905. These vinegars were examined for total acidity, volatile acids, total solids and ash. The nature of the solids and ash were not studied, except in a few special instances. For this reason it may be that an occasional sample of vinegar has been passed as a straight cider vinegar when it was adulterated. Ordinary adulterations would be detected by the methods employed by us. A skillful adulteration might have escaped detection.

It is gratifying to note that while there were low grade imitation vinegars on the market, no harmful ingredients were found. The fraud in every case was upon the pocketbook rather than upon the health of the consumer.

It is likewise gratifying that the makers and handlers of vinegar in the State are in apparent sympathy with the purpose of the law and desire to meet its requirements.

The results of the analyses are given in the table which follows.

Description and results of analyses of samples of different kinds of vinegars collected in Maine in the spring and fall of 1905.

Number.	Description*. Remarks.	Cost per gallon.	Total acids.	Volatile acids.	Total solids.	Ash.
	CIDER VINEGARS.	cts.	%	%	%	%
7059	A. H. Black, West Sidney. W. P. Stewart & Co., Waterville, April, 1905	25	5.86	5.74	1.76	.40
7289	A. H. Black, West Sidney. Edson Locke, Augusta, August, 1905	25	4.75	4.70	1.83	.38
7295	A. H. Black, West Sidney. G. E. Barrows, Waterville, August, 1905	25	4.53	4 37	1.85	.39
7261	Eastern Tea & Grocery Co., Bath, August, 1905. The barrel was labeled "pure cider vinegar" but did not carry the name of the maker. It appears to be a dilute cider vinegar, such as would result from adding a third or more water to a good vinegar	20	3.03	2.96	.82	.31
7046	John Cassidy Co., Bangor. S. H. Robinson & Son, Bangor, April, 1905	20	3.93	3.86	1.95	.30
7242	John Cassidy Co., Bangor. Robert Hickson & Son, Bangor, August, 1905	20	4.28	4.15	2.23	.43
7244	John Cassidy Co., Bangor. R. B. Blair, Brewer, August, 1905	25	4.35	4.20	2.28	.43
7271	E. Clifford & Co., Portland. Nealley & Miller, Lewiston, August, 1905	20	3.88	3.78	1.98	.34
7036	Chas. F. Dearth, Foxcroft. Fred T. Hall & Co., Bangor, April, 1905	30	6.05	5.82	2.74	.32
7042	Chas. F. Dearth, Foxcroft. J. C. Norton & Co., Bangor, April, 1905	25	5.88	5.73	2.80	.33
7053	Chas. F. Dearth, Foxcroft. W. S. Hamm, Foxcroft, April, 1905	20	5.67	5.52	2.68	.34
7247	Chas. F. Dearth, Foxcroft. Harlow Bros., Brewer, August, 1905	25	4.88	4.74	1.87	.32
7074	A. B. Donald. A. P. Conant & Co., Lewiston, April, 1905. Probably a pure cider vinegar, though rather poorly made	20	3.64	3.60	2.89	.48
7281	J. B. Donald, Portland. G. E. Whitehouse, Brunswick, August, 1905	20	4.43	4.16	3.18	.29
7047	Duffy Cider Co., Rochester, N. Y. F. H. Drummond, Bangor, May, 1905	25	4.10	4.00	2.21	.31
7293	Duffy Cider Co., Rochester, N. Y. Percival Bros., Augusta, August, 1905	25	4.00	3 94	2.30	.35
7055	E. G. Flanders, Sangerville. Warren & Dyer, Dover, May, 1905. Probably a poorly made straight cider vinegar	18	3.47	3.20	3.69	.35

* When two names are given, the first is that of the manufacturer. The date is that of taking the sample.

Descriptions and analyses of vinegars collected in 1905.

Number.	Description. Remarks.	Cost per gallon.	Total acids.	Volatile acids.	Total solids.	Ash.
7277	Fuller & Holmes Co., Augusta. Webber & Hewett, Augusta, August, 1905. Probably a rather poorly made cider vinegar	cts. 25	% 3.39	% 3.36	% 1.71	% .34
7041	"Gold Medal." Haynes-Piper Co., Boston. J. C. Norton & Co., Bangor, May, 1905	25	4.98	4.98	2.35	.36
7241	Holly Mills, Genesee Fruit Co., Holly, N. Y. Gallagher Bros., Bangor, August, 1905	25	4.22	4.04	3.41	.47
7037	H. J. Heinz Co., Pittsburg, Pa. James H. Snow & Co., Bangor, May, 1905	25	5.18	5.13	2.37	.30
7256	H. J. Heinz Co., Pittsburg, Pa. J. H. Snow & Co., Bangor, August, 1905	25	5.08	5.00	2.45	.42
7257	H. J. Heinz Co., Pittsburg, Pa. Walter S. Russell, Bath, August, 1905	25	5.40	5.38	2.35	.36
7282	H. J. Heinz Co., Pittsburg, Pa. H. T. Mason, Brunswick, August, 1905	25	4.60	4.44	2.40	.33
7286	H. J. Heinz Co., Pittsburg, Pa. H. E. Emmons, Brunswick, August, 1905	25	5.18	5.14	2.54	.41
7291	F. L. Hewins, East Winthrop. E. W. Church, Augusta, August, 1905. Probably an imperfectly fermented cider vinegar	25	3.08	2.92	2.95	.45
7060	W. S. Hunnewell, China. Geo. A. Kennison, Waterville, May, 1905	25	5.77	5.60	2.46	.35
7297	W. S. Hunnewell, China. Geo. A. Kennison, Waterville, August, 1905.	25	4.80	4.78	2.13	.33
7058	J. A. Jenkins, Lambs Corner. H. C. Haskell, Waterville, May, 1605	25	4.67	4.56	1.92	.37
7294	J. A. Jenkins, Lambs Corner. E. M. Jepson, Waterville, August, 1905	25	4.90	4.90	1.78	.35
7296	J. A. Jenkins, Lambs Corner. C. E. Mathews, Waterville, August, 1905	25	4.82	4.82	1.87	.37
7265	Pettingill, Limington. Wm. Milliken & Co., Portland, August, 1905	25	4.74	4.56	2.09	.44
7288	H. S. Melcher Co , Portland. E. M. Alexander, Brunswick, August, 1905	20	3.93	3.84	1.98	.34
7054	Daniel Page, Dover. Fred Palmer, Dover, May, 1905	20	6.12	4.76	7.26	.52
7068	E. D. Pettingill Bros., Portland. Morrill & Ross, Portland, May, 1905	25	4.63	4.38	2.83	.32
7270	E. L. Pettingill Sons Co., Portland. Scannell & Roche, Lewiston, August, 1905	20	4.57	4.34	2.48	.27
7064	J. F. Pillsbury. Geo. C. Shaw Co., Portland, May, 1905	25	5.65	5.50	3.15	.48
7268	Steadman, Hawkes & Co., Portland. Ames & Merrill, Lewiston, August, 1905	20	4.23	4.22	1.68	.25

Descriptions and analyses of vinegars collected in 1905.

Number.	Description. Remarks.	Cost per gallon.	Total acids.	Volatile acids.	Total solids.	Ash.
		cts.	%	%	%	%
7075	Maker unknown. Bowker & Scott, Lewiston, May, 1905	20	4.85	4.78	1.29	.24
7069	Twitchell-Champlin Co., Portland. F. E. Plumer, Portland, May, 1905	25	4.73	4.68	1.80	.29
7262	"Hatchet brand." Twitchell-Champlin Co., Portland. A. F. Williams, Bath, August, 1905	20	5.03	4.96	1.82	.29
7287	"Hatchet brand." Twitchell-Champlin Co., Portland. C. A. Pierce & Son, Brunswick, August, 1905	24	4.85	4.84	1.81	.29
7079	Fred Vickery, East Auburn. John Callahan, Auburn, May, 1905	20	3.97	3.82	2.52	.40
7273	J. P. Vickery, East Auburn. C. H. Libby & Co., Lewiston, August, 1905. If a cider vinegar it has apparently been reduced with water	20	3.70	3.64	1.23	.12
7063	"Domestic vinegar." Maker unknown. W. L. Wilson & Co., Portland, May, 1905	20	6.09	6.08	1.88	.36
7070	"Domestic vinegar." Maker unknown. A. M. Hanniford, Portland, May, 1905. Either a very poorly fermented or, what is more probable, a watered vinegar	18	2.30	2.20	1.79	.37
7266	"Domestic vinegar." Maker unknown. John W. Deering & Son, Portland, August, 1905. A rather poorly fermented cider vinegar	25	3.50	3.48	2.27	.25
7299	"Marvel brand." Maker's name illegible on barrel. Chas. Pomeleau, Waterville, August, 1905	25	4.47	4.44	1.65	.28
	MALT VINEGARS.					
7057	H. J. Heinz Co., Pittsburg, Pa. Warren & Dyer, Dover May, 1905	25	5.10	4.76	1.89	.24
7066	H. J. Heinz Co., Pittsburg, Pa. Geo. C. Shaw Co., Portland, May, 1905	60	6.13	5.70	2.84	.31
7067	H. J. Heinz Co., Pittsburg, Pa. F. H. Verrill, Portland, May, 1905	25	4.73	4.28	2.24	.23
7245	H. J. Heinz Co., Pittsburg, Pa. Harlow Bros., Brewer, August, 1905	25	4.70	4.37	1.97	.22
7259	H. J. Heinz Co., Pittsburg, Pa. Walter S. Russell, Bath, August, 1905	25	4.87	4.52	2.10	.30
7264	H. J. Heinz Co., Pittsburg, Pa. Geo. C. Shaw & Co., Portland, August, 1905	60	5.38	5.04	2.65	.22
7274	H. J. Heinz Co., Pittsburg, Pa. Atwood Market Co., Lewiston, August, 1905	25	4.76	4.32	2.60	.43
7292	H. J. Heinz Co., Pittsburg, Pa. G. W. Wadleigh, Augusta, August, 1905	30	4.80	4.48	2.03	.29
	DISTILLED VINEGARS. NOT COLORED.					
7040	E. E. Clifford & Co., Portland. Brennen & Curran, Bangor, May, 1905. Branded and sold as white wine vinegar	25	3.79	3.31	.10	.03

Descriptions and analyses of vinegars collected in 1905.

Number.	Description. Remarks.	Cost per gallon.	Total acids.	Volatile acids.	Total solids.	Ash.
		cts	%	%	%	%
7072	E. E. Clifford & Co., Portland Spear & Webster, Lewiston, May, 1905. Branded and sold as white wine vinegar	20	3.58	3.56	.21	.13
7249	E. E. Clifford & Co., Portland. Brennen & Curran, Bangor, August, 1905. Branded and sold as white wine vinegar	25	3.78	3.70	.11	.03
7251	E. E. Clifford & Co., Portland. F. S. Jones, Bangor, August, 1905. Branded and sold as white wine vinegar	25	3.12	3.07	.36	.24
7290	Fleischmann's Superior White Wine Vinegar. Merrill Bros., Augusta, August, 1905. Branded and sold as white wine vinegar	25	3.30	3.28	.18	.04
7313	J. B Donnell Co, Portland. Jensen & Blom, Portland, September, 1905. Branded and sold as white wine vinegar	....	3.10	3.10	.21	.08
7038	H. J. Heinz., Pittsburg, Pa. James H. Snow & Co., Bangor, May, 1905. This and all of Heinz's white vinegars are branded pickling vinegars distilled	30	5.26	5.26	.19	.04
7048	H. J. Heinz Co., Pittsburg, Pa. F. H. Drummond, Bangor, May, 1905	30	6.50	6.50	.22	.04
7056	H. J. Heinz Co., Pittsburg, Pa. Warren & Dyer, Dover, May, 1905......................	20	5.28	5.28	.33	.06
7065	H. J. Heinz Co., Pittsburg, Pa. Geo. C. Shaw Co., Portland, May, 1905	30	5.50	5.48	.22	.05
7071	H. J. Heinz Co., Pittsburg, Pa. Spear & Webster, Lewiston, May, 1905...............	30	4.98	4.98	.25	.06
7253	H. J. Heinz Co., Pittsburg, Pa. F. H. Drummond, Bangor, August, 1905	30	5.75	5.70	.24	.04
7258	H. J. Heinz Co., Pittsburg, Pa. Walter S. Russell, Bath, August, 1905	30	5.33	5.20	.16	.04
7272	H. J. Heinz Co, Pittsburg, Pa. Nealley and Miller, Lewiston, August, 1905. Branded white vinegar distilled. Sold for white wine vinegar	20	4.46	4.46	.18	.04
7278	H. J. Heinz Co., Pittsburg, Pa. Webber & Hewett, Augusta, August, 1905	25	5.22	5.18	.18	.04
7279	H. J. Heinz Co., Pittsburg, Pa. H. L. & W. E. Chase, Bath, August, 1905	35	5 18	5.16	.17	.04
7283	H. J. Heinz Co., Pittsburg, Pa. H. T. Nason, Brunswick, August, 1905	25	5.05	4.98	.31	.04
7285	H. J. Heinz Co., Pittsburg, Pa. "Howard white Vinegar." H. E. Emmons, Brunswick, August, 1905	25	4.00	4.00	.20	.05
7269	"White Wine." This is the only inscription on the barrel. The dealer obtained it from E. L. Pettingill Sons Co., Portland. Ames & Merrill, Lewiston, August, 1905.	20	4.13	4.12	.16	.04

Descriptions and analyses of vinegars collected in 1905.

Number.	Description. Remarks.	Cost per gallon.	Total acids.	Volatile acids.	Total solids.	Ash.
		cts.	%	%	%	%
7051	Pine Hill Farm. Staples & Griffin, Bangor, May, 1905	20	2.85	2.84	.43	.08
7248	White vinegar "T. R. S. & Co., Bangor." Harlow Bros., Brewer, August, 1905	25	2.58	2.54	.19	.03
7076	Maker unknown. Bowker & Scott, Lewiston, May, 1905. It was branded as white wine vinegar	20	4.86	4.84	.23	.08
7044	Maker unknown. F. L. Frank & Co., Bangor, May, 1905	30	2.48	2.46	.28	.08
7275	Maker unknown. Bowker & Scott, Lewiston, August, 1905. Branded and sold as pure white wine vinegar	20	4.28	4.28	.19	.05
	DISTILLED VINEGARS COLORED IN IMITATION OF CIDER VINEGAR					
7043	John Cassidy Co., Bangor. A. E. Baker, Bangor, May, 1905	25	3.08	3.06	.20	.03
7039	E. E. Clifford & Co., Portland. Brennan & Curran, Bangor, May, 1905. Warranted pure cider vinegar	25	3.85	3.82	.20	.04
7052	E. E. Clifford & Co., Portland. W. J. Eldridge, Foxcroft. "Guaranteed Mass. standard." May, 1905	20	3.75	3.68	.31	.07
7061	E. E. Clifford & Co., Portland. Whitcomb & Cannon, Waterville, May, 1905. "Pure cider vinegar"	25	3.78	3.78	.27	.14
7073	E. E. Clifford & Co., Portland Spear & Webster, Lewiston, May, 1905. "Pure cider vinegar"	18	3.81	3.80	.30	.05
7252	E. E. Clifford & Co., Portland. F. S. Jones, Bangor, August, 1905. "Pure cider vinegar, guaranteed Mass. standard"	20	4.25	4.19	.37	.25
7260	E. E. Clifford & Co., Portland. W. H. Swett, Bath, August, 1905. "Fine pure old XXXX vinegar"	25	3 55	3.50	.43	.09
7284	E. E. Clifford & Co., Portland. W. Hamilton, Brunswick, August, 1905. "Fine pure old XXX vinegar"	12	3.12	3.08	.28	.07
7250	E. E. Clifford & Co., Portland. Brennan & Curran, Bangor, August, 1905. "Pure Golden Russet vinegar"	25	3.88	3.80	.28	.03
7255	E. E. Clifford & Co., Portland. Staples & Griffin, Bangor, August, 1905. "Pure Golden Russet vinegar"	....	3.75	3.70	.18	.05
7314	E. E. Clifford & Co., Portland. Miss C. R. Garnet, Portland, by E. L. Cobb, Jr., milk inspector for Portland, September, 1905. "Golden Russet"	....	4.45	4.48	.22	.05

Descriptions and analyses of vinegars collected in 1905.

Number.	Description. Remarks.	Cost per gallon.	Total acids.	Volatile acids.	Total solids.	Ash.
		cts.	%	%	%	%
7300	Conant, Patrick & Co., Portland. Dumas & Vigue, Waterville, August, 1905. "Pure Perfection Vinegar." Sold for cider vinegar.	20	3.10	3.08	.38	.04
7276	F. G. Davis & Co., Lewiston. Bowker & Scott, Lewiston, August, 1905. "Fine Pure Old XXXX Vinegar"........................	20	3.20	3.16	.20	.16
7062	J. B. Donnell Co., Portland. John B. Johnson, Portland, May, 1905..................	25	2.93	2.92	.28	.13
7312	J. B. Donnell Co., Portland. C. A. Rounds, Portland, by E. L. Cobb, Jr., milk inspector for Portland, September, 1905. Labeled "Star brand vinegar"......	....	2.43	2.42	.23	.03
7315	J. B. Donnell Co., Portland. C. S. Johnson, Portland, by E. L. Cobb, Jr., milk inspector for Portland, September, 1905. It was labeled "Star brand vinegar"	...	2.13	2.12	.19	.03
7316	J. B. Donnell Co., Portland. Chas. Mahoney, Portland, by E. L. Cobb, Jr., milk inspector for Portland, September, 1905............	....	3.35	3.28	.20	.03
7045	Pine Hill Farm. F. L. Frank & Co., Bangor, May, 1905. A rather doubtful vinegar. It may be a cider vinegar watered..................	20	3.53	3.44	.96	.14
7050	Pine Hill Farm. Staples & Griffin, Bangor, May, 1905	20	3.20	3.18	.28	.04
7246	T. R. Savage & Co., Bangor. Harlow Bros., Brewer, August, 1905. "Pure vinegar"...	15	3.46	3.42	.37	.05
7298	"S, Bangor." Toulouse & Soucier, Waterville, August, 1905.........	25	3.12	3.12	.32	.06
7078	Steadman & Hawks. Olfene & Holmes, Auburn, May, 1905. This was guaranteed to be pure cider vinegar........	15	3.29	3.28	.37	.08
7243	Thurston & Kingsbury, Bangor. N. H. Hall, Brewer, August, 1905. "X L Pure pickling vinegar"..........................	20	3.43	3.30	.46	.06
7254	Geo. I. Wescott & Son, Bangor. T. J. Daley & Co., Bangor, August, 1905. "XXX vinegar"...	20	2.93	2.80	.39	.07
7317	C. A. Weston, Portland. S. F. Wood, Portland, by E. L. Cobb, Jr., milk inspector for Portland, September, 1905. "Solar brand"..	....	2.05	2.02	.38	.09
7049	Maker unknown. Fisher & Crocker, Bangor, May, 1905. "Strictly pure vinegar".........	20	2.95	2.90	.23	.03
7077	Maker unknown. E. B. Bray, Auburn, May, 1905..........................	20	2.65	2.64	.19	.04

FIG. 9. In need of renovation—one-half barrel of fruit.

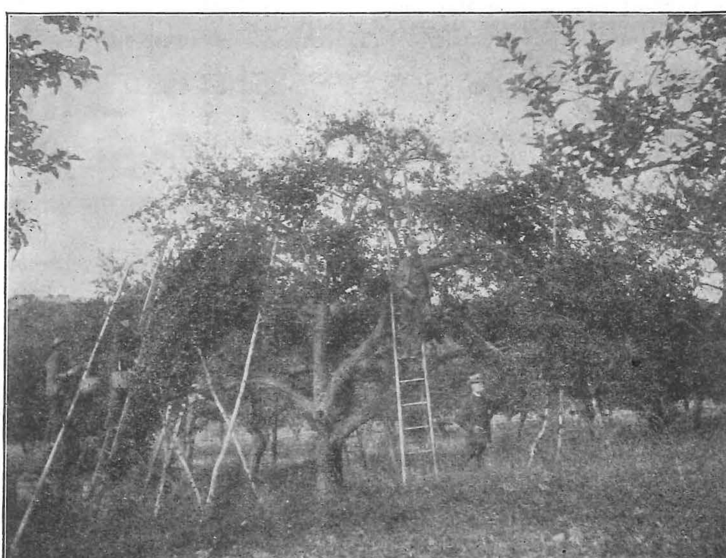


FIG. 10. The result of renovation—eight barrels of fruit. (See page 145.)

EXPERIMENTS IN ORCHARD CULTURE.

SECOND REPORT.*

W. M. MUNSON.

It has been estimated that the average value of the fertilizing elements taken from an acre of soil by apple trees during the period of 20 years, counting in ten crops of fruit, is approximately $377. Of this amount $147, or a little less than 39 per cent, is in the fruit; $160, or about 42 per cent, in the leaves; and $70, or about 19 per cent, in wood for the growth of the tree. The total amount of nitrogen, exclusive of that used in the growth of the trees, is about 1,300 pounds, of phosphoric acid 310 pounds, of potash 1,900 pounds per acre.

"To restore the potash alone as above, and that used by the growth of the tree, it would require 21.7 tons of high grade ashes containing 5 per cent potash. To restore the nitrogen would require 16.2 tons of a commercial fertilizer containing 5 per cent nitrogen."† In view of these facts, and also of the large amounts of fertilizing elements removed by crops of hay or grain, or by pasturing the orchard without giving extra feed to the animals, it is not strange that many of the orchards of Maine are deteriorating.

Of course, the fact should be taken into account that a portion of the material above referred to is returned to the soil in the way of fallen fruit and leaves and in the excrement of the animals, but with a liberal allowance for these returns the value of fertilizing elements actually removed from the soil during the period named will probably not fall short of $200, or $10 per acre per year.‡

As often urged in the publications of this Station, thorough tillage is one of the surest ways of rendering available the plant

* First Report see Bulletin 89, 1903.

† Roberts, Bul. 103, Cornell Exp. Sta.

‡ A recent valuable contribution to the literature of this subject is Bul. 265, N. Y. Agr. Exp. Sta. (Geneva).

food which is naturally contained in the soil. It may be added that apple trees are well suited to abstract this natural store of fertility; but there is a limit beyond which the tree cannot go without help.

In studying the methods of fertilizing orchards, the same general principles will apply as in the management of other farm crops. The essential constituents must be the same; but unlike ordinary farm crops, orchard crops do not give an opportunity for rotation. A certain amount of nitrogen is essential to the vigorous foliage upon which depends the life of the tree. Potash also is important, not only because it constitutes a large part of the ash of fruit trees and more than half of the ash of the fruit itself, but also, as suggested by Voorhees, because it forms salts with the well known acids. Lime, as also pointed out by Voorhees, "seems to strengthen the stems and woody portion of the tree, to shorten the period of growth and to hasten the time of ripening. Fruit trees growing on soils rich in lime show a stocky, sturdy, vigorous growth, and fruit ripens well; while those on soils which contain but little lime, particularly the clays, appear to have an extended period of growth, the result of which is that wood does not mature and the fruit does not ripen properly."*

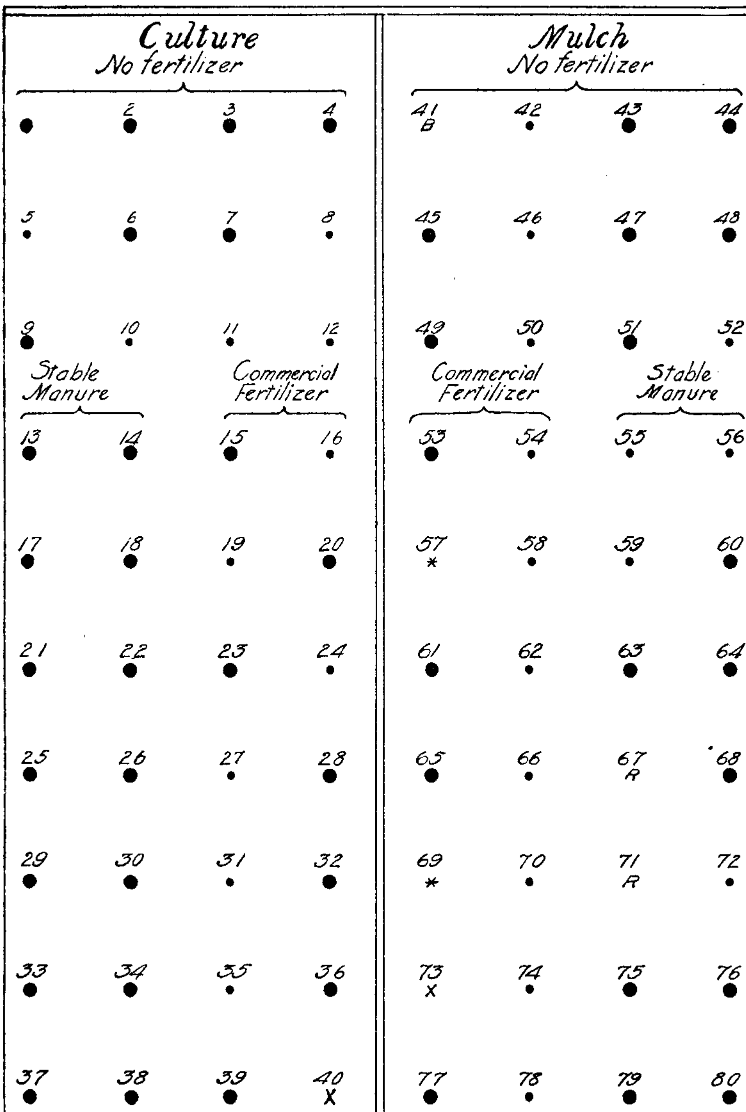
Culture and Fertilization.

In Bulletin 89, February, 1903, was published an outline of certain experiments relative to the culture and fertilization of orchards, together with such results as had been obtained. The work in question was conducted upon the farm of Mr. Chas. S. Pope, Manchester, Kennebec county, Maine. The interest evoked by these experiments, and the practical value of the demonstration of approved methods of treatment, have led to a considerable increase in the scope of the work and to the extension of operations with other growers. As in the past, much credit should be given to Mr. Pope for his faithful and hearty coöperation. The present report extends and supplements the report in Bulletin 89, and as little repetition is made as is consistent with clearness.

The comparative study of cultivation and mulch as treatment for a young bearing orchard is continued along the lines origin-

*Trans. Mass. Hort. Soc'y, 1896.

DIAGRAM OF THE ORCHARD.



Explanation of Diagram: The significance of the figures in the above diagram is as follows- ● = trees bearing in 1902; • = trees not bearing in 1902; × = vacancy; * = Bellflower tree; R = Roxbury Russet; B = Ben Davis.

ally planned. Forty trees are kept in cultivation and forty mulched; a part of each lot receiving complete fertilizer, part stable manure, and part no fertilizer of any kind.

HISTORY OF THE ORCHARD SINCE 1902.*

In 1902 no fertilizers were applied to any of the trees. The season was moist and the growth was satisfactory.

In 1903 and 1904 the treatment was the same as in preceding years except that the fertilizer used carried 3 per cent nitrogen, 6 per cent phosphoric acid, and 8 per cent potash, and was applied broadcast at the rate of 750 pounds per acre. No stable manure was used in 1904.

In 1905 two-thirds the usual amount of fertilizer was used; that is, 500 pounds was applied broadcast and a good application of stable manure was made to the trees usually receiving this material.

A good crop of fruit has been taken from the orchard every year as shown by the tables included in this report, although there is a marked individuality in the trees as to amount and character of fruit.

The weakness of seedling stocks, mentioned in Bulletin 89, has continued to manifest itself and several of the best trees have died, not because of injury to the Gravenstein or Tolman tops, but because of the inherently weak seedling trunks. This is a striking illustration of the advantage of using some well known, hardy, vigorous sort as the foundation of an orchard, rather than miscellaneous seedlings, even though they be home grown.

GROWTH AND CONDITION OF TREES.

The accompanying table, compiled from field notes taken each year, will convey an exact account of the growth of the trees from year to year. Numbers 1-12 and 41-52 inclusive have received no fertilizer of any kind. But the first mentioned trees were cultivated, while the second were mulched, as shown in the diagram. Numbers 13-24 and 53-64 respectively are Tolman. The remainder are Gravenstein, with the exceptions noted in the column of "Remarks," and numbers 42, 46, 50, 66, 70, 74 and 78, which are Tolman.

* For a history of the orchard up to the close of 1902, see Bulletin 89.

Annual Growth of Trees in Cultivated Area.

Number of tree.	Growth in inches.* 1902.	1903.	1904.	1905.	Average growth in inches for four years.	Remarks.
1	6- 8	4- 6	4-6	3- 4	4 - 6	Hurt by cold, 1904-5.
2	6- 8	3- 5	1-2	0	3 - 4	Hurt by cold, 1904-5—nearly dead.
3	8-10	5- 7	2-3	2- 4	4 - 6	In excellent condition.
4	6- 8	5- 7	3-5	3- 6	4 - 6½	In excellent condition.
5	8-10	6- 8	4-6	6- 8	6 - 8	Top partly killed by cold, 1904-5.
6	4- 6	1- 2	0	0	1 - 2	Nearly dead.
7	8-10	3- 4	3-4	1- 3	4 - 5	Defective stock.
8	10-14	10-12	5-6	8-10	8 -10½	Injured a little in center of top.
9	8-10	4- 6	3-6	3- 6	4½- 7	Injured a little in center of top.
10	10-12	6- 8	6-8	8-10	8½- 9½	Vigorous; a good tree.
11	6- 8	4- 6	2-4	2- 4	3½- 5½	Defective stock.
12	10-12	7- 9	5-7	5- 7	8 - 9	Vigorous, healthy; a fine tree.
					5 - 6½	*Average annual growth for the twelve trees.*
13	8-10	4- 6	4-6	3- 4	5 - 6½	Vigorous.
14	8-10	8-10	5-6	7- 9	7 - 9	A very fine tree.
15	8-10	5- 7	1-2	6- 8	5 - 7	Doing well.
16	4- 5	8-10	7-9	7- 9	6½- 8	Doing well.
17	8-10	6- 8	4-6	6- 8	6 - 8	Doing well.
18	6- 8	10-12	7	9-10	8 - 9	Extra good tree.
19	6- 8	4- 6	2-3	0	3 - 4	Defective stock.
20	8-10	10-12	3-4	5- 8	6½- 8½	Good tree.
21	10-12	6- 8	6-7	8-12	7½- 9½	Extra good—both tree and fruit.
22	0	......	......	......	......	Dead. (Defective stock; died in 1903.)
23	10-12	10-12	4-6	8-10	8 -10	Extra fine tree.
24	6	10-12	2-3	4- 6	5½- 7	Good tree.
					6 - 8	*Average annual growth; eleven trees.*
25	6- 7	4- 6	6-8	8-10	6 - 8	Doing well.
26	6- 8	5- 7	4-5	6- 8	5 - 7	Doing well.
27	12	7- 9	4-5	1- 3	6 - 7	Half of tree dying.
28	4- 6	6- 8	2-4	1- 3	3 - 5	Dying.
29	6- 8	4- 6	3-6	4- 6	4 - 6	Doing well.
30	6- 8	3- 5	......	0	3 - 4	Nearly dead.
31	10	8-10	3-6	4- 6	6 - 8	Injured in 1904; may be saved.
32	12	6- 8	4-6	5- 7	7 - 8	Good tree.
33	8	3- 5	5-7	1- 3	4 - 6	Good tree.
34	10	8-10	3-6	1- 3	5½- 7	Half of tree dying; trunk defective.
35	6- 8	5- 7	3	6- 8	5 - 6½	Half of tree dying; trunk defective.
36	8	5- 7	4-6	8-10	6 - 8	Doing well.
37	6- 8	6- 8	6	6- 8	6 - 7½	Doing well.
38	7- 8	4- 6	4-6	3- 5	4½- 6	One-third of tree Roxbury Russet. Doing well.
39	8	6- 8	5-7	6- 8	6 - 8	Good tree.
40	......	......	......	......	......	Vacant.
					5 - 7	*Average annual growth; fifteen trees.*

* Fractions less than ½ are disregarded.

Annual Growth of Trees in Mulched Area.

Number of tree.	GROWTH IN INCHES.* 1902.	1903.	1904.	1905.	Average growth in inches for four years.	Remarks.
41	8-10	8-10	4-6	8-10	7 - 9	*Ben Davis.* Doing well.
42	4- 6	5- 7	5-7	2- 4	4 - 6	
43	4- 6	3- 5	3-5	2- 4	3 - 5	
44	6- 8	6- 8	4-6	5- 7	5 - 7	
45	8-10	5- 7	3-5	1- 3	4 - 6	Center of top dying; defective trunk.
46	2- 4	4- 6	3-5	2- 4	3 - 5	
47	4- 6	4- 6	3-5	2- 4	3 - 5	
48	3- 6	3- 5	4-5	1- 3	3 - 5	
49	8-10	5- 7	5-6	4- 6	5½- 7	
50	2- 3	1- 3	2-3	1- 3	1½- 3	A weak tree.
51	6- 8	5- 7	4-7	2- 3	4 - 6	
52	2- 3	1- 3	3-5	1- 3	2 - 3	Half of top dying.
					3¾- 5½	*Average annual growth; twelve trees.*
53	6- 8	6- 8	1-3	4- 6	4 - 6	Doing well.
54	3- 5	4- 6	2-3	1- 3	2½- 4	Defective at base.
55	4- 6	6- 8	3-4	4- 6	4 - 6	
56	8-10	8-10	4-6	6- 8	6½- 8½	
57	10-12	7- 9	3-5	6- 8	6½- 8½	*Bellflower.* Fine tree. Excellent fruit in 1904; none 1905.
58	5- 6	7- 9	5-7	3- 5	5 - 7	Doing well.
59	4- 6	8-10	6-8	3- 5	5 - 7	Doing well.
60	5- 6	5- 7	3-5	4- 6	4 - 6	
61	6- 8	7- 9	4-6	3- 5	5 - 7	
62	4- 6	6- 8	3-5	4- 6	4 - 6	
63	8-10	8-10	4-6	4- 6	6 - 8	Particularly good tree.
64	10-12	10-12	5-7	4- 6	7 - 9	Particularly good tree.
					5 - 7	*Average annual growth; twelve trees.*
65	10-12	3- 5	3-5	3- 6	5 - 7	
66	2- 4	4- 6	1-3	1- 3	2 - 4	
67	10-12	8-10	4-6	6- 8	7 - 9	*Roxbury Russet.* Good tree.
68	8-10	8-10	6-8	5- 7	7 - 9	
69	12-14	8-10	4-6	6- 8	7½- 9½	*Bellflower.* Good crop of good fruit, both 1904 and 1905.
70	8	7- 9	3-5	8-10	6½- 8	
71	5- 7	5- 7	1-2	5- 7	4 - 6	*Roxbury Russet.*
72	6- 8	6- 8	5-7	6- 8	6 - 8	Doing well.
73	......	......	......	......	.....	Vacant.
74	1- 3	5- 7	1-2	1- 3	2 - 4	Good tree; 4½ bushels (Tolman), 1905.
75	6	6- 8	5-7	8-10	7 - 8	Fine tree; 9 bushels (Gravenstein), 1905.
76	6- 8	6- 8	6-8	6- 8	6 - 8	Doing very well.
77	10-12	6- 8	2-3	4- 6	5½- 7	Two-thirds of tree dead.
78	4- 6	5- 7	3-5	6- 8	4½- 6½	Doing well.
79	8-10	7- 9	5-7	8-10	7 - 9	Fine tree; 8½ bushels, 1905.
80	8-10	7- 9	6-8	8-10	7 - 9	Fine tree; 8¾ bushels, 1905.
					5½- 7½	*Average annual growth; fifteen trees.*

* Fractions less than ½ are disregarded.

Taking the orchard as a whole, there was an average annual growth of from three and one-half to eight inches. The unfertilized trees, in general, made less growth than did the fertilized trees, and the uncultivated than the cultivated. It is noticeable, however, that the Gravensteins which were mulched and fertilized averaged slightly better than those which were cultivated and fertilized. This is, no doubt, due to the partial killing of several of the trees on the cultivated ground. In nearly every case, however, it was the seedling stock which suffered and not the top, though of course the top soon followed. It is also true that the difference in elevation, if any, was in favor of the mulched trees; these being slightly lower, and possibly more moist. Such difference is very slight, however.

In Bulletin 89 the following table was published with the note that: "With a single exception, in which two trees had particularly good advantages, the growth on the mulched areas was less than on corresponding cultivated plats. On cultivated soil there was little increase in growth from the use of either manure or commercial fertilizer; while on the mulched land the growth was noticeably—two to five inches—greater as a result of adding plant food. These facts would indicate that there is enough plant food in the soil to produce a fairly satisfactory growth, if mechanical treatment is such as to render it available, and other plants are not allowed to rob the trees."

Variety.	Treatment.	Growth in inches; unfertilized.	Growth in inches; stable manure.	Growth in inches; commercial fertilizer.
Gravenstein ...	Cultivated......	7½–9⅔ (12 trees)	7 –8 (8 trees)	8½–9 (7 trees)
	Mulched.......	5½–7½ (9 trees)	7 –8½ (6 trees)	10-12 (2 trees)*
Tolman	Cultivated......	....	6⅔–8⅓ (6 trees)	7 –8½ (6 trees)
	Mulched........	2⅔–4⅓ (3 trees)	6½–8⅓ (6 trees)	5 –6½ (5 trees)

* These trees were in a slight depression and next to the cultivated area.

The record of succeeding years has justified the statement there made. For several years the unfertilized trees held their place both as to growth and as to yield, but during recent years the need of additional plant food has been manifest, even on the cultivated areas. The average growth of the same trees for the past two years has been as follows:

Variety.	Treatment.	Growth in inches; unfertilized.		Growth in inches; stable manure.		Growth in inches; commercial fertilizer.	
		1904.	1905.	1904.	1905.	1904.	1905.
Gravenstein...	Cultivated....	3 –4¾	3½–5	4 –5½	4 –6	3⅔–5⅓	4½–6½
	Mulched......	3⅔ –5½	2¼–4	5½ 7½	7 –9	2½ 4	3½–6
Tolman	Cultivated....	....	....	5¼ - 6¼	6½–8¼	3 –4½	5 –7
	Mulched......	3⅓–5	2 –4	4¼–6	4¼ - 6¼	3 –5	3 –5

These figures, when compared with the preceding table, indicate a decided falling off in the growth of the unfertilized trees, especially in the uncultivated plat. On the fertilized plats a part of this falling off in wood growth is of course due to the fact of the annual crops of fruit which have been produced. This reason is less applicable to the unfertilized trees, as they have borne less regularly. The low average growth of Gravenstein on the cultivated area as compared with the mulched trees, is due to the injury to some of the trees, as before mentioned. In the absence of injury, which was an individual matter, the cultivated trees made a larger growth than the others, as may be seen by referring to the tables on pages 185 and 186.

THE QUESTION OF YIELDS.

In 1902, the first bearing year of this young orchard, the following results—irrespective of fertilizers—were obtained:

Gravenstein—Cultivated, 19 bearing trees, averaging .72 bbl. per tree; mulched, 14 bearing trees, averaging .59 bbl. per tree.

Tolman—Cultivated, 9 bearing trees, averaging .44 bbl. per tree; mulched, 6 bearing trees, averaging .50 bbl. per tree.

In case of the Gravenstein, there was a decided difference both in number of bearing trees and in average yield per tree in favor of cultivation. With the Tolman the difference was less marked.

It is planned to keep an exact record of the yield of each tree in the orchard every year. By accident, however, the records of the Gravensteins were unsatisfactory for a part of the time, and there is given below only the record of the Tolmans.

Cultivation vs. Mulch—Annual Yields.

Number of tree.	1902.	1903.*	1904.	1905.	Remarks.
	CULTIVATED.				
			Bush.	Bush.	
13	Good		3.0	2.0	
14	Good		2.8	6.5	
15	Small		1.0	2.4	
16			0.5	1.9	
17	Medium		1.8	4.0	
18	Medium		2.0	7.0	
19	Small		1.2	2.5	
20	Small		.5	4.8	
21	Full		4.0	5.0	Extra; both tree and fruit.
22	Full				Dead.
23	Small		1.3	7.6	
24	Small		.3	.0	
	Total		18.4	43.7	
	MULCHED.				
53	Small		.8	4.5	
54			.0	0.0	
55			1.2	2.5	
56			3.0	4.2	
57	Small		Full...	Medium	Bellflower.
58			5.0	2.5	
59			1.8	1.7	
60	Medium		1.8	3.0	
61	Medium		2.6	2.2	
62			1.0	3.2	
63	Small		3.5	3.2	
64	Small		1.3	4.0	
	Total		22.0	31.0	

* By an accident the records of 1903 were rendered useless and are omitted. There was a fair crop on most of the trees.

With the exception noted, the above trees are now all in prime bearing condition and yield satisfactory annual crops. In Bulletin 89 the statement was made that, "With Tolman the number of bearing trees is greater by one-half on the cultivated area, but the average yield is slightly less. Most of the fruit on the cultivated area came from four trees; the remaining trees, in most cases, not having half a peck each." The same general ratio existed for the next two years. In 1904 the total yield from eleven trees on the cultivated plat, as shown by the table, was 18.4 bushels, or an average of 1.7 bushels per tree; while on the mulched area, for the same number of trees, the total yield was 22 bushels, or an average of 2 bushels per tree.

In 1905, however, the relative advantage of cultivation becomes evident when it appears that there is a total of 43.7

bushels, or an average of 4 bushels per tree on the cultivated trees, as compared with 31 bushels, or an average of 2.8 bushels per tree where mulching was used.

By reference to the diagram of the orchard, page 135, it may be seen that much better returns have, as a rule, been obtained from those trees upon which stable manure has been used. For example, trees 13, 14, 17, 18, 21 and 22, on the cultivated plat, received stable manure and produced an average of 2.7 bushels per tree in 1904, and 4.9 bushels in 1905; while the others, receiving commercial fertilizers, gave an average of .8 and 3.4 bushels for the two years respectively. On the mulched area similar results followed. Trees 55, 56, 59, 60, 63 and 64, received stable manure and gave an average of 2.1 and 3.1 bushels for the two years; while the other trees, receiving commercial fertilizer, yielded an average of 1.9 and 2.5 for the two years. These facts are given without further comment. Future management of the orchard will of course be governed by the lessons learned.

The Potash Orchard.

The study of the specific influence of different potash salts upon the apple is continued as in former years. The treatment is as detailed in Bulletin 89; but the need of additional nitrogen being evidenced by the growth of the trees, an application of 350 pounds per acre of nitrate of soda, and of about 650 pounds per acre of acid phosphate was made in 1904, besides the usual excessive application of potash salts. The season being very dry, the trees did not profit much by this application and it was repeated in 1905, with marked advantage.

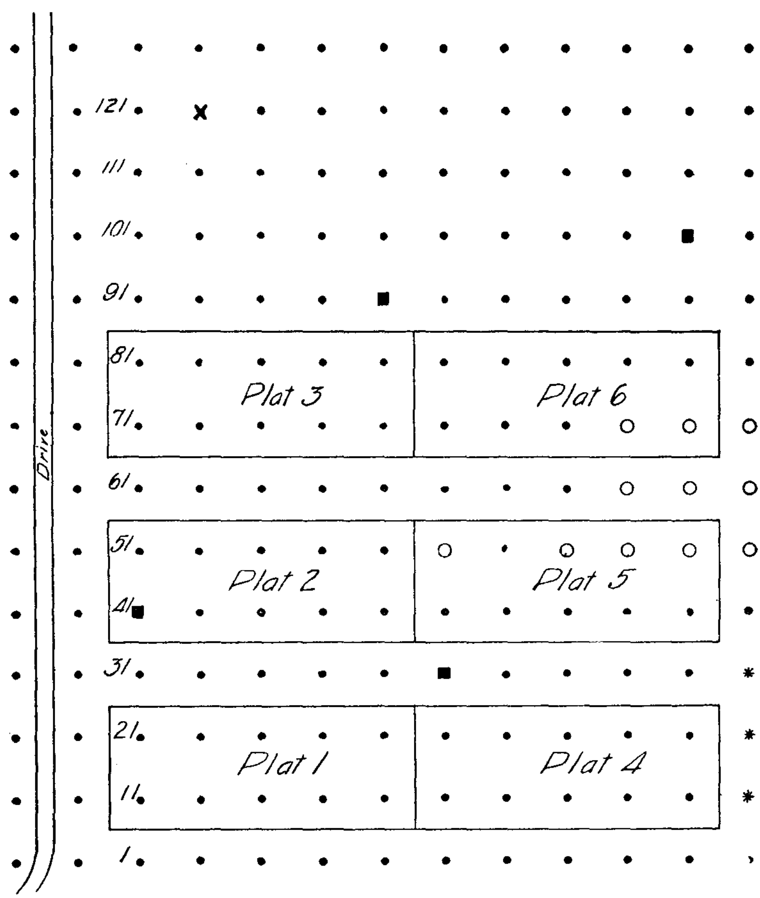
The severe winter of 1904-5 worked serious injury to some of the trees but as a result of the fertilizing and the cultivation given, most of them have started a vigorous new growth, and fruit buds are well developed for next year.

Without going into details at this time, it may be said that there is no noticeable difference in the character of fruit or of the behavior of the trees as a result of the form of potash used. The work will be continued further, however.

Orchard Renovation.

In 1902, because of the manifestly favorable results following the treatment given the orchards above referred to, one hundred trees were set apart for specific experiments in the renovation of an old orchard. The trees in question were about thirty-five years old, planted on the western slope of a dry gravelly hillside. They were divided into six groups, with appropriate check trees, as indicated in the accompanying diagram.

ORCHARD RENOVATION.—DIAGRAM OF THE ORCHARD.



TREATMENT OF THE ORCHARD.

The history of the orchard, as given in Bulletin 89, is as follows: "The soil is a light sandy loam, 6-8 inches deep, with gravelly or sandy subsoil. The trees were set in 1866-70 in a cultivated field which had previously produced corn, wheat, and general farm crops; but after a very few years the orchard was used as a sheep pasture, the trees being frequently mulched while young. No further attention was given the trees, save an occasional slight pruning, until May, 1892, when the whole orchard received an application of bone and muriate of potash. The same summer hogs were turned in, and they thoroughly stirred the soil and started the trees into vigorous growth. A very large crop of fruit was produced in 1893 and again in 1896, but since that date the trees have done practically nothing. Since 1892 the orchard has received no treatment except spraying, until the present year when a portion of it, as indicated in the diagram, was thoroughly tilled and variously fertilized."

The fertilizers used in 1902, 1903 and 1904 were as follows:

Plat 1—Muriate of potash 75 lbs; acid rock 75 lbs; nitrate of soda 50 lbs.

Plat 2—Muriate of potash 75 lbs; acid rock 75 lbs.

Plat 3—Nitrate of soda 50 lbs; acid rock 75 lbs.

Plat 4—Acid rock 75 lbs.

Plat 5—Muriate of potash 75 lbs.

Plat 6—Nitrate of soda 50 lbs.

In 1905 the same materials were used, but only two-thirds the amount of each.

The orchard has been plowed every spring and harrowed at intervals during the summer. The effects of the culture and feeding are evident as far as the orchard can be seen from surrounding hilltops; and the satisfactory annual crops of fruit more than illustrate the practical importance of systematic orchard management.

RESULTS OF TREATMENT.

At the close of the first season's treatment it was stated (see Bulletin 89, p. 19): "As might be expected, the plat receiving a complete fertilizer presented the best appearance at the end of the growing season. The use of nitrogen alone increased the growth to a marked degree (though less than the complete fertilizer) but there was a noticeable lack of color in the fruit. Trees on the plat receiving acid rock alone, in general, seemed no better than the check trees which were cultivated but not fertilized. Potash alone, on the other hand, produced a distinct improvement."

These impressions have been confirmed by the work of succeeding years, particularly as to the effect of the complete fertilizer and the nitrogen. The lack of color upon the fruit from trees receiving an excess of nitrogen is specially noticeable.

In 1904 a very serious injury to both tree and fruit was apparently the result of a too free use of nitrogen, either alone or in the absence of potash. The foliage dropped, the fruit cracked, and much of it dropped, while the remainder was as soft and mealy in October as it should have been the following May. This is referred to in another connection.

YIELD OF FRUIT—RENOVATED ORCHARD.

Since the first year of treatment, this orchard has made a good growth and has yielded annual returns of fruit. Not every tree has borne every year, for there is a decided individuality among trees given precisely the same treatment; but from the record of fruiting given below it is evident that the so-called "off year" in case of the Baldwin is an unnecessary condition,—a condition which the up-to-date orchardist will not permit to exist.

Without attempting to draw conclusions, at present, there are certain interesting facts brought out by the tables on pages 146 and 147. The best general results are seen to follow on plat 1, complete fertilizer; but there are notably good individual trees upon the other plats (see figure 10) and among the check trees. Taking at random some of the trees in the orchard, it will be seen that tree 11 in 1903 produced 4.5 barrels of fruit; in 1904, 1 barrel; in 1905, 2.8 barrels. Tree 25 produced 8.5, 4, and 5.8 barrels for the three years respectively. Tree 53 gave 5, 2.7 and 3.3 barrels, and so on. On the other hand, tree 43 has a record for the three years of 0, .7 and 0. Tree 75 is gradually improving, the record for the three years being 0, .8 and 1 barrel, respectively.

The check trees adjoining plats III and VI are noticeably productive; which fact may be due to sending their roots across into the adjacent plats.

Certain of the trees have been indicated as being of specially good type; these are watched from year to year to see if the character is permanent. If so, these trees become specially valuable as a source from which to obtain cions in top-working a young orchard.

These notes are to be regarded more as a report of progress than as data from which to draw definite conclusions.

Orchard Renovation—Annual Yield.

Plat and number of tree.	Yield per Tree, in Barrels.			Remarks.
	1903.	1904.	1905.	
Plat I. Tree No.				
11	4.5	1.0	2.8	
12	3.5	0.0	2.6	
13	3.5	3.3	2.4	
14	2.0	3.0	3.4	
15	6.5	1.7	3.0	
21	3.0	2.8	1.9	
22	3.0	6.0	1.0	
23	4.0	1.6	3.2*	* Extra good fruit, 1905.
24	.5	3.0	.6	
25	8.5	4.0*	4.8*	* Extra good fruit.
Check Row Tree No.				
31	3.5	6.1	.1	
32	5.0	3.9	2.1	
33	1.5	2.0*	2.1	* Extra good type.
34	1.5	4.2	0.0	
35	1.5	1.7*	1.5	* Extra good type.
Plat II. Tree No.				
41	....	....	....	Vacant.
42	3.0	8.7	0.0	
43	0.0	2.5	0.0	
44	3.5	4.1	0.0	
45	1.0	5.4	1.2	
51	4.5	5.9*	2.4*	* Extra good type of fruit.
52	1.0	3.4	0.0	
53	5.0	2.7*	3.3	* Extra good type.
54	.5	4.7	0.0	
55	.5	3.7	.1	
Check Row Tree No.				
61	....	1.5	0.0	
62	2.5	3.8	0.0	
63	1.0	4.5	.1	
64	1.0	6.4	0.0	
65	2.0	4.0	0.0	
Plat III. Tree No.				
71	5.5	.4 †	2.1	
72	6.6	.0 †	3.4	
73	1.5	.4 †	1.7	
74	1.0	1.5 †	.5	
75	0.0	.8 †	1.0	
81	6.0	2.9 †	1.5	† Nearly all the fruit on this plat dropped early, in 1904, remainder was soft and worthless as in April or May.
82	2.5	1.0 †	3.2	
83	3.5	1.5 †	2.6	
84	4.0	.9 †	4.8	
85	4.0	1.1 †	4.1	
Check Row Tree No.				
91	....	3.5	.6	
92	....	1.8	.5	
93	....	3.0	2.3	
94	....	5.4	3.6	
95	....	4.1	....	

Orchard Renovation—Annual Yield—Concluded.

Plat and number of tree.	Yield per Tree, in Barrels.			Remarks.
	1903.	1904.	1905.	
Plat IV. Tree No.				
16	1.5	1.3	1.0	
17	2.0	6.5*	.5	* Extra good type.
18	.0	.4	.9	
19	0.0	2.5	.7	
20	7.0	5.8*	1.3	* Extra good type.
26	.0	2.5	.1	
27	1.5	5.0	1.9	
28	.0	3.7	.4	
29	.0	5.1	2.3	
30	4.0	2.4	3.4	
Check Row Tree No.				
36	....	....	....	Vacant.
37	.0	5.0	.2	
38	.0	2.4	1.0	
39	.0	5.8	.3	
40	.0	.4	.1	Almost dead.
Plat V. Tree No.				
46	2.0	4.2	.0	
47	5.0	5.8	3.4	
48	.0	2.2	1.6	
49	.0	2.5	1.2	
50	.0	1.8	1.0	
56	....	....	....	Gravenstein.
57	.0	.0	.9	Tree broken; only one limb, extra fine fruit.
58	....	....	....	Gravenstein.
59	....	....	....	Gravenstein.
60	....	....	....	Gravenstein.
Check Row Tree No.				
66	1.5	2.4	1.6	
67	2.0	2.3	.8	
68	2.5	1.3	.2	
69	....	....	....	Gravenstein.
70	....	....	....	Gravenstein.
Plat VI. Tree No.				
76	3.0	1.0	1.0	
77	6.5	0.0	1.3	
78	.0	.0	.1	
79	....	....	....	Gravenstein.
80	....	....	....	Gravenstein.
86	3.0	.7 †	1.6*	* Also .8 bbl. Starkey on portion of tree.
87	4.0	.0 †	2.8	
88	3.5	2.8 †	3.5	† Condition of this fruit similar to that of plat 3.
89	.0	1.1 †	.5	
90	1.0	3.2 †	.9	
Check Row Tree No.				
96	....	7.0	.0	
97	....	2.6	1.0	
98	....	3.4*	2.0	* Extra good fruit.
99	....	.5	1.0	
100	....	4.2	1.1	

The Fisher Formula.

In response to a demand for definite information as to the merits of a highly nitrogenous fertilizer made after what is known as the "Fisher formula," and used quite extensively in some parts of the State, a comparison of this fertilizer with one commonly recommended by the writer for orchard purposes has been undertaken.

Briefly stated, the Fisher formula—so called because first suggested by Dr. Fisher of Massachusetts—is composed of about 8.6 per cent nitrogen, 3.3 per cent phosphoric acid and 11.9 per cent of potash, being made up as follows: Nitrate of soda, 350 lbs; sulphate of ammonia, 150 lbs; sulphate of potash, 230 lbs; acid phosphate, 200 lbs; kieserite, 50 lbs. "All to be thoroughly mixed and sown on the surface under the tree out a little further than the limbs extend, at the rate of ten pounds to a meduim sized tree, from the first to the tenth of May, or as soon as the blossom buds begin to open."

Unquestionably this fertilizer produces a most vigorous growth, resulting in large, though not always well colored fruit, and on uncultivated land it is regarded with favor by many growers. For use in connection with the thorough cultivation now recommended, however, the percentage of nitrogen is too high for the best results.

The Station formula contains about 3 per cent nitrogen, 5½ per cent phosphoric acid and 8 per cent potash, being made up as follows: 200 lbs nitrate of soda; 75 lbs sulphate of ammonia; 225 lbs muriate of potash; 500 lbs acid phosphate.

The cost of this fertilizer is about $16 per 1,000 pounds; that of Fisher fertilizer about $21 per 1,000 pounds for the materials alone.

Twenty Baldwin and five Tolman trees are being used for the specific test of each of these formulas. The Baldwins are kept under cultivation; the Tolmans are in sod. The work has been in progress for two seasons, which time is of course not sufficient to warrant conclusions. It may be said, however, that both lots of trees have responded freely to the treatment, and yielded a good crop of fruit this year. The Baldwins were in an exhausted condition when the work was commenced, but all are now making a remarkably strong, vigorous growth, and promise well. It should be said, however, that as in the experiments first mentioned, the stirring of the soil, and the decay of the turf in case of the cultivated trees, obscures any specific difference in the relative merits of the two formulas up to the present time.

The following diagrams represent the orchards now under observation:

FISHER FORMULA—DIAGRAM OF BALDWIN ORCHARD.

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	21	32
⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙
33	34	35	36	37	38	39	40
⊙	⊙	⊙	⊙	⊙	⊙	⊙	⊙

FISHER FORMULA—DIAGRAM OF TOLMAN ORCHARD.

1	2	3	4	5	6	7
•	•	•	□	□	⊙	•
8	9	10	11	12	13	14
•	•	•	⊙	□	⊙	•
15	16	17	18	19	20	21
×	•	•	•	□	⊙	•

EXPLANATION OF DIAGRAM. □—Station formula; ⊙—Fisher formula; •—untreated tree; ×—vacancy.

THE TOP-WORKING OF ORCHARDS.

The experiments here noted include the relative value of cions from bearing trees of known value as compared with cions from miscellaneous sources; the actual commercial advantage, if any, of changing vigorous trees from Ben Davis to Baldwin, Sutton, Spitzenburg, or Jonathan; and incidentally the question as to the value of Ben Davis as a stock for top-working.

PLAN OF WORK.

Adjacent trees (three of each) were top-grafted April 8, 1904, with cions from nursery trees and from bearing trees, as shown by the map on page 151. The "nursery cions" were obtained from H. S. Wiley, Cayuga, N. Y.; the "fruiting tree cions," from Geo. T. Powell, Ghent, N. Y. (except Baldwin which were from Mr. Pope's orchard). As a check upon this work, and to see if it really pays to top-work a young orchard of this kind, four of the original Ben Davis trees are left (Nos. 7, 8, 26 and 27). These are to be pruned and cared for the same as the top-worked trees.

HISTORY AND CONDITIONS OF THE ORCHARD.

The orchard was set (two-year-old trees) in May, 1890. The trees were cultivated the first year. After that, however, they were left in sod and hay was cut every year until 1902 when hogs were turned in for one season. No treatment of any kind was given in 1903, and a good crop of fruit was produced. Trees made an excellent growth in 1902 and 1903, and the north half of the orchard is in good condition. About the middle of the plat the water has stood some in winter and trees have suffered.

With the exception of tree No. 14, the trees which were top-worked in 1904 were in good vigorous condition.

1904. Orchard plowed and cultivated during summer. Five hundred pounds of fertilizer analyzing about 3 per cent nitrogen, 6 per cent phosphoric acid, and 8 per cent potash. Photographs made at time of grafting.

1905. Treatment of previous year repeated. Superb growth,—15 to 24 inches. Photographs made October 23.

Naturally conclusions are not yet drawn from this work.

DIAGRAM OF TOP-WORKED ORCHARD.

39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57
●	●	●	●	O	O	O	●	●	●	●	●	●	●	●	●	●	●	●
20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
●	●	●	⊙	⊙	⊙	●	●	□	□	□	*	*	*	●	●	●	●	●
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
●	●	⊙	⊙	*	⊙	●	●	□	□	□	*	*	*	●	×	●	●	●

EXPLANATION OF DIAGRAM: The significance of the characters in the above diagram is as follows: ●—Ben Davis, original trees; ⊙—Baldwin; ■—Sutton; *—Jonathan; O—Spitzenburg; ×—vacancy.

All cions used in the first row were from nursery trees; all cions in the second row from bearing trees. The Spitzenburg cions in third row, from bearing trees

Keeping Qualities as Affected by Culture.

The influence of cultivation in an orchard, as affecting the keeping quality of the fruit, is a question of perennial interest. The Station has no facilities for conducting a satisfactory inquiry in this direction, but as bearing upon the subject several barrels of fruit were set aside in the winter of 1904-5 in Mr. Pope's cellar, and were left until some time after the usual season for marketing. While conclusions can not be drawn from this test, certain indications may be suggestive.

For the trial three barrels of Tolmans and four barrels of Baldwins were set aside. Of the Tolmans, one barrel each from sod and from cultivated land were taken, and one barrel was divided between the two. Of the Baldwins, two barrels were from trees in sod and two from adjacent cultivated trees. The fruit was sorted as for commercial purposes and the barrels were headed up and set in a very cool cellar, in a temperature of 35 to 40 degrees Fahrenheit.

On April 7 the Tolmans were examined and showed signs of breaking down. They were accordingly assorted and a record made of their condition. At this time the Baldwins showed no sign of breaking down, and they were left until May 10 before assorting. In each case the fruit was divided into three classes: (1) that which was perfectly sound; (2) slightly decayed, or "specked," including that form of breaking down commonly called "scalding;" (3) decayed or worthless fruit. The following table represents the exact condition of the fruit at the times indicated:

Variety.	Number fruits sound.	Number fruits specked.	Number fruits decayed.	Total number fruits.	Per cent sound.	Remarks.
Tolman						
No. 1 (sod)........	344	102	48	494	69.6	Free from scald and of better color than
No. 2 (sod).......	164	27	21	212	77.4	cultivated fruit—often with blush.
No. 3 (cultivated)	314	140	27	481	65.3	A little scald.
No. 4 (cultivated)	222	45	15	282	78.7	Much scald.
Baldwin						
No. 1 (sod)........	655	83	14	752	87.1	Sod grown fruit scalded worse than the
No. 2 (sod)........	507	196	25	758	66.9	other but was of better color.
No. 3 (cultivated)	438	125	120	683	64.1	
No. 4 (cultivated)	361	183	51	595	60.7	

These figures seem to contradict, or at least to cast doubt upon the statement frequently made by some of the best writers upon fruit growing, viz.: "Apples grown in sod attain a higher color and keep longer than those grown under clean culture."

There is no uniformity in the results shown. For instance, of the Tolmans the barrel from sod land gave 69.6 per cent of sound fruit at the end of six months; while the corresponding barrel from cultivated land gave 65.3 per cent—a difference of only 20 apples in the barrel, and the actual number of worthless fruits was nearly double from the sod grown tree. Where the fruit was in the same barrel (numbers 2 and 4 of Tolman), the difference was 1.3 per cent in favor of the cultivated fruit. Of the Baldwins, one barrel was decidedly better than all of the others, and both barrels from sod land gave a higher percentage than did those from cultivated land; but the difference between number 2 and numbers 3 and 4 was not greater than might be expected from fruit grown under the same conditions. Indeed not so great as the difference between numbers 1 and 2.

The color of the fruit grown on sod was usually better than that from the cultivated trees; but the size of the other fruit was greater. In order to be of permanent value these tests should be made under the best conditions for a series of years, and with a wide range of varieties.

Cover Crops.

While no data are to be reported at this time, the importance of a winter cover for orchard lands that are given clean culture during the summer should not be overlooked. In brief, the practice followed by the writer is to plow the orchard in May, cultivate freely and frequently until about the first to the tenth of August and at the last cultivation seed the ground with some crop which shall make an effective cover through the winter and during the period of freezing and thawing, the following spring.

ADVANTAGES OF A COVER CROP.

The advantages following the use of a cover crop may be summarized as follows:

(1) The cover crop utilizes soluble fertilizers which would otherwise be wasted, and prevents washing of the land.

(2) Adds humus to the soil.

(3) Protects roots during winter, and holds the snow.

(4) Helps to dry out the soil in spring, thus permitting earlier working of the land.

(5) In some cases adds directly to the store of nitrogen in the soil,—as when leguminous crops are used.

(6) Growth of trees late in the season is checked.

KIND OF COVER CROP.

What to sow for a cover crop depends largely upon soil and location. On good strong land, which is not specially in need of additional nitrogen, winter rye has proved the most satisfactory of anything tried at the Station. It germinates quickly, and even in cold seasons, when frosts come early, will form a very satisfactory mat before winter. On "thin" soils, however, rye does not stool freely and fails to make a good cover. Such soils also are usually in need of more nitrogen and will be benefited by the use of some leguminous crop like the vetches or mammoth clover. The ideal cover crop on such soils is winter vetch (*Vicia villosa*), sown as early as July 15. Within six weeks this plant develops nitrogen accumulating nodules and contributes directly to the fertility of the land. It is hardy and usually makes a good growth the following spring before time for plowing.

Spring vetch (*Vicia sativa*), is another nitrogen gathering cover crop which makes a very vigorous growth in the fall, often forming a perfect mat a foot thick, when sown August 1. It is apparently even more efficient than the winter vetch as a nitrogen gatherer, but it does not survive the winter; hence is not as valuable in preventing washing by the spring rains, and does not help dry out the land in spring.

Mammoth clover must be sown as early as July 15 to produce sufficient growth to be of much value. As a rule the vetches are to be preferred.

Other crops used at the Station for this purpose are peas, oats, and these two combined. All things considered, however, the first three mentioned are the most satisfactory.

A WORD OF CAUTION.

While in general the use of a cover crop in cultivated orchards is advantageous, there are cases where, if used injudiciously, it may be actually detrimental. One such case is the use of rye upon a soil naturally dry and gravelly; especially if the crop is left late in spring before plowing under. This treatment may result in so drying the soil as to seriously interfere with the growth of the trees. On soils of the nature indicated, spring vetch or oats are always to be preferred unless the land is to be plowed promptly in the spring.

ORCHARD WORK AT NEW GLOUCESTER.

For the purpose of emphasizing the importance of rational treatment of orchard lands in other sections of the State, arrangements have been made with Mr. John W. True and Mr. Fred H. Chandler of New Gloucester to carry on certain coöperative experiments in the planting and management of orchards.

The work in Mr. True's orchard includes the use of cover crops and a comparison of the Fisher formula with the Station formula and with stable manure. For the latter work an orchard of Baldwins, set about 20 years and sadly in need of pruning, was selected. The orchard was pruned and plowed, and fertilizers were applied as follows: 4 rows were given stable manure; 5 rows Station fertilizer; 4 rows Fisher fertilizer; with a check row between each two plats. For the study of cover crops, a two-acre orchard of Ben Davis and a one-acre orchard of Sutton, both just coming into bearing, are available. The crops thus far used are rye and winter vetch, but of course only a report of progress can as yet be made concerning either line of work indicated.

The work in Mr. Chandler's orchard contemplates a study of different methods of orchard treatment and some of the problems connected with the top-grafting of orchards. About eight acres of rolling land, in plain sight from the Maine Central Railroad station at New Gloucester, were fitted and planted to various trees in the spring of 1905. The land is mostly a strong loam, with heavier subsoil, and had been in hay for several years. The ground was plowed the first week in May and, after harrowing, the trees were set two rods apart each way. Between the first five rows, and alternating with the trees in those rows, (thus making a "quincunx" planting) "fillers" of Wealthy were planted. In 1906 the planting of "fillers" will be extended. Strong two-year-old trees of the following varieties were used:

Northern Spy, Ben Davis, Tolman, and Wealthy. Most of these, except the Wealthy "fillers," will eventually be top-grafted to Baldwin.

Careful maps and records have been made and reports of progress will be made later. During the past season the orchard between the trees was planted to corn, peas and potatoes. It is designed to keep the greater part of the orchard under cultivation each year.

STRAWBERRY CROWN GIRDLER. *Otiorhynchus ovatus,* Linn.

EDITH M. PATCH.

More than a little annoyance has been caused in the State by the strawberry crown girdler, a small, black, snout beetle, noticed in some localities especially for its habit of crowding into the house.

It was the protests of tried housekeepers that drew attention to the beetle last season. "We have been overrun with these hateful pests." "I killed more than 400 one evening in the front room." "They travel all over the house and crawl from baseboard to ceiling only to drop to the carpet and try it over and over again. They hide under any protection, carpet, clothing, bedding, and are a general nuisance." Such reports came from Maysville Center, Houlton, Monson, North Wayne and Caribou during September, June and August. They seemed worthy of some attention and this season observations of the strawberry crown girdler were made with reference to the habit of crowding into houses, habits of larva and adult, and remedial or protective measures.

The beetles in the house with reference to their out-of-door habits. The troublesome habit this beetle has of crowding into the house and getting into the way makes it an objectionable insect, although it does no real harm indoors. It feeds upon plants and is therefore, unlike the larder and carpet beetles, interested neither in the food supply of the household nor in clothing and carpets. For the past two years the beetles have occurred in great numbers about the first of June, lasting through that month, and have appeared again in August and September. The house which seems to be troubled most at North Wayne was built in 1822, and as might be expected had crevices near the foundation which offer attractions for insects in search of a hiding place. The beetles were most numerous in the front room into which they crept through cracks near the base boards, though they entered the house also at the doorway under the screen. If they were content to be quiet after once finding a hiding place, their presence would be less objectionable, often unsuspected indeed, but their exasperating persistence in "climbing over everything only to drop into everything else" as one housekeeper complained, entitles them to the rank of household pests.

The house at North Wayne was not visited until June 27, 1905, and at this time the beetles were not numerous enough to give sufficient data as to the relation of their house infesting habits to their out-of-door movements. Farther north, however, near Houlton July 5, ample opportunity for observation was afforded. A day's search was made for the adult beetles out of doors. They were not found hiding under planks, stones or other objects in damp places, but in dry soil they were frequently dug up from among the roots of plants. Some of these were newly transformed from the pupal condition and would naturally be found under the surface where the larval period was passed, but others were well hardened specimens which seemed to have sought the roots from above ground, very likely for the deposition of eggs.

Toward the top of a hill along a hot, dusty road more of the beetles were found during the day than elsewhere. The road was bordered by white clover, which may have been significant, for larvæ of the beetles were found at the roots of this plant. The puzzling thing about the beetles here was the fact that they (ordinarily more active during the evening) were wandering restlessly across the road at mid day, under a scorching sun which they were evidently glad to avoid, for every time a leaf or chip was placed near these wanderers they crept underneath and remained there. The question why, if they wanted shelter, they had not apparently found it before midday, was unsolved until a horse and carriage passed, scattering dry layers of clay with which the road was well supplied at this place. Then disturbed beetles were seen everywhere poking out from crumbled clay bits and walking off in search of another nook in which to finish their nap. More than 200 beetles were captured easily after this disturbance before they had found satisfactory hiding places. Except when the beetles were moving it was difficult to see them, for though they are black they were too thoroughly dust covered to be detected readily in the roadway.

Toward dusk the hill top road was again visited and this time the beetles were more numerous and more interested in their journey, for they had voluntarily quitted shelter, and were out for purposes of their own. Before dark, beetles were seen everywhere along places where they had been sought in vain during the day; fence rails, piles of sun heated stones, tree trunks, sides of sheds, came in for their share of the active beetles as well as doorway and window sill by which the creatures were entering the house.

These out-of-door observations lead logically enough, it seems, to the conclusion that the house seeking habit of the strawberry crown girdler is merely an incident in the general trend of the movement of this beetle,—perhaps accident would be a more appropriate term from the beetle's standpoint for the house proves a gigantic trap from which the beetles, in spite of restless and persistent climbing, find no means of egress. Like the old fashioned wire fly traps, the house is easier to enter from the foundation than to get out of at the ceiling. The beetles desire a dry shelter and find a building as acceptable as a clump of clay,—until they try to get out.

The restless wanderings of these beetles in and out of the house is probably a necessary impulse for the spread of the species for, unlike many insects, they are incapable of flight and are doomed to walk the earth if the succeeding generations are to find new feeding grounds.

It may not be entirely without interest to question whether the presence of these beetles in houses is augmented by lights as is frequently the case with insects most active at night. At North Wayne the room most troubled was the closed front room where no lights were taken during the evening except for a little while to collect the beetles. Yet in one evening over 400 were killed in this room.

The foregoing discussion has a bearing upon two characteristics commonly accredited this beetle. It is spoken of as "gregarious," and its entrance into houses has been explained as "hibernating."

Certainly these beetles were not observed to show gregarious instincts in the sense of seeking the companionship of others of their kind, but wandered about quite indifferent to the direction or destination of their kindred. Of course in places of concentrated local infestation many beetles independently happen upon the same shelter.

If the beetles were found in houses only in the fall their presence might seem a hibernation, but in Maine there are two times when they appear most abundantly,—during June and in August and September, and the June lot are as troublesome in the house as the fall beetles. These two marked periods might seem to indicate two annual broods, but it is difficult to obtain dependable evidence with an insect which is to be found as adults, pupæ and larvæ of various sizes, from early June until fall, as is the case with this beetle in Maine.

Feeding habits of larvæ. At North Wayne, late in June, a day was spent in search of larvæ of the strawberry crown girdler. Close to the foundation of the house near the room most troubled by the adults, the roots of a grass, *Poa cerotine,* were found to be freely infested by nearly grown larvæ, and this grass had doubtless supplied a fair proportion of the troublesome beetles. A few pupæ and some newly developed adults, still brown in color, were found among the roots with the larvæ. The main seat of action, however, seemed to be the strawberry bed. The weather had been wet and cold for some time, but in spite of that there were conspicuous wilty places in the bed, here and there. The strawberry plants in these spots could be lifted from the ground with the slightest pull, for their roots were eaten through at a distance of two or three inches from the crown. The appropriateness of the popular name of this beetle was thus approved for the strawberry crowns in this bed were certainly " girdled."

A space containing three square feet was selected at random from one of the wilted places in the bed. More than 200 nearly grown grubs, pupæ, and freshly developed adults of the girdler were found about the strawberry roots in this space, besides which there were one young cut worm and four Lachnosterna grubs under half size. How many more there would have been if eight fat predaceous ground beetles had not been skirmishing through these three square feet of infested soil is a question, depending for its solution upon the capacity of the beetles. It was not surprising to learn, one month later (July 28) that this strawberry bed was more than half dead.

Near Houlton on the place where the beetles were most annoying there was no strawberry bed, and a day was spent examining the roots of meadow plants, July 6, 1905. Larvæ and pupæ of the girdler were found at the roots of wild strawberry, Timothy grass, June grass and white clover. Large potato fields were close at hand, but no signs of the crown girdler were found about potato vines which were dug up in various places in the field.

Feeding experiments with adult beetles. Several hundred beetles taken near Houlton early in July were brought to the laboratory for the purpose of testing the range of their food plants. These were confined for three days at a time in bottles containing perfect leaves. The following list records such leaves (or flowers as indicated) as were found to be eaten to a greater or less extent during this time: Apple, cauliflower, red clover (blossom), red clover, woodbine, Tartarian honeysuckle, turnip, radish, white clover (blossom), white clover, rose (petal), oak, dandelion, lettuce, maple leaf, lawn grass, sorrel, timothy grass, basswood, raspberry, mulberry, spirea, currant, strawberry, rose, plantain, celery, mountain ash, Roman wormwood, rhubarb, bean, nasturtium, wolf weed, nightshade, box elder, thistle, cottonwood, elm, geranium, flowering currant, dahlia, syringa, peony, blackberry, fall dandelion, asparagus, horse radish, pea, chickweed, wild cherry, gooseberry, birch, iris, willow, "self heal."

While it is probable that beetles placed in confinement would eat some leaves which in the open they would avoid for other food, still the foregoing test bears out the reputation of this insect as a general feeder.

REMEDIAL MEASURES.

Arsenate of lead. Two experiments were made with elm leaves (a favorite diet of the girdler) dipped in arsenate of lead, mixed at the rate of 4 pounds to 50 gallons of water. For the first, 42 well fed beetles were confined with a few poisoned leaves for two days, when 18 were dead and 24 still alive. For the second test 40 beetles were kept without food for 7 days and then confined for 36 hours with poisoned elm leaves. At the end of this time 32 beetles were dead and 8 alive. These tests, especially the second, were arbitrary and unfair with respect to normal out-of-doors conditions because ordinarily the beetles would not be so hungry and there would be unsprayed food within traveling distance. The only significant fact concerned is if they eat sprayed plants they die. In this connection the experience in Montana * with new strawberry plants dipped in arsenate of lead is exceedingly interesting. It was found in that instance that the beetles avoided the sprayed leaves and began to feed upon the roots of the strawberry.

In view of the great range of food plants accepted by the adult beetles there seems little help to be expected from the application of poison except as it might serve to a certain extent as a protection of valuable plants by causing the beetle to shun them. Mr. R. A. Cooley * concluded that where adult beetles attacked the leaves badly, spraying was better than no treatment and was worth the cost and trouble incurred. The injury to strawberry beds in Maine, however, has been (so far as known) by the grubs alone, working at the roots, and thus spraying, here, would be of no avail.

Cultural means. The fact that grubs (larvæ) of the crown girdler were found during the past season at the roots of grasses, white clover, and wild strawberry merely confirms the evidence of other observers that the larva of this insect finds its natural food in roots of grasses and other meadow plants. Young strawberries set out on newly broken ground already infested with these grubs would of necessity be seriously attacked.

Mr. R. A. Cooley says * in this connection, "The remedial measure that seems to promise most is so managing the soil that when it is desired to set out the field to strawberries the beetles will have been previously starved out." He also cites the case of a Montana fruit grower who was so troubled by this insect that he abandoned strawberry growing entirely some years ago, using the land for other crops. Strawberry plants were started on this same place in the summer of 1904 and were not troubled at all by these beetles.

This method is in accordance with preventive means commonly acepted as the only practical way of combating other underground enemies, such as the white grub and the wire worm.

No extended tests have been made in Maine as to what crops would be best adapted for this purpose. At Houlton, however,

* Montana Agr. Exp. Sta., Bul. 55.

favorable opportunities for an observation were offered. Potato fields were at hand on newly broken ground adjoining meadows freely infested with grubs of the crown girdler. In two of these fields, the roots of potato vines variously situated were examined and in no case were larvæ of the crown girdler found. This, of course, is no positive indication that potato vines are never attacked by this insect, but the situation of the potato field was exactly such as would have proven the worst possible condition for a strawberry bed; and the apparent freedom of the field from the grubs certainly seems significant.

In localities where the strawberry crown girdler is present to any marked extent, it would be unsafe to set strawberry plants in newly broken land. Some less susceptible crop (the potato would probably serve) should be used first, and the soil so thoroughly cultivated that grass or other weeds cannot remain as a bait for the beetles, or food for such larvæ as chance to be already in the ground.

Repellents. As most of the complaints against this beetle in Maine were concerned with its entrance to houses, a few tests were made to see if camphor gum could be used successfully as a repellent to be placed at cracks about baseboards or windows. Between 30 and 40 beetles were placed in a space 6 inches in diameter surrounded by a circle of powdered camphor gum piled about an inch high. The beetles seemed neither stunned nor excited, but walked about in the space and climbed over the camphor apparently indifferently for quarter of an hour when the beetles were taken and buried under a mound of the camphor gum and left for nearly two hours. Shortly after the camphor was removed, the beetles deliberately stalked off, to all appearances as well as ever. The experiment was repeated with flowers of sulphur with precisely the same results.

At Maysville Center where the beetles in troublesome numbers were entering a house under the baseboard, a liberal application of fresh pyrethrum powder was recommended. The report came "They do not seem affected one bit by insect powder. They walk right through it and do not mind it at all."

Probably all that can be done to guard against an invasion of the house is to stop the cracks with putty as far as possible and then philosophically to regard these beetles that get in as really harmless. It may be, too, that the beetles will not occur for many years in succession in such large numbers in the places of worst infestation. At North Wayne about 18 years ago there was an outbreak of the same pest which overran the house for two or three seasons, after which the trouble disappeared, not to come again in conspicuous numbers until the last few years. What natural agencies controlled the situation are quite a matter for surmise.

SUMMARY.

Out of doors. The strawberry crown girdler in the larval or grub stage feeds upon the roots of grasses and some other plants. Strawberries are especially susceptible to attack and should not be set in, or very near, soil infested by these grubs. The only known practical remedy is clean cultivation. The adult beetles feed upon the leaves of the strawberry and many other plants, and when they are numerous enough to cause much injury, arsenate of lead should be used as a spray.

In the house. The presence of great numbers of the beetles in the house is annoying but need cause no real alarm, for they are bent upon no mischief either to persons, clothing or food supplies. Ordinary repellants seem to be of no avail, and probably all that can be done to guard against them is to make the house as tight and beetle proof as possible. With this precaution such beetles as can not be conveniently swept or gathered up, can be tolerated as harmless and transient guests.

INSECTS OF THE YEAR.

EDITH M. PATCH.

Tussock moth. Cocoons of two species of tussock moth, *Notolophus leucostigma* and *N. antiqua,* were received in such numbers during the present year that it is simpler to give them single mention than to list each specimen sent for identification. Most of these cocoons were accompanied by the question "Is this the nest of the brown-tail moth?" In order that further confusion may be avoided to some extent at least, figures 14 and 15 are presented with this comment: The winter nests of the brown-tail moth contain many tiny caterpillars, while the cocoons of the tussock moth are empty during the winter and those from which the females have emerged are covered by a mass of whitish eggs. These egg clusters should be collected and burned.

Red-humped caterpillars. There were also too many of the red-humped caterpillars, *Œdemasia concinna,* to list in the accompanying table. Between July 29 and October 28, 1905, 81 lots of these caterpillars were received for identification. As only 11 came last year, these insects seem to be on the increase at present. They undoubtedly did great damage in the State this season. Many orchardists reported that entire orchards of young trees were stripped of their foliage, except for the mid ribs of the leaves, before the presence of the pest had been discovered. They are not especially difficult to combat as the broods are gregarious and if found while the caterpillars are young the whole colony can usually be removed with ease. The fact that they come late in the season makes their attacks a surprise oftentimes. Arsenical sprays will kill them, but the presence of ripe fruit sometimes debars the use of poison. There is no difficulty in recognizing this peculiar caterpillar by its red head and conspicuous red band about the body a short distance behind the head. See figure 16.

The yellow-necked caterpillar, *Datana ministra,* seems also to be increasing in this State. During August this species vied with the preceding in troubling orchardists. Means of combating these two species are identical. See figure 19.

Tent caterpillars. The unsightly webs of the tent caterpillar, *Clisiocampa americana,* which had not been numerous for several seasons, were present to a troublesome extent all over the State this spring.

Stalk borer. In July and August the stalk borer, *Papaipema nitela,* caused complaint from several localities. The destruction of a crop of sweet corn for two seasons was charged to its account near Gardiner. From Westbrook five specimens of this caterpillar were received with the report: "This pest is destroying my rasperry, blackberry, currant, and gooseberry bushes, corn and dahlia stalks, potato vines and many other kinds of plants, by boring a hole into the plant, usually near the ground but sometimes as many as 30 inches above the surface of the ground, and then eating its way, usually up but sometimes down, until the plant is destroyed."

Cherry tortrix. An interesting communication from North Newry late in June gave a description of a "yellowish worm one and a quarter inches long, present by thousand in the grass in the meadow." The owner of the meadow feared a "new grass pest." When specimens were asked for, a mass of grass was sent which was webbed solidly together, and writhing with larvæ of the cherry tortrix, *Cacœcia cerasivorana.* They were not eating the grass and further inquiry elicited the infomation that they had stripped some wild cherry bushes on the meadow border and then had webbed the grass far into the meadow. About 9 cubic inches of the web was saved and the larvæ pupated, packing it full of pupal cells. On July 10, 119 fresh looking pupæ were counted in this section. During the next few days many moths and a few ichneumons emerged. Brown egg masses were deposited in thin, well varnished layers on the sides of the glass jars and upon leaves, by the imprisoned moths.

Mourning cloak. Larvæ of the mourning cloak butterfly, *Euvanessa antiopa,* were reported in destructive numbers from several localities upon elm, willow and apple. Fully half of the caterpillars received at the Station (about 200) were parasited by tachina flies. See figure 20.

Dotted geometer. Late in the summer larvæ of the chain dotted geometer, *Cingilia catenaria,* were plentiful upon sweet fern, and large swarms of these beautiful, smoky winged moths were common during the cool autumn days and evenings near Orono and Alfred. See figure 17.

Snout beetle. At North Wayne in June an interesting looking bronze gray snout beetle was found in and about a house frequented by the strawberry crown girdler. More of this species were reported from North Wayne during September and one of the specimens was sent Dr. L. O. Howard, chief of the Bureau of Entomology, United States Department of Agriculture, for identification. Dr. Howard kindly replied that the specimen "was identified by Mr. E. A. Schwarz as *Sciaphilus muricatus,* Fab. This species is now referred to *asperatus.* A brief note on its occurrence in Maine with reference to other occurrences in this country is given on p. 272 of vol. VII of Insect Life. It is an introduced species, and some doubt has been expressed by Mr. Schwarz as to its permanent location in this country."

The reference to Insect Life reads as follows:

"During September of the present year a correspondent at Bangor, Me., sent to this office a small lot of European snout beetle, *Sciaphilus asperatus* Bonsd. (*muricatus* Fab.), which has attracted some little attention in that city. Our correspondent informs us that the beetles gather on the fences, and 'getting on the top rail just cluster and keeping still seem to enjoy life.' They have a singular habit of 'piling up on each other in a straight line, many at once and in many small groups.' They were not, however, observed to be copulating. This unusual gathering took place during the first of September and was preparatory to hibernation.

"The first notice of the occurrence of this insect in North America is by Mr. Samuel Henshaw, published in 1888 in Psyche (vol. V, p. 137). The insect was collected at Brookline, Mass., by Mr. F. C. Bowditch, on *Populus balsamifera.* In the Canadian Entomologist (vol. XXIII, pp. 23, 114, 1891) Mr. W. H. Harrington reports this species at Sydney, Cape Breton, Nova Scotia. It was found in 1884 and 1890 and was not uncommon. In the National Museum collection there are also specimens from Malden and one other locality in Massachusetts, and Mr. M. L. Linell informs me that he has taken a specimen near Brooklyn, L. I.

"It will be noticed that although the species was known to have been introduced at least ten years ago, that it is still limited to districts near the seashore. Like other allied wingless species that have been introduced from Europe it will probably not extend its range much farther south, but will move gradually westward from the points where it has now established itself. It is a common European species and is known to feed on a great variety of deciduous trees and shrubs, and though it is impossible to forecast the future it is not probable that it will ever be particularly injurious to cultivated plants in this country.—F. H. C."

As the foregoing account was written some ten years ago, data concerning this season's collection in Maine may be of interest.

On June 20, 1905, a correspondent wrote a vigorous protest against beetles in her house and stated "there are two kinds of bugs, but more of the black than the gray ones." Both kinds were reported to have been very numerous for two years in June and again in the fall. Specimens accompanied the letter and the black ones proved to be the strawberry crown girdler, while the gray ones were the species recently identified by Mr. Schwarz as *Sciaphilus asperatus* Bonsd. (*muricatus* Fab.)

At North Wayne on June 27 seven of this species were collected at dusk climbing the foundation of the house and a few more were taken inside the dwelling.

Between 20 and 30 of these beetles were collected by the North Wayne correspondent September 11, and sent to the Station with the information: "I found all I send on my dahlia blossoms. There are none in the house now but I find them out of doors on 'most everything though not very thick."

It would seem that this imported snout beetle has not yet lost its hold. No other specimens of *Sciaphilus asperatus* are recorded at the Station this season, except a single specimen collected at Orono, August 8, 1905.

Rose chafer. On June 28, the vicinity of North Wayne and Kent's Hill was observed to be invaded by the rose chafer, *Macrodactylus subspinosus.* Willows and alders had been eaten to the greatest extent, though wild blackberry bushes were stripped here and there. The rose bushes did not happen to be attacked badly at that date. One alder clump composed of five stems none of which was six feet high presented a peculiar appearance with every leaf skeletonized and dangling with pairing beetles. From this single clump 1,315 chafers were collected and then the task of clearing the bush was abandoned as hopeless. Twenty leaves were then picked at random and from one to three pairs of chafers were still clinging to each.

About this time specimens of the rose chafer were received from Mt. Vernon with the complaint that some of the orchard trees were covered with them. Several apples about one inch in diameter, accompanying this communication, were tunneled to the core by the chafers which were gorged and sticky with the repast. See figure 21.

A report from West Peru stated that a whole orchard had been stripped. Early in July from East Sumner a correspondent wrote that for three years the rose chafer had done great damage to orchards, berry bushes and gardens, " about ruining everything they touch."

Carpet beetle. Early in June carpet beetles, *Anthrenus scrophularius,* were seen commonly upon rhubarb and horse radish blossoms at Orono. June 9, they seemed especially numerous and a half day's collection was made from one rhubarb bed during which time 156 of these beetles were taken. As they were also on polliniferous flowers which are gathered for house decoration, it is advisable to be on the watch for these beetles in picking flowers in order to make sure that none are carried into the house in this way. The adult beetles are pollen eaters but the young, as is known well enough, are among the most troublesome of household pests.

Flea beetle. About June 6, several species of flea beetles were much in evidence at Orono. The cucumber flea beetle, *Epitrix cucumeris,* had riddled the leaves of potato vines. A striped flea beetle, *Phyllotreta vittata,* was present especially on horse radish, and bronze flea beetles were conspicuous upon rhubarb and other plants.

Wire worms. As the present season brought an unusual number of complaints against wire worms, the following statements in regard to these insects were published as a newspaper bulletin.

Wireworms are slender grubs of yellowish white color and very hard bodies. They are the young (larvæ) of click-beetles, or snapping beetles, so called from the fact that when placed upon their backs they will suddenly bend the body and, with a sharp clicking sound, throw themselves a considerable distance into the air. They are among the most troublesome of crop pests and as they live underground it is difficult to combat them.

At the New York, Cornell, Agricultural Experiment Station, exhaustive experiments covering a period of three years were made for the purpose of testing remedial measures. The statements here made are based largely upon the results of those experiments. Many methods that had previously been recommended for the destruction of these pests were found to be inefficient. To cite but one example: It was found that the wire worms were still alive in soil to which salt enough had been applied to kill the vegetation.

One method, especially approved, was fall plowing. The explanation of the beneficial results that follow fall plowing is believed to be found in the following facts. Wire worms live for at least three years in the worm or larval state. When the worms are full grown they change to soft white pupæ during July. The pupal stage lasts only about three weeks, the insect assuming the adult form in August. But, strange to say, although the adult state is reached at this time, the insect remains in the cell in the ground till the following April or May, nearly a year. This period of quiescence is apparently necessary to the life of the beetle, for in every case where the soil was disturbd after the insects had transformed, the beetles perished. By fall plowing we can destroy the beetles in the soil and thus prevent their depositing eggs the following season. After plowing (at least six inches deep) the soil should be well pulverized and kept stirred so that the earthern cells of the pupæ and adults may be destroyed. It will usually require at least three years to render the soil comparatively free from wire worms, as only the pupæ and adults are killed, the young larvæ remaining uninjured.

Nematode worm. Late in November specimens of diseased gardenia from one of the nurseries in the State were received at this Station. The trouble seemed to be caused neither by insect or fungus attack and the material was sent to the United States Department of Agriculture, Bureau of Plant Industry, for examination. Mr. C. O. Townsend, acting pathologist and physiologist of that bureau, stated the trouble to be due to nematode worms.

Although worms are not insects, the nature of their attack and the remedies applied bring them into a closer relation with work pertaining to insects than any other department of the Station, and a record of this case is included with notes on insects.

As Mr. Townsend's letter is of interest and as the preventive means he recommended apply with equal force to millipedes, concerning which complaints from greenhouses frequently reach the station, the letter is quoted in full:

"The swellings on the roots were caused by the root-knot nematode, *Heterodera radicicola.* These swellings, after the nematodes have reached maturity and laid their eggs, decay and bring about thus the death of the plant. They also reduce the vigor of the plant before the period of decay is reached by checking the water supply and diminishing the root growth.

"There is no certain method known by which the nematodes can be killed in the roots of this plant without injury to the plant itself. Experiments were conducted at Washington some years ago with roses badly infested with nematodes, using 1 per cent solution of formalin. This proved effective in destroying the pests and, although it caused the shedding of the leaves, did not kill the rose plants. Whether similar treatment would be destructive to the gardenia plants or not can be determined only by experiment. The plants should be hardened off somewhat for a week or two before the experiment is made.

"The trouble can be avoided by sterilizing the soil in which the plants are to grow and then using only such plants as are absolutely free from any signs of root-knot. This sterilization can best be effected, as described in Bulletin No. 55 of the Hatch Experiment Station, by the use of live steam from a boiler with a pressure of 40 to 60 pounds. This is conducted through perforated pipes laid in the bottoms of the benches, the steam being passed into the soil until it has all been heated to the temperature of boiling water. This suffices to kill not only the nematodes but also various destructive fungi."

Tarnished plant bug. The tarnished plant bug was present in the usual numbers this season and during the spring caused considerable injury to opening leaf and flower buds by puncturing the buds, which resulted in deformed growth.

Plant lice. Serious injuries were caused by plant lice in different parts of the State. Perhaps the most important of these this season were injuries to cucumber vines, several beds being entirely ruined. Where the plants were small enough, however, to cover, bisulphide of carbon was recommended and this treatment met with entire success. It is not a difficult remedy to apply and the gardeners who used it were pleased with the results.

For the past two seasons enormous numbers of plant lice have appeared upon the potato vines near Houlton, working both on the stalks and on the under side of the flower leaves.

As usual where plant lice are numerous, complaints against ants and lady beetles are frequent. "Ants have attacked our woodbine and caused the leaves to wilt," and specimens of lady beetles sent in with the report "these are completely devastating cucumber patches," or "ruining a small ash tree," are examples of this all too common mistake. When ants are seen running over plants it is usually for the purpose of sipping a sweet fluid exuded by the plant lice and not to injure the plant. It is especially unfortunate that larval lady beetles are not more generally recognized, because they are among the most active of the natural checks upon plant lice, devouring great numbers of them.

Nearly 80 collections of plant lice were made during the summer, most of them near Orono. It was interesting to notice that though this family of insects was everywhere abundant the past two seasons the species most common in 1904 were not so much in evidence in 1905 as different species. A fuller and more definite record of this material is reserved for future discussion.

The natural checks which seemed to be most effective in connection with the observed species of plant lice, were Syrphus flies, lady beetles, predaceous Capsidæ, and parasites of the genus *Aphidius.*

Garden flea. At the time garden plants were just starting, about the first of June, garden fleas, *Smynthurus albamaculata* Harvey, were to all appearances guilty of real havoc in Orono gardens. Myriads of the tiny creatures occurred on the tender young leaves of lettuce, beans, cucumbers and squash and other plants which were at the time quite free from other insect guests. They worked round cavities in the soft leaves (usually from the under side, but not infrequently from the upper) reaching into the soft tissues, but not piercing quite through both surfaces of the leaf. The plants attacked were much damaged.

Apple maggot. There seems little to be said about the apple maggot for 1905 except that there is no apparent change in the general situation. It is at least not increasing in extent of injury in Maine.

Brown-tail moth. By far the most serious insect problem for Maine at present is the brown-tail moth. An account of this destructive and distressing pest was published last year.* A discussion of the moth and a history of the campaign against it has recently been ably presented in Bulletin of the Department of Agriculture of Maine, Vol. IV, No. 4, as a report of Hon. A. W. Gilman, Commissioner of Agriculture, and Mr. E. F. Hitchings, Entomologist. It hardly seems necessary here, therefore, to do more than touch upon the work of this Experiment Station in connection with the situation. Previous to the State appropriation for protection against insect ravages, the State Pomological Society expressed a helpful interest in the matter, and the Experiment Station worked in co-operation with the Commissioner of Agriculture in ascertaining the extent of infestation. This co-operation was continued during the spring of 1905, the Station locating infested areas in the counties of York, Cumberland, Androscoggin, Sagadahoc, Kennebec, Lincoln, Knox, Waldo, and Hancock. Station bulletins and other printed matter concerning the brown-tail moth and the danger involved were scattered broadcast over the State.

Whenever the infestation was discovered, the town or local authorities earnestly used every means within their power to inform the people of the danger and incite them to the destruction of the nests. So thoroughly was the work done that for the season just over, no appreciable loss has been experienced in Maine from the brown-tail moth and only a few cases of poisoning have been reported. It is not to be understood, however, that anything approaching an extermination has taken place. Scattered nests in wild growths remained to form new centers

* Me. Exp. Sta., Bul. 108.

of infestation and alarming invasions of the winged moths from neighboring states occurred during the past summer. This year, no less than last, Maine is confronted with a serious menace to the orchard and woodlands, to the attraction of summer resorts, and to the health and comfort of the people; and the neglect of the situation now means a gigantic financial problem for later years to meet.

Insect legislation. Until 1905 no state appropriations had been made in Maine to provide for the protection of trees and shrubs from the introduction and ravages of dangerous insects and diseases. The alarming invasion of the brown-tail moth during 1903 and 1904 emphasized the need of legislation relating to such matters, and on February 28, 1905, a protection act was passed. This act provides for the inspection of nurseries in the State and of nursery stock shipped into the State, by a competent entomologist to be employed by the Commissioner of Agriculture; and places with the Commissioner of Agriculture the duty of making full investigations of any locality when the presence of the brown-tail or gypsy moths or other injurious insects or plant diseases may be suspected.

A copy of this act may be procured by applying to the Commissioner of Agriculture, Augusta, Me., in whose hands the matter rests.

LIST OF INSECTS RECEIVED.

A partial list of the insects received at this Station for identification from January 1 to December 1, 1905, is given on the following pages.

INSECTS RECEIVED FOR IDENTIFICATION.

Name.	Date.	Host.	Locality.	Remarks.
Fuller's rose beetle, *Aramiges fulleri*	Jan. 17	Tuberous begonia	Ellsworth	Larvæ troublesome in greenhouse.
————, *Chrysomela multiguttata*	May 25	Linden	Portland	Adults numerous.
————, *Serica sericea*	June 8	Strawberry	Indian River	Adults devouring the leaves, numerous.
Strawberry crown girdler, *Otiorhynchus ovatus*	June 22		Wayne	Great numbers in house.
Strawberry crown girdler, " "	June 29		Caribou	Great numbers in house.
Strawberry crown girdler, " "	June 29		Maysville Centre	Great numbers in house.
Strawberry crown girdler, " "	June 29		Monson	Great numbers in house.
Rose chafer, *Macrodactylus subspinosus*	July 1	Apple plum	West Peru	Stripped the orchard.
Rose chafer, " "	July 3	Blackberry, elm and others	East Sumner	Very troublesome.
Rose chafer, " "	June 29	Apples	Mt. Vernon	Apples eaten to the core.
Lady beetles, ————	July 14		Belfast	Larvæ numerous on ash, feeding on plant lice.
Lady beetle, ————	Aug. 23		Portland	Larvæ feeding on plant lice on poppy.
Lady beetle, *Coccinella 5-notata*	Aug. 3		Lewiston	Numerous on cucumber vines.
Saw-toothed grain beetle, *Silvanus surinamensis*	July 14	Flour and starch	Richmond	
Tortoise beetle, *Chelymorpha argus*	July 17		Lisbon Falls	Larvæ.
Tortoise beetle, " "	Aug. 3	Raspberry	Stroudwater	Pupæ and adults numerous.
————, *Chrysochus auratus*	July 22	Dogbane	Bethel	
Bean weevil, *Bruchus obtectus*	Aug. 28		Searsport	
————, *Monohammus titillator*	Aug. 30		Winnegance	Adult.
White pine weevil, *Pissoides strobi*	Sept. 6	Pine	Bar Harbor	Destroying leading shoot.
Round-headed apple tree borer, *Saperda candida*	Sept. 23	Apple	Solon	Adult reported to be feeding on apple leaves.
Bumble flower-beetle, *Euphoria inda*	Oct. 9	Apple	South Bridgton	Adults destroyed about 100 grafts in apple trees.
Wire worms, ————	Nov. 8	Potato	Newport	Larvæ very troublesome.
Wire worms, ————	Oct. 24	Potato	Clinton	Larvæ very troublesome.
Wire worms, ————	May 18	Onion	Lee	Larvæ very troublesome.
Eyed elater, *Alaus oculatus*	June 29		Corinna	Adult.
Leaf-rolling weevil, *Attelabus sp.*	Aug. 8	Alder	Gardiner	Packets on leaf.
————, *Sciaphilus asperatus*	June 20		North Wayne	Adults in house.
————, " "	Sept. 11	Dahlia	North Wayne	Adults in blossoms.
Brown-tail moth, *Euproctis chrysorrhœa*	Feb. 23		South Berwick	Nests numerous.
Brown-tail moth, " "	Feb. 27		Bowdoin	Nest.
Brown-tail moth, " "	Feb. 28	Apple	Portland	Nests.
Brown-tail moth, " "	March 4		Lincolnville	Nest.
Brown-tail moth, " "	March 17		Kittery Point	Nests numerous.
Brown-tail moth, " "	March 20		West Scarboro	Nest.
Brown-tail moth, " "	April 3	Apple, plum, birch	Vinalhaven	Nests in great numbers.

INSECTS RECEIVED FOR IDENTIFICATION—CONTINUED.

Name.	Date.	Host.	Locality.	Remarks.
Brown-tail moth, *Euproctis chrysorrhœa*	May 19	Plum	Maxfield	Nest containing 183 living caterpillars.
Brown-tail moth, *Euproctis chrysorrhœa*	June 1		East Jefferson	Nest.
Brown-tail moth, " "	July 29		Bar Harbor	Egg mass.
Cherry tree tortrix, *Cacœcia cerasivorana*	June 26	Wild cherry	North Newry	Larvæ webbing grass.
Cherry tree tortrix, " "	July 1	Wild cherry	Palmyra	Larvæ.
Cherry tree tortrix, " "	July 3	Wild cherry	North Monmouth	Larvæ.
Cherry tree tortrix, " "	July 10	Wild cherry	Greenville	Larvæ.
Cherry tree tortrix, " "	July 17		Gardiner	Larvæ.
Stalk borer, *Papaipema nitela*	July 7	Corn	Gardiner	Larvæ ruining corn stalks.
Stalk borer, " "	July 7	Strawberry	Sanford	Larvæ buried in fruit. Troublesome.
Stalk borer, *Papaipema nitela*	July 15	Sweet corn	Gardiner	Spoiled sweet corn for two seasons.
Stalk borer, " "	July 27	Corn, potato, dahlia	Westbrook	Devastating garden.
Stalk borer, " "	Aug. 10	Potato	Portland	Working havoc in stalks.
Thysbe clearwing, *Hemaris thysbe*	July 1		Vinalhaven	Adult.
Galium sphinx, *Deilephila chamœnerii*	July 3		Athens	Adult.
Virginian tiger moth, *Spilosoma virginica*	July 3		Abbot	Adult.
Salt-marsh caterpillar, *Estigmene acraea*	July 3		Winterport	Adult.
Unicorn prominent, *Schizura unicornis*	Sept. 6	Apple	Lisbon Falls	Lavæ.
————, *Sabulodes transversata*	Sept. 12	Apple	Lewiston	Lavæ.
Scallop-shell geometer, *Calocalpe undulata*	Sept. 18		Kezar Falls	Lavæ.
Codling moth, *Carpocapsa pomonella*	March 17		Brooklin	Adult.
Oblique-banded leaf roller, *Cacœcia rosana*	June 13	Apple	Newport	Lavæ in great numbers.
Gray comma, *Grapta progne*	June 16	Currant	Lowell	Larvæ plentiful.
Gray comma, " "	July 15	Gooseberry	Ashland	Parasited larva.
Laurel sphinx, *Sphinx kalmiœ*	June 16		Solon	Adult.
Laurel sphinx, " "	June 29		Skowhegan	Adult.
Laurel sphinx, " "	July 8		Skowhegan	Adult.
Green apple leaf-tier, *Teras minuta*	June 21	Apple	Houlton	Larvæ.
Canker worm, *Anisopteryx pometaria*	June 21	Apple	Houlton	Larvæ.
Mourning cloak butterfly, *Euvanessa antiopa*	June 24	Elm	Portland	Larvæ.
Mourning cloak butterfly, " "	July 1		Berwick	Larva.
Mourning cloak butterfly, " "	July 24	Elm	North Monmouth	Larvæ,
Mourning cloak butterfly, " "	July 24		Greenville	Parasited larva.
Mourning cloak butterfly, " "	July 26	Elm	Harrison	Larvæ.
Mourning cloak butterfly, " "	July 29	Elm	Lee	Larvæ.
Mourning cloak butterfly, " "	Aug. 3	Balm gilead	Wells	Larvæ.
Mourning cloak butterfly, " "	Aug. 7	Poplar	North Monmouth	Larvæ.
Mourning cloak butterfly, " "	Sept. 16		Auburn	Larvæ.

INSECTS RECEIVED FOR IDENTIFICATION—CONTINUED.

Name.	Date.	Host.	Locality.	Remarks.
Apple sphinx, *Sphinx gordius*	Aug. 23	Apple	Lewiston	Larva full grown.
Achemon sphinx, *Philampelus achemon*	Aug. 23	Woodbine	Waterville	Larva.
Promethea moth, *Callosamia promethea*	Feb. 18		Kennebunkport	Cocoons, common.
Cecropia moth, *Samia cecropia*	March 17		South Paris	Cocoon.
Cecropia moth, " "	April 10		Greene	Cocoons.
Cecropia moth, " "	April 17	Apple	Jay	Cocoon.
Cecropia moth, " "	April 18	Pear	Wiscasset	Cocoon.
Cecropia moth, " "	May 1		Ripley	Cocoon.
Cecropia moth, " "	May 6		Skowhegan	Cocoon.
Cecropia moth, " "	May 19		Abbot	Cocoon.
Cecropia moth, " "	June 21		North Anson	Cocoon.
Cecropia moth, " "	July 3		Detroit	Male.
Cecropia moth, " "	July 26	Apple	Harrison	Cocoon.
Cecropia moth, " "	Aug. 16		Bar Harbor	Larva full grown.
Cecropia moth, " "	Aug. 25		Newport	Larva full grown.
Cecropia moth, " "	Oct. 16		Dryden	Cocoon.
Cecropia moth, " "	Oct. 19		Buckfield	Cocoon.
Swallow-tail butterfly, *Papilio polyxenes*	March 3		South Paris	Chrysalis.
Swallow-tail butterfly, " "	July 7	Parsnip	Brunswick	Larva.
Tiger swallow-tail, *Papilio turnus*	Aug. 18	Apple	Belgrade Lakes	Larva.
Tiger swallow-tail, " "	Sept. 1		Hutchins	Larva.
Tiger swallow-tail, " "	Aug. 15	Apple	Dover	Larvæ.
Polyphemus moth, *Telea polyphemus*	May 1		South Paris	Cocoon.
Polyphemus moth, " "	July 3		Gardiner	Male.
Polyphemus moth, " "	July 13		Olamon	Male.
Polyphemus moth, " "	Sept. 13		Gorham	Cocoon.
Tent caterpillar, *Clisiocampa americana*	May 19		North Penobscot	Eggs.
Tent caterpillar, " "	May 31	Apple	Bar Harbor	Nest and larvæ.
Tent caterpillar, " "	June 2	Apple	Mechanic Falls	Old cocoon.
Tent caterpillar, " "	July 24		North Monmouth	Male.
Tent caterpillar, " "	Aug. 21		Foxcroft	Egg cluster.
Tent caterpillar, " "	Aug. 22		East Lowell	Egg cluster.
Tent caterpillar, " "	Aug. 29		East Holden	Egg cluster.
Tent caterpillar, " "	Sept. 1		West Troy	Egg cluster.
Tent caterpillar, " "	Sept. 2		Skowhegan	Egg cluster.
Tent caterpillar, " "	Sept. 13		Unity	Egg cluster.
Tent caterpillar, " "	Oct. 4		Monmouth	Egg cluster.
Hickory tiger moth, *Halisidota caryii*	July 17	Apple	Springvale	Larvæ.

INSECTS RECEIVED FOR IDENTIFICATION—CONTINUED.

Name.	Date.		Host.	Locality.	Remarks.
Hickory tiger moth, *Halisidota caryii*	July	29	Apple	Greene	Larvæ.
Hickory tiger moth, " "	Aug.	4	Apple	Charleston	Larvæ.
Hickory tiger moth, " "	Aug.	15		Dexter	Larvæ.
Chain-dotted geometer, *Cingilia catenaria*	Aug.	8	Sweet fern	Dayton	Larvæ very numerous.
Chain-dotted geometer, " "	Aug.	15	Sweet fern	Lyman	Larvæ very numerous.
Chain-dotted geometer, " "	Aug.	19	Sweet fern	Alfred	Larvæ very numerous.
Chain-dotted geometer, " "	Oct.	4		Alfred	Moths flying about sweet fern.
Fall web worm, *Hyphantria cunea*	Aug.	8	Apple	Kent's Hill	Larvæ.
Fall web worm, " "	Aug.	15		Kennebunk	Larvæ.
Dagger moth, *Apatela lepusculina*	Aug.	11	Poplar	Dexter	Larvæ.
Skiff slug caterpillar, *Eulimacodes scapha*	Aug.	21	Apple	Foxcroft	Larvæ.
Io moth, *Automeris io*	Aug.	8		West Buxton	Larvæ.
Io moth, " "	Sept.	6		Westbrook	Larvæ, "Pest on delicate garden plants."
Mediterranean flour moth, *Ephestia kuehniella*	Oct.	13		Gardiner	Reared in laboratory.
Thistle butterfly, *Pyrameis cardui*	July	27	Echinops	Bar Harbor	Larvæ troublesome in nursery.
Chersis sphinx, *Hyloicus chersis*	Aug.	7	Ash	Fort Fairfield	Larvæ.
American lappet moth, *Phyllodesma americana*	July	24	Birch	North Monmouth	Larva.
————, *Argynnis cybele*	July	24		North Monmouth	Adult.
Velleda lappet moth, *Tolype velleda*	July	25		Gerry	Larva.
Walnut caterpillar, *Datana angusii*	Aug.	23	Black walnut	South Berwick	Larvæ.
Yellow-necked caterpillar, *Datana ministra*	July	26	Apple	Harrison	Larvæ.
Yellow-necked caterpillar, " "	Aug.	4	Apple	Eliot	Larvæ.
Yellow-necked caterpillar, " "	Aug.	4	Apple	Litchfield	Larvæ.
Yellow-necked caterpillar, " "	Aug.	8	Hazel	Gardiner	Larvæ.
Yellow-necked caterpillar, " "	Aug.	11	Apple	Mechanic Falls	Larvæ.
Yellow-necked caterpillar, " "	Aug.	11	Apple	Fairfield	Larvæ.
Yellow-necked caterpillar, " "	Aug.	11	Apple	South Paris	Larvæ.
Yellow-necked caterpillar, " "	Aug.	15		Wales	Larvæ.
Yellow-necked caterpillar, " "	Aug.	21		Litchfield	Larvæ.
Yellow-necked caterpillar, " "	Aug.	21		Foxcroft	Larvæ.
Yellow-necked caterpillar, " "	Aug.	22		East Lowell	Larvæ.
Yellow-necked caterpillar, " "	Aug.	23		Sabattus	Larvæ.
Yellow-necked caterpillar, " "	Aug.	25		Vassalboro	Larvæ.
Yellow-necked caterpillar, " "	Aug.	28		Springvale	Larvæ.
Yellow-necked caterpillar, " "	Aug.	28		Ross Corner	Larvæ.
Yellow-necked caterpillar, " "	Aug.	30		North Anson	Larvæ.
Yellow-necked caterpillar, " "	Sept.	1		Lee	Larvæ.

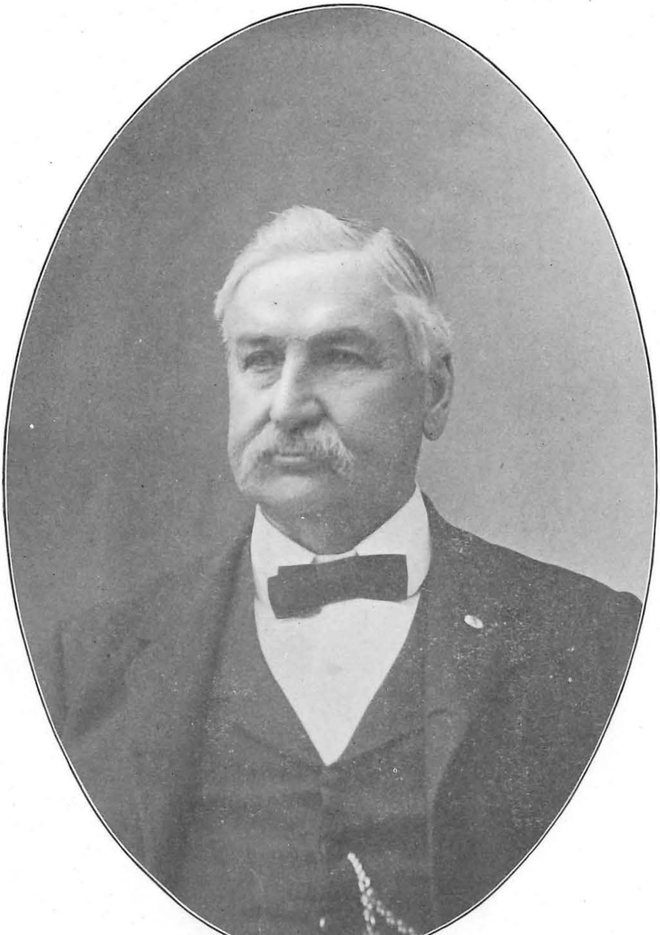
INSECTS RECEIVED FOR IDENTIFICATION—CONTINUED.

Name.	Date.	Host.	Locality.	Remarks.
Yellow-necked caterpillar, *Datana ministra*	Sept. 1		North Jay	Larvæ.
Yellow-necked caterpillar, " "	Sept. 1		Skowhegan	Larvæ.
Yellow-necked caterpillar, " "	Sept. 4		East Waterford	Larvæ.
Yellow-necked caterpillar, " "	Sept. 6		Sumner	Larvæ.
Scalloped owlet moth, *Scoliopteryx libatrix*	April 5		Augusta	Adult.
White marked tussock moth, *Notolophus leucostigma**				
Old tussock moth, *Notolophus antiqua*				
Red-humped caterpillars, *Œdemasia concinna**				
Elm leaf curl, *Schizoneura americana*	Feb. 16	Elm	Presque Isle.	
Elm leaf curl, " "	March 4	Elm	Alfred.	
Elm leaf curl, " "	April 1	Elm	Norridgewock.	
Elm leaf curl, " "	June 23	Elm	Gardiner.	
Plant lice, ————	March 20	Asters	Gardiner	On roots; very destructive.
Plant lice, ————	July 1	Cucumbers	West Bath	Vines ruined for two years.
Plant lice, ————	Aug. 18	Cucumber	Portland	Ruining the bed.
Plant lice, ————	Aug. 18	Poppy	Portland.	
Plant lice, ————	Aug. 18	Rhubarb	Portland	Especially troublesome.
Plant lice, ————	Aug. 19	Apple	Newport.	
Plant lice, *Pemphigus rhois*	Sept. 12	Sumach	East Holden	Galls numerous.
Plant lice, *Pemphigus*	Sept. 14		Castine	Numerous on the wing.
Alder blight, *Pemphigus tesselata*	Aug. 21	Alder	South Orrington	Conspicuous infestation.
Apple aphis, *Aphis mali*	Oct. 24	Apple	Keazer Falls	Adults and eggs.
Woolly louse of the apple, *Schizoneura lanigera*	Oct. 13	Apple	South Thomaston.	
————, *Pemphigus acerifolii*	July 13		Alfred	Winged forms, "present by thousands."
————, *Pemphigus acerifolii*	July 14	Maple	Kennebunk	Several localities infested.
————, " "	July 27	Maple	Bar Harbor.	
Oyster shell scale, *Mytilaspis pomorum*	April 29	Cornus	Winter Harbor	Killing big branches.
Scale, *Aspidiotus*	June 13	Bay laurel	Bar Harbor.	
Scale, *Lecanium*	June 20	Apple	Lincoln.	
Morga's scale, *Chrysomphalus dictyospermi*	Aug. 14		Bar Harbor.	
Cottony maple scale, *Pseudococcus aceris*	July 8	Maple	Sanford Mills	Great numbers.
Garden flea hopper, *Halticus uhleri*	July 27	Clematis virginiani and Clematis vitalba	Bar Harbor.	

*See discussion under "Insects of the Year" in this bulletin.

INSECTS RECEIVED FOR IDENTIFICATION—CONTINUED.

Name.	Date.	Host.	Locality.	Remarks.
Tarnished plant-bug, *Lygus pratensis*	May 2	Pear	Harrison	On buds of young pear tree. Numerous.
————, *Dog-day cicada*	July 17		Vanceboro	Pupa.
————, *Cercopids*	Aug. 12	Garden plants	Portland	On flower and leaves in garden. Causes buds to drop.
Giant water bug, *Belostoma americana*	Oct. 7		Pittsfield.	
Horntail, *Urocerus albicornis*	Aug. 30		Lewiston	Female.
Giant saw-fly, *Cimbex americana*	Aug. 8		Ellsworth	Larva.
Giant saw-fly, " "	Aug. 11	Elm	Cornish	Cocoon.
Oak fig gall, *Biorhiza forticornis*	Aug. 21	White oak	Woodfords	Galls common.
Pear slug, *Eriocampoides limacina*	Sept. 15	Cherry Quince	Lewiston	Larvæ.
Mossy rose gall, *Rhodites rosæ*	Oct. 10	Rose	Castine	Galls with larvæ.
Maple spot gall, *Sciara ocellata*	June 29	Maple	Hancock Point	Numerous.
Comb-horned fish-fly, *Chauloides pectinicornis*	July 13		Gardiner	Adult.



Richard H. Libbey, late member of executive committee. See Portfolio page 114.

APPENDIX.

Annual Report of the State Pomological Society

1905-1906.

CONTENTS.

SECRETARY'S REPORT.

ORCHARD CONDITION.

The winter of 1904-5 was severe and many trees that had been weakened by heavy bearing, suffered to the extent of killing many limbs, and frequently entire trees. The Baldwin trees were the greatest sufferers. For several years they had borne heavily, and where the trees had been neither fertilized or cultivated, the injury was most conspicuous. This will be made apparent by the papers and discussions prepared for the annual meeting. It is gratifying to note that those orchards that received cultivation and fertilization, although bearing more fruit than those neglected, had stored up strength to resist both cold and disease. There are more such orchards in the State than ever before, and the number is increasing.

In his travels over the State the secretary notes many neglected orchards, some containing old trees that have long outlived their usefulness, and only menace other trees in consequence of the dangerous insects and diseases that abound among them. Better, far better, to clear up these than to spend time and money on new trees. Neglected opportunities are very noticeable in thousands of seedling trees that are producing only natural fruit. Worked over into desirable varieties these trees would soon become a source of wealth to the owner.

Although we read of the extensive orchard planting in the West and South as reiterated over and over, there is nowhere more profitable returns than come from Maine orcharding. Sometimes there may be a dull market in consequence of large crops, but this is equally true in every department of agriculture. An orchard on a steep hillside was purchased last year for $2850. It bore 300 barrels last year and this year 600. It seemed to many a large price and yet it will pay better than bank stock, and is a little safer than mining stock. An orchard of 1200 trees in a Maine town is in the market for $3000, less than $3 per tree, and yet the orchard bore 310 barrels of marketable fruit. There are still other opportunities of this sort and it seems to the secretary that they offer the most favorable conditions for commercial fruit growing in Maine.

THE FRUIT CROP.

Many inquiries have come to the secretary during the year, asking for information about the apple crop. Some have asked how it compared with an *average* crop, but I do not know what an average crop of apples really is, and I don't believe any one else does. Thousands of young trees have been coming into bearing in the State every year, so that there are thousands of barrels of fruit on these trees that never bore before; and it is going to be so for years to come. In the estimates I have made I have compared the crop with that of 1904. The figures have been from one-third to one-half of that crop. Now that the fruit is harvested, it shows quite the one-half.

The estimated crop last year was a little over a million barrels, and a probable sale of over 500,000 barrels. From this the crop for 1905 would be a little over 500,000 barrels. The low price last year led many to feed out their apples to the stock, but this year, the prices being more, indications point to the sale of the entire marketable crop. There was a good demand for the early fruit with satisfactory prices.

THE MARKETS.

While there has been a good demand for early fruit in Boston and nearby cities, a large part of the later fruit is going forward to Liverpool. Still there is more or less fruit being sent to Western cities. It was urged by President Gilbert not long since, that we should make more account of our local markets. And this subject certainly deserves attention. Within the past three months I have had inquiries from responsible dealers in Pittsburg, Cincinnati, Chicago, St. Louis and Minneapolis, from which it would seem that they want to handle our fruit. There is one thing we may be sure of, they are much nearer than Liverpool and we can better understand their methods of selling the fruit in the home markets.

Many growers have had apples in the past and many have them now, that they would be glad to send to Boston but for the fact that there are no heater cars available for less than car-load lots, so that a man who has twenty barrels of Northern Spy that are worth more in Boston than in Liverpool, cannot send them to either place during the cold weather. The result is that he must either sell to the local buyer or make some deal with the shipper who may or may not be taking in fruit at the time he is ready to sell. Perhaps if we should ask it the railroads would send a heater once or twice a week over the different lines to enable small growers to ship their own fruit if they wished to do so.

I met a gentleman the other day who is receiving fruit in small lots, to be sent in car lots to Boston. He has made arrangements with reliable parties to receive the same and send it forward or cause it to be delivered to any one in the city. For doing this work he receives five cents per barrel, but his patrons have the benefit of the car rate, which for my county makes a saving of (18 less 5) about 13 cents on a barrel. It is a new plan in my part of the State, but it seems worthy of trial elsewhere.

Not long since an "apple trust" went into effect in England, under which an association of fruit auctioneers was formed to bar all buyers from the auction room who do not join the trust. The first sale of apples made after it went into effect caused a "slump" of several shillings in the price. The effort of the trust seems to be to limit competition in the auction rooms. To what extent this situation may affect the price of our fruit this year, one cannot tell, but to me it seems to place the advantage in the buyers' hands. There are English auctioneers who are not in the trust, and so the grower may exercise some choice in the matter. We shall see what we shall see.

MEETINGS OF EXECUTIVE COMMITTEE.

There have been three meetings in all. The first was a twin-meeting—to close up the affairs of the old year and to lay out the work for the new year. The second meeting was held in connection with the orchard meeting in August. At this meeting the death of Mr. R. H. Libbey, an efficient and esteemed member of the committee, was officially announced. It was voted to ask Dr. Geo. M. Twitchell to prepare and present to the annual meeting, a suitable memorial of our beloved associate. At the same meeting it was also voted to ask Mr. Will E. Leland of East Sangerville to fill temporarily the position made vacant by Mr. Libbey's death.

PUBLIC MEETINGS.

With the funds available your executive committee did not see the way clear to arrange for more than two meetings—the orchard meeting and the annual meeting.

The orchard meeting was held with Mr. John W. True of New Gloucester, August 31st. The early morning was unfavorable and a storm seemed to be threatening for the day, but by nine o'clock the rain had ceased falling and the sunshine brushed away the clouds. About a hundred and fifty put in an appearance and Mr. True's garden and orchards became special objects of study. Reference is made to the meeting and its results, which occupied one session of our annual meeting. The officers and invited guests were royally entertained by Mr. True and his family. The occasion was altogether pleasant and profitable, and the secretary expresses the hope that these field meetings may be made more frequent.

By invitation of Canton Grange of Canton the annual meeting was held in Grange Hall, Canton, November 14, 15 and 16. The first day was devoted to the preparation of the exhibition, which was of excellent quality, though displayed in crowded quarters. The programme was largely determined by the society at its last annual meeting. It was intensely practical and especially helpful to the fruit growers of the State. A cordial good feeling prevailed, and the general verdict of all was that as a whole the meeting was one of the pleasantest and most satisfactory in the history of the society. General regret was expressed at the absence of President Gilbert, who found a telegram awaiting him on his arrival in Canton the first day, announcing the death of his brother, Rev. Selden Gilbert.

OUR ANNUAL TRANSACTIONS.

Your secretary has frequently called attention to the importance of having our transactions available during the winter when it is most needed, and when it is of the most value to the farmers. This year the first copies were distributed at our orchard meeting, Aug. 31st. It has been the custom to print the agricultural report last of all and it seems unfortunate to have this delay when the information it contains is inquired for over and over again. The winter affords the best opportunity for reading and studying the contents so that when the springtime comes, its recommendations may be adopted. Think of it! Most of the matter contained in our report was presented at our meeting last November, and it was not available for the farmers until the last of August. It isn't a quarrel with the State printers, it is simply asking the authorities to furnish this volume of valuable information when it is most needed and when its information will be the most valuable.

In closing I wish again to call attention to the cordial relations existing between the society and other agricultural organizations in the State. This is as it should be, for there is only the greatest progress when there is harmonious action all along the line.

D. H. KNOWLTON,
Secretary.

OFFICERS FOR 1905.

President.

Z. A. GILBERT, North Greene.

Vice Presidents.

D. P. TRUE, Leeds Center.
EDWARD L. WHITE, Bowdoinham.

Secretary.

D. H. KNOWLTON, Farmington.

Executive Committee.

President and Secretary, *ex-officio;* V. P. DeCoster, Buckfield; C. A. Arnold, Arnold; * R. H. Libbey, Newport.

Trustees.

Androscoggin county, A. C. Day, South Turner.
Aroostook county, John W. Dudley, Mapleton.
Cumberland county, John W. True, New Gloucester.
Franklin county, E. F. Purington, Farmington.
Hancock county, E. W. Wooster, Hancock.
Kennebec county, E. A. Lapham, Pittston.
Knox county, Alonzo Butler, Union.
Lincoln county, H. J. A. Simmons, Waldoboro.
Oxford county, J. A. Roberts, Norway.
Penobscot county, A. A. Eastman, Dexter.
Piscataquis county, Will E. Leland, East Sangerville.
Sagadahoc county, A. P. Ring, Richmond Corner.
Somerset county, Frank E. Nowell, Fairfield.
Waldo county, Fred Atwood, Winterport.
Washington county, D. W. Campbell, Cherryfield.
York county, C. A. Hooper, Eliot.

Auditor.

DR. GEO. M. TWITCHELL, Augusta.

Member of Experiment Station Council.

CHARLES S. POPE, Manchester.

* Deceased. Will E. Leland, East Sangerville, chosen to fill vacancy.

MEMBERS OF THE SOCIETY.

NOTE.—Any errors or changes of residence should be promptly reported to the Secretary. Members will also confer a favor by furnishing the Secretary with their full Christian names where initials only are given.

LIFE MEMBERS.

Andrews, A. Emery............Gardiner
Andrews, Charles E..............Auburn
Arnold, C. A.......................Arnold
Atherton, Wm. P..............Hallowell
Atkins, Charles G.............Bucksport
Atwood, Fred....................Winterport
Averill, David C.................Temple
Bailey, W. G.....................Freeport
Bennoch, John E...................Orono
Bickford, Lewis I.......Dixmont Center
Bisbee, George E...................Auburn
Blanchard, Mrs. E. M..........Lewiston
Blossom, L. H.............Turner Center
Boardman, Samuel L.............Bangor
Briggs, John.......................Turner
Burr, John........................Freeport
Butler, Alonzo......................Union
Chandler, Mrs. Lucy A..........Freeport
Chase, Henry M., 103 Federal St., Portland
Corbett, Hermon...............Farmington
Crowell, Mrs. Ella H...........Skowhegan
Crowell, John H...............Farmington
Cummings, Mrs. Anthony........Auburn
Dana, Woodbury S..............Portland
Dawes, S. H......................Harrison
DeCoster, Virgil P..............Buckfield
DeRocher, Peter......Bradentown, Fla.
Dirwanger, Joseph A...........Portland
Dunham, W. W.................North Paris
Dyer, Milton.............Cape Elizabeth
Emerson, Charles L.........South Turner
Farnsworth, B. B................Portland
*Fessenden, Francis............Portland
Frost, Oscar F.................Monmouth
Gardiner, Robert H.............Gardiner
George, C. H.......................Hebron
Gilbert, Z. A................North Greene
Goddard, Lewis C.............Woodfords
Grover, Franklin D..................Bean
Hackett, E. C...........West Gloucester
Hall, Mrs. H. A.....................Brewer
Hanscom, John.......................Saco
Harris, William M................Auburn
Hoyt, Mrs. Francis.............Winthrop
Jackson, F. A....................Winthrop
Jones, J. H.........................Mercer
Keene, Charles S....................Turner
Knowlton, D. H.............Farmington
Lapham, E. A.....................Pittston
Leland, Will E..........East Sangerville
Lincoln, E. L.......................Wayne
Litchfield, J. H..................Lewiston
Litchfield, Mrs. L. K...........Lewiston
Lombard, Thurston M............Auburn
Luce, Willis A...........Columbia Falls
Macaulay, T. B...........Montreal, Can.
*Marston, Charles A..........Skowhegan
McCabe, George L.........North Bangor
McLaughlin, Henry.................Bangor
McManus, John...............Brunswick
Mitchell, Frederick H.............Turner
Moody, Charles H..................Turner
Moore, William G.............Monmouth
Moor, F. A.....................Waterville
Morse, F. H.....................Waterford
Morton, J. A........................Bethel
Munson, W. M.......................Orono
Page, F. W..........................Auburn
Palmer, George L......South Livermore
Parsons, Howard G.......Turner Center
Perley, Charles I...............Cross Hill
Pope, Charles S..............Manchester
Prince, Edward M.....West Farmington
Pulsifer, D. W......................Poland
Purington, E. F........West Farmington
Richards, John T................Gardiner
Ricker, A. S.........................Turner
Roak, George M...................Auburn
Sanborn, Miss G. P..............Augusta
Sawyer, Andrew S.......Cape Elizabeth
Seavy, Mrs. G. M..................Auburn
Simmons, H. J. A.............Waldoboro

* Deceased.

LIFE MEMBERS—*Concluded.*

Skillings, C. W............North Auburn
Smith, Henry S..............Monmouth
Snow, Mary S....................Bangor
Starrett, L. F....................Warren
Stetson, Henry..................Auburn
Stanley, O. E..................Winthrop
Stilphen, Asbury C............Gardiner
Taylor, Miss L. L...(Lakeside) Belgrade
Thomas, William W........... .Portland
Thomas, D. S ....North Auburn
Thurston, Edwin......West Farmington
Tilton, William S..........Boston, Mass.
Townsend, Mrs. B. T...........Freeport
True, Davis P..............Leeds Center
True, John W... ....New Gloucester
Twitchell, Geo. M................Auburn
Vickery, James.................Portland
Vickery, John....................Auburn
Wade, Patrick ....Portland
Walker, Charles S...................Peru
Walker, Elmer V.................Oxford
Waterman, Willard H......East Auburn
Waugh, F. A..............Amherst, Mass
Wheeler, Charles E..........Chesterville
Yeaton, Samuel F.....West Farmington

ANNUAL MEMBERS, 1903.

Allen, L. L......................Fairfield
Blossom, L. H............Turner Center
Bradley, Mertie E............... Vienna
Breed, W. O....................Harrison
Campbell, D. W ....Cherryfield
Day, A. C... ....South Turner
Dingley, Mrs. P. G..................Auburn
Fairbanks, A. E........North Monmouth
Fessenden, Francis ....Portland
German Kali Works ....New York
Goodale, G. C ....Winthrop
Guptill, W. T ....Topsham
Hall, C. G ....Cedar Grove
Harding, Nathaniel..........New Sharon
Hathaway, W. S.............East Auburn
Johnson, H. E... ... .Auburn
Jones, Mrs. Barnum.......North Auburn
Jordan, Ira.....................Milbridge
Leland, W. E............East Sangerville
Libbey, R. H ....Newport
Libbey, Mrs. R. H...............Newport
Lord, T. Merrill......North Parsonsfield
Mayo, E. R...................Manchester
McAllister, Z ....West Lovell
Merchant, S. L.................Winthrop
Merrill, A. L.... ....North Auburn
Morrill, Stephen...............Lewiston
Nowell, F. E.....................Fairfield
Payson, H. L...................Rockland
Phinney, C. S ....Standish
Roberts, J. A......................Norway
Smith, F. W ....Rockland
Smith, Geo. R ....Augusta
Staples, Mrs. Arthur G...........Auburn
Tarr, Edward ....Mapleton
Toothaker, L. P........Simpson's Corner
Tucker, Benjamin....... .North Norway
White, Edward L ....Bowdoinham
Whitman, H. H.............South Turner
Whittier, Phineas.....Farmington Falls
Willey, A. B................Cherryfield
Woodside, E. G. ....Lewiston

ANNUAL MEMBERS, 1904.

Allen, S. L.......................Fairfield
Arnold, M. F.....................Carmel
Beal, S. H. ....Skowhegan
Benson, Mrs. G. S ....Skowhegan
Burkett, Andrew..................Union
Butler, L. F.....................Madison
Cole, J. E...........................Union
Daggett, E. L ....Union
Danforth, F. G...............Skowhegan
DeCoster, V. P................ Buckfield
Frost, J. H.........188 Pearl St., Portland
Gleason, F. A ....Union
Greenleaf, A. C ....Farmington
Hall, Chas. G ....Cedar Grove
Jepson, Albert E.. ....Norridgewock
Knowlton, J. B..............Farmington
Leland, Will E..........East Sangerville
Lenfest, Mrs. F. H..................Union
Lincoln, Mrs. E. L...............Wayne
Mayo, E. R...................Manchester
McAllister, Z ....West Lovell
Merchant, S. L..... ....Winthrop
Nowell, F. E.....................Fairfield
Sanborn, C. E................Skowhegan
Sherman, Mrs. Clara E....... .... Union
Shurtleff, S. G ....South Livermore
Swan, J. A ....Skowhegan
Tarr, Edward..................Mapleton
Toothaker, L. P ....Etna
Tucker, Benj.......................Norway
Warren, Henry P...........Albany, N. Y.
Waterman, L. C................Buckfield
White, Mrs. Charles..........Skowhegan
White, Edward L ....Bowdoinham
White, P. C....................Skowhegan
Whitman, W. C. & Son.....South Turner

ANNUAL MEMBERS, 1905.

Abbott, S. E .... Bethel
Bass, Mary A .... Wilton
Berry, W. F........................ Canton
Briggs, Arthur B.................. Canton
Bryant, C. A .... Livermore Center
Campbell, D. W .... Cherryfield
Chase, Solon................ Chase's Mills
Craig, William.................... Auburn
DeCoster, Mrs. V. P............ Buckfield
Ellis, Mrs. Kate B .... Fairfield
Fairbanks, A. E........ North Monmouth
Goodale, G. C .... Winthrop
Greenleaf, A. C .... Farmington
Hardy, E. E .... Farmington
Hitchings, E. F............. Waterville
Leland, Will E.......... East Sangerville
Lincoln, Mrs. E. L................. Wayne
Mayo, E. R..................... Hallowell
McLatchey, R. E .. 46 Clinton St., Boston
Mendell, Mrs. C. E .... Hartford
Merchant, S. L.................. Winthrop
Nowell, F. E. .... Fairfield
Perley, F. B .... Vassalboro
Scales, Lilla M.................... Temple
Shurtleff, S. G.......... South Livermore
Smith, Mrs. F. A .... Canton
Spaulding, Stephen ..... North Buckfield
Staples, George W................ Temple
Stetson, T. B. W .... Canton
Toothaker, L. P...................... Etna
Tucker, Benjamin .... North Norway
Virgin, G. H .... Canton
Virgin, Mrs. G. H.................. Canton
Walker, Mrs. F. L .... Canton
Wallingford, John................ Auburn
Washburn, C. C .... Mechanic Falls
White, Edward L .... Bowdoinham
Whittemore, F. H ...... Livermore Falls

REPORT OF THE EXECUTIVE COMMITTEE.

The general work of the society is shown by this volume of Transactions, and the various reports published by the newspapers of the State. A summary of receipts and expenditures and a statement of resources and liabilities make the following financial showing for the year:

RECEIPTS.

Balance in treasury, Jan. 1, 1905	$90 11
State stipend	1,000 00
Interest on permanent fund	90 34
Life members	50 00
Annual members for 1904	7 00
Annual members for 1905	38 00
Sale of report	1 00
Dividend on bank stock in liquidation	12 00
Total receipts	$1,288 45

EXPENDITURES.

Debt of 1904 in full	$550 00
Executive committee, travel and expense	99 23
Treasurer, travel and expense	6 50
Speakers	16 98
Judges	3 45
Postage	15 00
Premiums paid	297 25
Annual meeting	6 19
Stenographer	47 85
Binding Transactions	28 40
Hotel bills of officers and speakers	106 15
Salary of Secretary in part	50 00
Cash in treasury, Jan. 1, 1906	61 45
Total expenditures	$1,288 45

ORDERS DRAWN AND NOT PAID.

Salary of Secretary, balance for 1905	$100 00
Salary of Treasurer for 1905	25 00
Printing and stationery	55 97
Total	$180 97

RESOURCES.

Cash in treasury	$61 45
Due from State	1,000 00
Permanent fund	1,510 00
	$2,571 45

LIABILITIES.

Outstanding orders	$180 97
Due permanent fund	50 00
	$230 97
Resources in excess of liabilities	2,340 48
	$2,571 45

PERMANENT FUND.

Invested as shown by the Treasurer's report	$1,510 00
Due from Society	50 00
	$1,560 00

All of which is respectfully submitted.

Z. A. GILBERT,
D. H. KNOWLTON,
V. P. DeCOSTER,
C. A. ARNOLD,
WILL E. LELAND,
Executive Committee.

Augusta, January 19, 1906.

REPORT OF TREASURER.

Ellis L. Lincoln, Treasurer, in account with the Maine State Pomological Society for the Year 1905.

1905	RECEIPTS.	
January 12, received from Chas. S. Pope, Treasurer for 1904..		$80 11
January 14, received from Farmington National Bank, interest on stock		12 00
April 11, received from State stipend		1,000 00
June 17, received from Chas. S. Pope, 1904		10 00
June 17, received from Chas. S. Pope annual membership fee not credited for 1904		7 00
July 14, received from Farmington National Bank interest on stock		12 00
September 2, received from bound volume Transaction		1 00
September 2, received from William Craig, Auburn, membership fee		1 00
November 2, received from Livermore Falls Trust and Banking Company, interest on certificate of deposit		7 00
November 2, received from S. G. Shurtleff, South Livermore, membership fee		1 00
November 17, received from Kate B. Ellis, Fairfield, for annual membership fee		1 00
Received from D. H. Knowlton for four life members ten dollars each as follows: F. H. Morse, Waterford; Geo. L. Palmer, So. Livermore; V. P. DeCoster, Buckfield; Will E. Leland		40 00
Also from D. H. Knowlton for 16 annual members one dollars each, as follows: F. E. Nowell, Fairfield; Edward L. White, Bowdoinham; R. E. McLatchey, 46 Clinton St., Boston; Stephen Spaulding, No. Buckfield; F. H. Whittemore, Livermore Falls; E. E. Hardy, Farmington; F. B. Perley, Vassalboro; S. E. Abbott, Bethel; C. C. Washburn, Mechanic Falls; Mary A. Bass, Wilton; Lilla M. Scales, Temple; Solon Chase, Chase's Mills; E. F. Hitchings, Waterville; Will E. Leland, East Sangerville; Mrs. V. P. DeCoster, Buckfield; Benjamin Tucker, North Norway		16 00
December 6, received from the Merchants' National Bank, Gardiner, 4th dividend in liquidation		12 00

December 20, received from W. F. Berry, Canton, membership fee	$1 00
Received from Arthur B. Briggs, Canton, membership fee	1 00
Received from C. A. Bryant, Livermore Center, membership fee	1 00
Received from D. W. Campbell, Cherryfield, membership fee	1 00
Received from A. E. Fairbanks, North Monmouth, membership fee	1 00
Received from G. C. Goodell, Winthrop, membership fee	1 00
Received from A. C. Greenleaf, Farmington, membership fee	1 00
Received from Mrs. E. L. Lincoln, Wayne, membership fee	1 00
Received from E. R. Mayo, Manchester, membership fee	1 00
Received from Mrs. C. E. Mendall, Hartford, membership fee	1 00
Received from S. L. Merchant, Winthrop, membership fee	1 00
Received from Mrs. F. A. Smith, Canton, membership fee	1 00
Received from Geo. W. Staples, Temple, membership fee	1 00
Received from B. W. Stetson, Canton, membership fee	1 00
Received from L. P. Toothaker, Etna, membership fee	1 00
Received from G. H. Virgin, Canton Point, membership fee	1 00
Received from Mrs. G. H. Virgin, Canton Point, membership fee	1 00
Received from Mrs. F. L. Walker, Canton Point, membership fee	1 00
Received from John Wallingford, Auburn, membership fee	1 00
Received from J. H. Jones, Mercer, life membership fee	10 00
December 31, received from Augusta Trust Co., interest	38 17
December 31, received from Augusta Savings Bank, interest	21 17
Total	$1,288 45

EXPENDITURES.

January 13, paid Cony House, expenses at Augusta	$23 00
Paid Z. A. Gilbert, expense as President	75
Paid E. L. Lincoln, expense at Augusta	3 00
January 19, paid D. H. Knowlton, expense at Augusta as Secretary	6 72
Paid R. H. Libbey, expense at Augusta	2 50
Paid V. P. DeCoster, expense at Augusta	4 80
Paid C. A. Arnold, expense at Augusta	3 00
April 25, deposit Augusta Trust Co., Winthrop, to credit of permanent fund	200 00
Deposit in Augusta Savings Bank to credit of permanent fund	350 00

September 4,	paid D. H. Knowlton, postage and Secretary expense	$29 79
	Paid V. P. DeCoster, expenses, postage, executive committee	8 70
	Paid Z. A. Gilbert, expense as President	8 85
September 11,	Paid D. H. Knowlton, on account of salary as Secretary for 1905	50 00
November 17,	paid W. E. Dresser, for board of officers and speakers	83 15
	Paid Kate B. Ellis, for expense as speaker at Canton	3 28
	Paid E. L. Lincoln, expense at Canton	3 50
	Paid D. H. Knowlton, expense as Secretary, postage, etc., Canton	27 25
	Paid W. M. Munson, expense at Canton meeting	7 55
	Paid A. F. Russell, service and expense at Canton	6 19
	Paid W. E. Leland, travel and expense as executive committee	5 59
	Paid C. A. Arnold, expense as executive committee, Canton	8 28
	Paid V. P. DeCoster, expense as executive committee, Canton	8 00
	Paid Miss Mary A. Bass, travel and service at Canton	1 85
	Paid Miss Lilla M. Scales, expense as speaker at Canton	1 85
	Paid John W. True, expense as judge at Canton	1 45
	Paid F. H. Morse, expense at Canton meeting	2 45
	Paid S. G. Shurtleff, service as judge at Canton	2 00
December 20,	Paid E. L. Lincoln, Treasurer, premiums awarded at Canton	297 25
December 31,	Paid Miss L. B. Raynes, service as stenographer at Canton	47 85
	Paid Smith & Reid, binding Transactions	28 40
		$1,227 00
Cash in treasury, Jan. 1, 1906		61 45
Total		$1,288 45

PERMANENT FUND.

151 life members' fees as reported for 1904		$1,510 00
Fees received in 1905:		
F. H. Morse	$10 00	
George L. Palmer	10 00	
Virgil P. DeCoster	10 00	
Will E. Leland	10 00	
J. H. Jones	10 00	
		50 00
		$1,560 00
Invested as follows:		
Four shares First National Bank of Farmington	$400 00	
Deposit in Augusta Savings Bank	610 00	
Deposit in Augusta Trust Company	500 00	
Due for the Society	50 00	
		$1,560 00

ELLIS L. LINCOLN, Treasurer.

BUSINESS TRANSACTIONS.

MEETINGS OF EXECUTIVE COMMITTEE.

AUGUSTA, January 12, 1905.

Approved bond presented by E. L. Lincoln, Treasurer for 1905.

Voted, That the Treasurer for 1905 be instructed to pay the Society's debt to the permanent fund when the stipend from the State shall be received.

Voted, That the Secretary, if he finds conditions favorable, is authorized to call a field meeting of the Society at such time and place as may seem advisable.

Revised schedule of premiums for 1905.

Voted to instruct Secretary to have 1500 schedules of premiums printed.

NEW GLOUCESTER, August 30, 1905.

The death of our associate, R. H. Libbey, was formally announced to the Committee, and it was resolved: That Dr. Geo. M. Twitchell in behalf of the Committee and Society be invited to prepare and present at our next annual meeting a memorial of our deceased associate.

Voted, To instruct the Secretary to have fifty copies of Transactions bound in cloth for exchange with other societies, etc.

Voted, That the place for holding the annual meeting be referred to Messrs. Gilbert and DeCoster with authority to locate, during week of November 13th.

Voted, That the preparation of programme be referred to the President and Secretary.

Voted, That Will E. Leland of East Sangerville be invited to fill position made vacant by death of R. H. Libbey.

Voted, That Mr. Gilbert be requested to arrange for judges of fruit at annual exhibition.

CANTON, November 14, 1905.

Mr. Will E. Leland, having accepted the position tendered him at the last meeting, was present to act with other members of the Committee.

Mr. Gilbert announced the following judges for the exhibition: S. G. Shurtleff on collections of apples; John W. True on single varieties of apples; Mrs. Dennison and Chas. S. Pope on canned goods and flowers; Prof. W. M. Munson on pears.

Mr. Gilbert announced that he had received information of his brother's death, in consequence of which he should be obliged to return home in the morning. Mr. Edward L. White was asked to read the annual address of the President in consequence of Mr. Gilbert's absence.

ORCHARD MEETING.

By invitation of John W. True, an orchard meeting was held at his beautiful home in New Gloucester, August 31, 1905. Mr. True met all who came by train at the station with teams and took them to his home, and in due time returned them to the station.

The officers and many others were hospitably entertained by Mr. and Mrs. True. Further reference is made to this meeting in the Secretary's report, and a review of the meeting and the lessons taught by it were reviewed and discussed at the annual meeting, to which reference is here made.

As an expression of thanks for the numerous courtesies of the day, Prof. Munson proposed three cheers for Mr. and Mrs. True and their households, and the cheers were given with a will.

ANNUAL MEETING.

By invitation of Canton Grange the annual meeting and exhibition of the Society were held in their commodious halls in Canton, November 14-16. The 14th was devoted to perfecting the exhibition, which was held in the lower hall of the building. Although the exhibition was somewhat crowded, a very attractive display was made. The quality of the fruit shown was excellent and the display was very effective.

The programme for the 15th and 16th was as follows:

WEDNESDAY, OPENING SESSION AT 11 A. M.—Prayer, Rev. Marcia Selman, Canton; address of welcome, W. W. Blanchard, Canton; response, Prof. W. M. Munson, Orono; President's annual address, Hon. Z. A. Gilbert, Greene.

WEDNESDAY AFTERNOON—Our Insect Troubles. At the last annual meeting of the society it was voted—That a committee be appointed to urge upon the Legislature the imperative necessity of enacting stringent laws for the protection of the fruit interests of the State, and from the brown-tail moth and other noxious insect pests and fungous diseases, and to represent the society in securing the desired legislation. Report of committee, Z. A. Gilbert, Greene; What the Agricultural Department Has Done, and the Present Situation, Prof. E. F. Hitchings, State Entomologist; What More Can the Society Do? D. H. Knowlton, Farmington; Report of the Committee on New Fruits, Prof. W. M. Munson, Orono. At the last annual meeting it was voted: That a standing committee on new fruits be established, and that it shall be the duty of this committee to examine into the merits of new varieties of fruit offered for sale in the State, or which seem likely to be of value to Maine growers, and that this committee shall report at each annual meeting.

WEDNESDAY EVENING—Music. Storage of Fruit. The following recommendation was made and approved at the last annual meeting and referred to the Executive Committee—That a committee be appointed to look into the matter of cooperative storage and marketing, suggest plans, make specifications for storage houses, learn what is actually being done in other states and report at the next annual meeting of the society. Recommended further, that one session of the next annual meeting be devoted solely to the discussion of this very important subject. As forming a part of their report upon the subject the Executive Committee have arranged the following programme for this session: Home Storage Results, F. H. Morse, Waterford; music; Cooperative Storage, and the Operation of the

Fruit-Marks Act in Canada, William Craig, (formerly of Canada), Auburn. Full opportunity for discussion will be given. The following recommendation was passed at the last annual meeting: Recommended that a committee be appointed to consider the feasibility of legislaton regarding the grading, marking and inspection of fruit along the line followed in Canada and in sister states and report at the next meeting. Report on above, Dr. Geo. M. Twitchell. Music.

THURSDAY FORENOON—Annual Meeting: Report of Treasurer, E. L. Lincoln, Wayne; report of Secretary, D. H. Knowlton, Farmington; report of the Executive Committee. At the last annual meeting of the society the following recommendation was adopted and referred to the Executive Committee: First—That in the judgment of this society the factor of quality in fruit should be given more prominence. That in the exhibitions held by this society, the intrinsic merit of the varieties shown shall be given weight rather than mere number of sorts in the exhibit or the display of color only. Recommended further, that the influence of the members of this society be used in the same direction, in the various fairs and fruit exhibits in the State. Second—That a committee be apponted to confer with the officers of the various agricultural societies of the State with a view to putting fruit and flowers upon a more satisfactory basis upon the premium list. Election of officers for 1906. Memorial of Richard H. Libbey, deceased member of the Executive Committee, Dr. Geo. M. Twitchell, Report of Committee on "Fruit Packages," E. L. Lincoln, L. H. Blossom, Chas. S. Pope, committee. The following recommendation was passed at the last annual meeting of the society: That a committee be appointed to study the requirements of foreign markets with reference to size and style of packages and methods of shipment, and report at the next annual meeting. Recommended further, that this committee shall suggest the most practical size and style of package for endorsement by this society.

THURSDAY AFTERNOON—Our Orchard Meeting: The Place Where It Was Held and What Its Proprietor Has Accomplshed, John W. True, New Gloucester; Lessons Learned at the Orchard Meeting, Edward L. White, Bowdoinham; Results of Fertilizing and Cultivating, V. P. DeCoster, Buckfield; Experiments in Orchard Fertilizing, Prof. W. M. Munson, Maine Experiment Station.

THURSDAY EVENING—Ladies' Night. Music; A Woman's Work in Fruit-Growing, Miss Lilla M. Scales, Temple; A Woman's Work in Orcharding, Mary Augusta Bass, Wilton; music; A Woman's Work in Beautifying the Home, Mrs. Kate B. Ellis, Fairfield; music.

Excellent music was furnished by the young ladies of Canton.

BUSINESS MEETING.

The Treasurer and Secretary presented their reports and they were accepted.

On the oral report of the Executive Committee, made by the Secretary, it was voted to appoint a committee to formulate an exhibition rule regarding the quality of exhibition fruit. The following committee was appointed: William Craig, Prof. W. M. Munson, Charles E. Wheeler.

Charles E. Wheeler, J. W. True and Alonzo Butler were appointed as a committee to distribute, collect and count ballots.

Voted and by major vote made choice of the following officers for 1906:

President—Z. A. Gilbert, North Greene.

Vice Presidents—D. P. True, Leeds Center; Edward L. White, Bowdoinham.

Secretary—D. H. Knowlton, Farmington.

Treasurer—E. L. Lincoln, Wayne.

Member of Executive Committee for two years—Will E. Leland, East Sangerville; member for three years, V. P. DeCoster, Buckfield.

Auditor—Dr. George M. Twitchell, Auburn.

Trustees—Androscoggin county, A. C. Day, Turner Center; Aroostook county, John W. Dudley, Mapleton; Cumberland county, John W. True, New Gloucester; Franklin county, E. E. Hardy, Farmington; Hancock county, E. W. Wooster, Hancock; Kennebec county, F. B. Perley, Vassalboro; Knox county, Alonzo Butler, Union; Lincoln county, H. J. A. Simmons, Waldoboro; Oxford county, J. A. Roberts, Norway; Penobscot county, W. M. Munson, Orono; Piscataquis county, C. C. Dunham, Foxcroft; Sagadahoc county, A. P. Ring, Richmond; Somerset county, Frank E. Nowell, Fairfield; Waldo county, Fred Atwood, Winterport; Washington county, D. W. Campbell, Cherryfield; York county, J. Merrill Lord, Parsonsfield.

Member of Experiment Station Council—Charles S. Pope, Manchester.

On motion made by Prof. W. M. Munson it was voted that the Secretary be requested to provide for one session of the next annual meeting a round table discussion on the topic—"How can the meetings and exhibits of the Society be made of the greatest educational value?"

The memorial of Richard H. Libbey, prepared by Dr. George M. Twitchell, was read by Mrs. V. P. DeCoster, and it was *voted,* that these resolutions be accepted and placed on record, and that a copy also be sent to our Sister Libbey.

(For memorial see Secretary's Portfolio).

Voted, That the President's address be referred to a committee for consideration and report to the Society. Prof. W. M. Munson, A. S. Ricker and F. H. Morse were appointed as said committee.

Later the committee offered the following report and it was accepted:

President Gilbert made a personal investigation and found almost without exception that this year's crop of fruit came from trees recently cultivated or fertilized, or which bore lightly last year. In accordance with this suggestion, which is in line with the observation of other growers, your committee would urge upon the Society, and upon the fruit-growers of Maine, the importance of better care and management of orchard trees. This work of improvement must be commenced immediately on the opening of the spring season if a crop of fruit is to be obtained for the next "off" year.

Your committee would commend the effective work of the President and Secretary in securing legislation looking toward the control of injurious insects, and would endorse most heartily the efficient work of the Commissioner of Agriculture and the State Entomologist in carying out the provisions of the law. The continuance of this work is urged, and the cooperation of the Society for the future is bespoken.

It is recommended that the action of the President in bringing to the attention of the Governor and Council the importance of an early publication of the Society's Transactions be endorsed.

It is further recommended that the Society instruct its officers to prepare their respective reports and use their influence in securing the publication of the same and of the full volume of the Agriculture of Maine at the earliest possible date every year.

W. M. MUNSON,
A. S. RICKER,
F. H. MORSE.
Committee.

Charles E. Wheeler, John Wallingford and Alonzo Butler were appointed as a committee on resolutions, and at the last session of the meeting offered the following resolutions, which were accepted:

Resolved, That the thanks of the Society are hereby extended to the Portland and Rumford Falls and Maine Central Railroads for reduced rates, and to the proprietor of the Revere House for the excellent service and low rates.

Resolved, That this Society express its thanks to Canton Grange for the use of their hall during this annual session.

Resolved, That our thanks be extended to Mr. S. F. Russell and the citizens of Canton, and especially the friends who furnished music, for their cooperation in making this session a success.

Resolved, That particular mention should be made of the exhibits of fruit and chrysanthemums by Prof. Munson.

CHARLES E. WHEELER,
JOHN WALLINGFORD,
ALONZO BUTLER,
Committee.

Canton, November 16, 1905.

Dr. George M. Twitchell reported on the following passed at the last annual meeting: "Recommended that a committee be appointed to consider the feasibility of legislation regarding the grading, marking and inspection of fruit along the line followed in Canada and in sister states and report at the next meeting," and offered the following resolution, which was accepted:

Resolved, That this Society, recognizing the substantial growth of our fruit industry and realizing the necessity for a more critical grading of the stock, for the protection of the grower, declares in favor of national legislation looking to a Fruit Marks Act, and authorizes the appointment of a committee whose duty it shall be to correspond with the officers of the Fruit Growers' Associations in the several states, and if a general sentiment is found favoring such action to arrange a conference for the purpose of outlining national legislation, said committee to be authorized to expend a sum not to exceed fifty dollars for postage and necessary printing and expenses, a full report to be made at the next annual session of this Society.

Mr. E. L. Lincoln in behalf of the Committee on Fruit Packages offered the following resolution:

Resolved, That this Society recommend the adoption of a Maine standard apple box of the capacity of one bushel, with the following inside dimensions: length, 21 inches; depth, 11 inches; width, 10 inches.

Voted, To refer back to the same committee the question of the size of package to be adopted, and further that this committee be instructed to, if possible, agree with representatives of other New England and New York Associations as to the size of box to be adopted by all societies, and report at the next meeting.

Committee on Exhibition Rules reported as follows, and it was accepted:

Voted, That no wormy, spotted or otherwise defective fruit be granted a premium by this Society.

Voted, That the Executive Committee be instructed and authorized to employ a competent assistant to aid in perfecting the exhibition.

General apple exhibit by counties at Maine Pomological Society, 1905, at Canton. Photograph by courtesy of Mr. G. C. Sevey of New England Homestead.

PAPERS, ADDRESSES AND DISCUSSIONS OFFERED AT VARIOUS MEETINGS OF THE SOCIETY.

ANNUAL INVOCATION.

By Rev. Marcia Selman of Canton.

Our Father who art in Heaven, maker of all created things, we bow in thy presence with submission as we ask thy blessing upon this gathering. We thank thee that thou has made this earth such a goodly place for our habitation and that thy presence is so universally present in it, that every inch of its surface is quick with the germs of intelligence and of life. We thank thee that even what seems to be decay and death is made under thy wise laws to minister to the upspringing of new life. We thank thee that thou hast made the very soil on which we tread to bring forth that which is beautiful and bountiful to minister to our comfort and our joy.

And we thank thee that thou has so blessed man with intelligent thought, that thou hast enabled him to tread thy path throughout the universe and to think thy thoughts after thee. Thou hast extended even to him thine own great divine prerogative of creator, and hast made him able by finding out and following thy laws to bring new life into existence.

We come to ask thy blessing upon our gathering together—and yet it is not so much that, our Father, as to ask thee to remind us that thou art blessing us now and all the time; that the efforts of such societies as these are being continually blessed by thee under thy wise laws; that thou hast blessed our efforts in the past, that thou art blessing them in the present, that thou wilt bless them in the future; that everywhere, where man comes in contact with nature and learns her laws and applies them, there he comes, wittingly or unwittingly, into contact with thyself, and there he becomes, knowingly or unknowingly, a very co-operator with the great God of the universe.

We thank thee, our Father, that this Society meets in the interests of a peaceful project; that whereas in this place and in that place among the councils of men, men are gathered together to learn to study the arts of war, the engines of destruction, gathered together to carry forth those projects which are to bring devastation upon the land, that here and there, as in this place, there are men and women, intelligent, thoughtful, Christian men and women, who are gathered together to cultivate the land, to bless homes instead of destroying them, to glorify them by making the earth bring forth and bud and blossom as the rose.

Bless, we pray thee, the sessions of this Society. Bless the speakers that they may speak out of the wisdom of their hearts and communicate to us that divine wisdom. Bless us that we may go forth and learn new things, of which thy universe is full, for our further blessing.

And we pray this morning while we assemble together in fellowship and in brotherhood, that thy blessing may go as our thought goes out to him, the President of this Association, who has been called away from our midst by a sad message of bereavement. Let the comfort of thy Spirit, the sustaining comfort of God's presence be with him, we pray thee, and with us all, as we remember and as we are reminded from time to time that however we may strive and endeavor and plan, yet after all the issues of life and death are in God's hands, and being there they are safe.

So help us to wait upon thee that the sessions of these meetings may glorify thee, may exemplify thy wisdom and thy truth. Bless the homes here represented. Bless all the efforts of these men and women to their satisfaction and to thy glory. We ask it in the name of the great husbandman of souls, the Lord Jesus Christ. Amen.

ADDRESS OF WELCOME.

W. W. BLANCHARD, of Canton.

I feel the honor conferred upon me of welcoming you this morning, and as a citizen I recognize the fact that we should be deeply grateful, in addition to the hospitable feeling of welcome, as we realize what your Society has done,—as we appreciate the end toward which your labors are directed.

It is with pleasure that we look back over the past; it is with a certain disappointment that we note the fact that the achievements along the peculiar lines have been attended by difficulty. The work of the husbandman has been for many ages considered a laborious, hard, unsatisfactory toil. It has been thought that a person, no matter how illy equipped and insufficient he was for other fields of labor, could as a husbandman, as a tiller of the soil, as a cultivator of fruit, make a success. But the very fact is, as our name teaches us, today those fields of labor have their peculiar sciences and arts. And as we recognize what has been accomplished along these lines today, our hearts swell with appreciation, and we are glad to welcome you in our midst, as we realize that your coming means good to us. It means advancement to us. It means the taking on of new stimulus, the infusion of new energy into our work. It means education as well. Today we have no class of men and women more studious, it seems to me, than the classes represented in these fields of labor that bring us together upon this occasion. It is true that their work is more laborious and the fields are new. When our forefathers came here this land was covered with forests. They were subdued. Those giant monuments of nature have crumbled and passed away, and today we stand, with vigorous bodies, as patrons of husbandry, as cultivators, developers of the science of fruit raising and horticulture, to subdue and contend with forces that have impeded the advance of progress all the time.

Now today we are glad that you are here. It is certainly a revolution and evolution, a step in advance, as we see the intelligence present. And perhaps the greatest, the highest avocations of life open to us along these lines, and we trust that we may be able mutually to profit by this Association. We certainly appreciate the fact that to us will be brought new ideas; truth will be given to us which we never have appreciated before. Thank you for it. And to such hospitalities as we have, we welcome you gladly, realizing that we are the ones that receive the benefit, not you.

RESPONSE.

By Prof. W. M. Munson.

It is with the greatest of pleasure that I respond to the very cordial words of welcome which have been extended to us. It is an honor to me, as a member of this Society, to be chosen as its mouth-piece. I consider it as a special honor because of the standing of the Society, because of what the Society represents.

As Mr. Blanchard has just indicated, the Society stands for education; it stands for the motive to which personally I have devoted my life; and for that reason I take a double interest in it, responding not only in behalf of the Society, but in my own behalf and in behalf of the institution with which it is my fortune to be connected. For all of the agencies of the State which tend to better the condition of agricultural workers are and should be working together. The Pomological Society, the University, the State Commissioner of Agriculture with his numerous helpers, and the agricultural press of the State all combine to elevate Maine's agricultural conditions, combine to bring before the people of the world the fact that right here in New England we have conditions which are adapted specially to certain phases of agricultural work. And not the least important of those phases is that which is represented by the Maine State Pomological Society.

Now what does this Maine State Pomological Society stand for? We have already said it stands for education. It also stands for the great fruit interest of the State. But it stands for more. It stands for better men and women. It stands for better boys and girls. It stands for better homes in the State of Maine. What, let me ask, do the great farms of the West, or even of our own State, amount to if they stand simply for providing a little more bread and butter? if they stand for the motive of the Western farmer, of raising a little more corn to raise a few more hogs to get a few more dollars to raise a little more corn? I say they stand for better homes; and it is the home spirit, the home life of New England, which we are aiming to foster.

Now this home life can in no better way be encouraged than by providing attractive suroundings for our boys and girls. I mean attractive surroundings in the way of home buildings, of home grounds, of well-kept roadsides. But that is not all. When our boys and girls go to the schools, to the academy, to the normal schools, there they want also to see attractive surroundings, they want also to come in touch with the spirit of country life. While I didn't intend to say anything about the normal schools at this time, I can't forbear saying that I hope every man and every woman here will see that in the near future our normal schools not only are willing, but are anxious, but they must provide such instruction that our teachers who go out into the country schools shall be fitted to teach country children. The trouble with so many of our country schools at the present time is that the children are taught by pupils of the high school, teachers that know absolutely nothing of country life, and then we wonder why our boys and girls are educated away from the farm. This then is one of the things for which the Maine State Pomological Society stands, the betterment of the country homes and the elevation of everything pertaining to country life.

The Society stands for better fruit and more of it. Now that is saying a good deal in view of the exhibit that you have downstairs at the present time. But, as I have said, there is not a section of the country so well adapted to the particular interest mentioned, that of producing fine fruit, especially fine apples, as this particular corner of New England; and we have not only our local markets but the foreign markets right at our door. Now what we want to do is to control these markets, by producing the best and putting it upon the market in the best shape. That, friends, is one of the important lessons which we are to study with you here at the meeting in Canton at this time. We believe in better care of our orchards, in better care of the soil and in better care of the trees. We believe in better feeding; we believe in better packing; we believe in better grading; we believe in better packages; and we believe in providing facilities for storage of the fruit until such times as the market shall meet our ideas as to the value of that fruit. These also are lessons which we hope to study with you, and ask you to give us the benefit of your thought and of your experience, that we may receive mutual benefit, and may look back upon the meeting at Canton as one of the most successful in the history of the Society.

Friends, again, in behalf of the Society, I thank you for the very cordial welcome which has been extended, and urge upon the people of the vicinity constant attendance upon the meetings and free participation in the exercises of every meeting.

ANNUAL ADDRESS.

By Hon. Z. A. GILBERT, Greene, President of Maine State Pomological Society.

Another succession of the rounds of the seasons brings the State Pomological Society again to its convention and exhibition—the annual celebration of the fruitage of the year. While congratulations over any marked bounty along the lines of our chosen specialty might at this meeting be out of order, yet, as with every returning year, cause for thanksgiving in many lines of fruit growers' efforts have been such as to bring forth feelings of gladness and of encouragement in the pursuit of the line of effort our Society is organized to encourage and promote.

As is the case in almost every passing year of experience in the growing of fruit, there has been success in full measure with the labors of some growers, and failure quite as plainly marked with others. To study these varying degrees of experience is quite as necessary to success in the business as is knowledge acquired from other sources. These lessons cannot be learned from books, nor are they found in recorded scientific treatises. They must be learned by the individual who plants his own vine, prunes his own trees and watches the results of his own labors through the advancing season up to the rewards of the harvest. To bring together this knowledge and put it in form to aid each other is the object that has invited the fruit growers of our State to assemble here at this time.

Each passing year brings its special lesson. This past year a record has been so plainly written that no one can fail to read it aright. Apples are our leading commercial fruit. The past season has not been generally a fruitful one. Some trees and some orchards have rewarded their owners with a reasonably good crop of fruit. Many other trees and most other orchards have given but little fruit. There is a reason for this. The books do not show the reason for this—it is written nowhere else but on the trees.

Your president has taken the time the past autumn to look around among the orchards over a wide territory of the leading apple producing portion of our State for the express purpose of making observations on the apple crop. In every direction, in every orchard without an exception, and almost with every tree the lesson was plain. The apples of the year were on orchards under cultivation and on trees that had recently been liberally fertilized, or in a few cases in orchards that bore lightly the year before. More fertilization and better treatment of trees was written all over the orchards of the State the past season, and so plainly that there can be no overlooking the lesson. This Society has before called attention to this crying want of the orchards of the State. If the barren trees and the dead branches of the orchards would but force the attention of owners to active efforts for the remedy, a liberal compensation for the loss of the crop would then be realized. A large part of the orchards of the State, especially the trees that have been some time in bearing, are hungry for the food with which to nourish a generous fruitage. It is time this lesson was taken home by every grower in its full importance. It is the one great demand calling for attention by growers ahead of every other. The growing of fruit in the off years is where the supply comes from when most wanted, and where the money is made by those who are wise enough to grow the needed supply.

There are two ways through which the supply of fertilizing material needed to promote the fruitage of trees may be provided. One is by cultivation. This serves to destroy the grass and other vegetable growth around and about the tree, thus leaving the full strength of the soil and its contents for the support of the trees. It also sets free each year a measure of the elements of fertility contained in the soil and gives it up to the use of the tree for the growth of fruit. The importance of this method of treatment for orchards has heretofore been pressed to the attention of fruit growers by our Society and is already bearing results. It is not claimed that cultivation alone will for all time be sufficient for the full wants of trees. That it will do much towards it is evidenced the past year by the loaded trees wherever the cultivation has been introduced.

The other method of furnishing trees with their needed fertilization is by the application of manures to the surface of the soil without the cultivation. This is to receive attention in the program prepared for this meeting and need not take further time at this early stage of our proceedings.

Fruit growing in this State has been and now is almost entirely a branch of the mixed farming of the farm on which the orchard is located. It never will be found that fruit growing can be made the successful business it is capable of until it is made a specialty and given the time and attention its best interests require. There will be years of general bounty, like a year ago, when the profit, if indeed there is any, is small. So there will be other years, like the present, when only the well cared for trees will give a crop. Then it is that the specialist, with his trees that have received the full attention their best estate required, realizes the reward his attentive care deserved.

During the past year the entomological field has received careful attention on the part of the officers of our Society, in so far as this matter was left in their charge by the action taken at the annual meeting one year ago. The action taken by them and the results following are familiar to all. The present standing of the brown-tail moth invasion and the attitude of the State in the defense against it is a matter on which you are to be further informed during the course of this meeting. Certainly this Society deserves well to be complimented on its prompt action of a year ago on this important matter.

Your attention is invited to the fact that the transactions of this Society for the year 1904, and which embraced the proceedings of the annual meeting held in November of that year, which are made a part of the annual report of the commissioner of agriculture, was not placed in the hands of our members till three-quarters of the present year had passed. This delay of almost a year from the time of the close of the work therein recorded detracts in a large degree from its value. The same also applies to the entire volume of "Agriculture of Maine." The change in the law made by the last legislature places the State printing in the charge of the governor and council, and thereby opens a way by which this printing can be done promptly on the opening of the year. The committee on printing of the council have this matter under arrangement at the present time. Your president has taken the liberty, in view that prompt action was called for, to suggest to that committee that a way is now open for a needed reform in this printing. I now suggest that if this movement meets the approval of this Society, that action be taken to supplement the move already made by your president and thus throw the full influence of the Society in aid of an earlier appearance of our transactions and with it the full volume of "Agriculture of Maine."

THE INSECT SITUATION IN MAINE.

At the last annual meeting of the Society it was voted, That a committee be appointed to urge upon the legislature the imperative necessity of enacting stringent laws for the protection of the fruit interests of the State, and from the brown-tail moth and other noxious insect pests and fungous diseases, and to represent the Society in securing the desired legislation.

Report of committee made by D. H. Knowlton: It is unexpected for me to speak upon this matter, but at the same time I shall take considerable pleasure in telling you the story.

You will remember, going back a little bit, a year ago last spring or towards spring the alarm was sounded that the brown-tail moth was in the State of Maine. Commissioner Gilman, President Gilbert in behalf of our Society, and several others at once appeared before the governor and council and made representations to them of the situation. The governor and council, appreciating at once what the situation was, although no appropriation was made or had been made for such purposes, instructed Mr. Gilman of the agricultural department to go ahead and exterminate just as many of the brown-tail moths as possible. He did that work and did it well so far as that goes, and so far as I know. As the first session of the legislature afterwards was approaching, our Society last year took the matter up and after discussing it somewhat and realizing the danger from the terrible pest, resolutions were passed calling for the appointment of a committee to make such representations as might be necessary to the committee on agriculture of the legislature, and present to the legislature a bill covering the situation. The committee as appointed I will say consisted of Mr. Gilbert as chairman, myself as second on the committee, and Commissioner Gilman as third. And I can assure you that Mr. Gilman in his position was one of the most influential and active on the committee and rendered aid in every way possible.

Well, we sat down together and talked over the situation and examined more or less laws, both present and prospective, in other places, and we concluded that the only way was to resort to vigorous measures. We accordingly formulated a bill, which in substance placed the matter in the hands of the commissioner of agriculture and gave him for the purpose of carrying the work forward the sum of $5,000 each for 1905 and 1906. That is as far as the immediate bill reaches. A little later you will have the opportunity of hearing from Prof. Hitchings who will tell you somewhat of what the department has done. The bill necessitated the appointment practically of an entomologist. Mr. Gilman, after considering the matter and discussing what was involved in it, decided that it was practically the proper thing to have a State entomologist—I don't know but that we did so in the bill—we did in substance because the work to be done there necessitated the knowledge and skill possessed by an entomologist. He arranged with Prof. Hitchings to do that work and they have carried the work forward. I won't tell what that work is because he is going to do that, I am simply telling you what this committee, which you appointed last year, has done. We were very proud of the result. We went before the committee of the legislature. They gave us a most courteous hearing, and other members of the legislature were interested in every word that was said to them individually, and when the time came for the legislature to act upon it it went through without a dissenting voice. It is something I feel very proud of, that in every instance when we have gone before the legislature we have received the most courteous consideration. It is one of the hopeful and promising signs for the future usefulness of the Society, to say nothing about the past in which we have been so long engaged in earning the reputation which we have. I hope nothing may ever tarnish it.

WHAT THE AGRICULTURAL DEPARTMENT HAS DONE, AND THE PRESENT SITUATION.

Prof. E. F. HITCHINGS, State Entomologist.

Through the efforts of our State Pomological Society and the commissioner of agriculture, our last State legislature passed an act relative to the protection of trees, vines and shrubs from the introduction and ravages of dangerous insects and plant diseases. This act covered the inspection of all nurseries in the State, or places where trees, shrubs, vines and plants are grown or offered for sale; also to make full investigation of any locality when the presence of the brown-tail or gypsy moths or other injurious insects or plant diseases may be suspected. As soon as this act was approved, the commissioner of agriculture appointed an entomologist to take charge of the work under his supervision. Fifteen men were employed to do educational work throughout the infested sections, assisted by the entomologist at the Experiment Station, in calling the attention of the town and city officials to the fact of the existence of the evil and the great importance of a speedy campaign against it. In all cases their efforts were met more than half way, with the result that in every town visited the work of extermination was at once instituted and pushed with great vigor. In fact some of the Massachusetts papers, in commenting on the work done here, stated that if Massachusetts had shown half the wisdom and spirit that Maine had the pests would have been driven from her midst long ago.

We have realized for years that one great need of our State was a department of entomology at Augusta. The many products of our farms and forests are of too great importance to be neglected or left to the depredation of our insect enemies and plant diseases. We, as farmers and orchardists of Maine, have not as yet come to realize the importance of what seem to be minor details in our farm, garden and orchard management.

The invasion of the brown-tail moth into our State has brought very forcibly to our mind the work done in the state of Massachusetts in its campaign against the gypsy moth in the ten years from 1890 to 1900, when over a million of dollars was expended by the state besides unknown thousands by cities, towns and private individuals in their attempt to exterminate the pest. Their experience in this line at that time was of incalculable value in our campaign last spring. It was the greatest mistake that Massachusetts ever made when the state appropriation was discontinued and the dreadful pest, which had been reinforced by the brown-tail moth, a no less dreaded companion, were allowed to again overstep their bounds and rapidly spread over the adjacent territory and continue their onward march north, south, east and west. In four short years of uninterrupted freedom save by what restriction the towns were able to place upon them, the gypsy moth covered over four hundred square miles of territory. The brown-tail moth, which is a very strong flyer, had spread south into Rhode Island and Connecticut, north to the White Mountains in New Hampshire and had invaded Maine to quite an extent. At the beginning of the present year, the people of Massachusetts were so exercised over the situation that active measures were begun to see if something could not be done to exterminate the pests before they got beyond control. Prof. L. O. Howard, entomologist at Washington, investigated the situation and reported that in his judgment it would be impossible to exterminate the pests. The members of the legislature were so wrought up over the situation that an act was drawn up and presented to the legislature asking for an appropriation of six hundred thousand dollars for the purpose of suppressing the brown-tail and gypsy moths in the state. This passed both houses, but the governor asked that it be changed so that the cities and towns where the invasion existed should be taxed for a part of the expense. This was finally done and the appropriation of three hundred thousand dollars was secured, with an additional thirty thousand for experimental purposes in endeavoring to obtain parasites from foreign countries to assist in the extermination. So that now Massachusetts has a new commission and is again active in the campaign against this evil. This should be an object lesson to us in our work against our insect enemies. The inspection of the nurseries in the State has brought to light the great need of the work to be done in this line. In a number of them I have discovered conditions that were not safe to continue, and it has been a great source of gratification to me to see such a willingness on the part of the owners to have all objectionable conditions removed at once. Such men are outspoken in their appreciation of the work done by the department, and are only too glad to assist in every way the progress of the work.

During these inspections I have discovered other pests that were not previously known to exist in the State. The dreaded woolly aphis of the apple has been found in several localities; the most noted case was in the city of Portland where I found a tree, at least ten inches in diameter, literally alive with them, with its vitality destroyed, practically dead, and standing as a menace to the trees near by. The owner said he would have it cut and burned at once. This pest ought to have a passing notice, as it is a dangerous one to have in our midst. It is rather a peculiar insect, leading a dual existence, one form living on the fibrous roots of the tree, producing galls similar to the dreaded grape phylloxera of Europe, and as hard to combat. The other a white woolly form, found covering the limbs and trunk of the tree. An allied species is very common on the alder, and is especially abundant this season. I have seen whole alder swamps literally covered with this snow white mantle of crawling aphids. But this species will not attack the apple. If an orchard is infested by this insect, it will soon sap the vitality of the trees to such an extent that the best remedy is to cut and burn all infested trees. The root form inoculates the soil so that new trees must not be set in the same places, although pear, plum or cherry trees might be substituted with no evil effects.

The strawberry weevil has been found in several localities in the State. These are only a few of the many insect pests that have been considered during the past season. The much dreaded San Jose scale has reached Massachusetts and will soon find its way here. The gypsy moth has reached Portsmouth, N. H., and it is only a question of time when it will cross the river into Maine.

THE PRESENT SITUATION.

It is rather early yet to predict what the actual situation is as regards the brown-tail moth invasion in our State. As a result of the systematic work done last spring, hundreds of thousands of nests were taken and destroyed. This infested district extended from Kittery on the southwest to Bar Harbor on the northeast, and so effectively was this work done that no serious complaint has come to the notice of the department from any source. This speaks volumes for the enterprise and public spirited enthusiasm of the several cities and towns along the border line. Thousands of dollars were spent and time and energy freely given in the good cause. While inspecting the nursery at Bar Harbor in August I discovered several clusters of eggs of the brown-tail moth and later in the summer and early fall I received a number of nests from there, but the authorities are wide awake to the situation and will do all in their power to rid the island of the nests during the coming winter. In Portland, where a large number of nests were taken, the situation is very encouraging. Of course we would expect that many nests would be found there, as a result of the moths coming direct from Boston by steamer and rail as heretofore.

In Kittery the situation is quite serious, as New Hampshire did practically nothing last year and the state was badly infested, so that we anticipated that this condition would prevail. Last July, during the flight of the moth, I was in Kittery to investigate the situation and found that they were coming by the thousands. The moth is a night flyer and is strongly attracted by a light. They were reported at the navy yard buildings in great numbers, and were killed by the thousands by the workmen employed on the yard. On investigation last week, I found the trees in many localities as badly infested as they were last year; but taking the territory as a whole, I have every reason to believe that the worst is over, *provided,* that a diligent watch is kept up and a vigilant campaign continued each year.

The bulletin on the brown-tail moth will soon be issued. This will give a concise account of the year's work in that line. It is earnestly desired that all possible information of any insect invasion may be sent in to the department as soon as discovered. We can then be in a position to successfully cope with all of our insect foes before they gain a strong foothold in the State. This is the only way in which we may hope to check the gypsy moth and San Jose scale.

(Shows vial containing twig with woolly aphis; twig with San Jose scale; and brown-tail moth in different stages, including nests.)

You notice the dots on the end, golden brown color, the covering of the egg cluster, right on the end of the leaf. When the moth lays the eggs they are white but while she is laying them the hairs pull out from the abdomen onto these sticky eggs and cover the whole cluster of eggs, as you will see in that little case that is being passed. And those are the caterpillars in there. They are live caterpillars and simply hibernate in that form through the winter upon the trees where you can get at them easily—it is your own fault if you don't cut them down if they are in your section,—and early in the spring they are all ready to go to work on the trees the moment the buds start enough to give them a chance to get something to eat—you must know they would be hungry after they have slept all winter. We had them crawling and eating in Portland in April last year.

I will give you a few figures. They took in the city of Portland 122,000 nests of the brown-tail moth last spring. In the banner town of the State they took about 200,000 nests, and that was all done in about six weeks' time. The banner town was the town of York. They appropriated more money than any other town—twice over what Portland did—and as a result they got the largest number of nests; but they didn't get them all. They employed men from Boston to come down and spray for the caterpillars where they didn't get the nests off. One nest overlooked last year would mean from 50 to possibly 150 nests this year.

Dr. TWITCHELL: You spoke about finding these nests and cutting them, but you did not emphasize the necessity of burning them.

Prof. HITCHINGS: I don't know as I did. Of course you want to cut and burn. I am glad that you spoke of that because we did have men last spring that thought if they cut them and let them down on the ground that that was all that was necessary. That would not hinder them very much. In an hour's time, on the first trip to Kittery I made last spring, I found them on thirteen different varieties of trees, and in many places so thick that the trees could not have leafed out possibly. I was there last week. In some places they are thicker than they were last year, for this reason: New Hampshire did nothing practically. All they have to do is to fly across the river, and that is a short distance, and the pear trees there are just loaded, not with pears but with brown-tail moth nests today.

Now I want to associate with that the gypsy moth for this reason, if the gypsy moth gets here it will be worse than the brown-tail, and there is no reason why it should not get here. And it may be here. I have investigated five different reports, two of them from Massachusetts men, one of them a superintendent of one of the parks who had charge of fourteen men working under him in the gypsy moth work, and he declared straight up and down that he saw these egg clusters in the city of Portland a year ago last March. I told him that I thought strange that with the work that we did last spring we didn't discover the gypsy moth if it was in Portland. "Well," he said, "don't you suppose I know the gypsy moth?" I said: "I don't account for that at all." I went to the superintendent and said "How long has that man been employed as superintendent of the park?" He said "A little over a year." I asked him "What did he know of the gypsy moth a year ago last March?" He said, "He probably didn't know much about it." So I came to Portland, investigated where he said they were, and it was the tussock moth. The city of Portland is overrun with another species of insect, and the superintendent of the park commission told me last week that three years ago they took twenty barrels of just the egg clusters of the tussock moth in the city of Portland, and today I think they could do the same.

We had families move down here from the infested district in Massachusetts, right where the gypsy caterpillars were crawling all over their sheds and wood-piles, come down here right in the time of the caterpillars' crawling, and move their stores with them. What do you think of that? Just as soon as it was reported of course the wood was burned. A young lady came this fall. She had a dress that she had hung away, hadn't had it on for two or three weeks. She came from there about the time the caterpillars were spinning their cocoons. She got the dress to put it on, felt a queer sensation on her arm, took it off and found one done up in the sleeve of her dress. There are lots of ways of getting them here. Now why do we dread these? Because they will eat anything—they are like goats, anything but tin cans. Our evergreen trees, if they strip them once they are dead. And so in one way we ought to dread them more than we would the brown-tail. It is true they won't spread as rapidly; but yet those of you who have visited Massachusetts know what the condition is there and how we ought to dread them. They hibernate in the egg through the winter and that is why they will be difficult to find. The moth lays the eggs a little later than the brown-tail, but hides them away. She cannot fly. I have watched probably thousands of them to see if they could fly. I was in Massachusetts during the old commission,—I was teaching there at the time and knew something of the work there, and I have watched them many times. Before they lay their eggs they are so heavy with eggs that they cannot fly practically. I have seen them try to crawl up a tree and almost invariably they would lose ground and come down rather than ascend. They lay about five hundred eggs; and so of course they would not spread as rapidly. While these brown-tail moths might—I won't say they would, but I don't see any reason why they couldn't fly ten miles before they stopped to lay their eggs if the wind was in the right direction. So there is that difference between them. One other thing I will just mention in regard to this brown-tail moth, you have heard so much of it. Why they took such active measures in the town of York was because of the resorts there, York Beach and York Harbor, that received lots of letters from parties out of the State inquiring about the brown-tail and saying that they were going to take their summer vacation in other directions if the brown-tail was here. So the people in York realized what it would mean to them to have their summer visitors go somewhere else and they took the active measures they did. There were a number of cases though of this brown-tail itch, as it is termed. When those caterpillars reach the stage of moults, the skins that they shed,—the hairs have a property of breaking up and working under the skin if they come in contact with the body, and producing a very annoying irritation, puffing up, in many cases worse than any ivy poison, and of course that is what they dread. I know that families move out from infested districts in Massachusetts during that time of the year, and families that were not used to going away from home were obliged to on account of that.

Prof. MUNSON: One question I would like to ask Prof. Hitchings. I heard no reference made to the oyster-shell bark louse, and in some sections of the State I would ask if that is not nearly as serious a pest as the San Jose scale?

Prof. HITCHINGS: It is. I had a case reported to me. A gentleman wrote saying that his orchard was dying—his young trees. He said he knew it must be the San Jose scale. He had shown it to a number of his neighbors and they said it must be. I wrote him I had so many engagements just then I couldn't go for a day or two—but I told him I would come—and asked him to send a twig. He sent one and it was what we term the oyster-shell bark louse—you are all, I guess, familiar with it. I saw some down stairs on the apples. They are shaped something like an oyster shell. They are small, of course, about an eighth of an inch long—one end round, one end larger than the other, and so it gets its name. They are easily treated and you ought to treat them too.

One thing I omitted to say in regard to the San Jose scale. They breed in a different manner from our ordinary insects. Suppose a tree came from New York with one female scale on it in the spring. Under that scale the female would not be quite developed when it reached here but in a short time would reach maturity, and instead of laying eggs she would give birth to young—that is, about ten. They have carefully estimated the number per day and about ten on the average per day would be born, and that would continue for forty consecutive days. There is 400 at once. Then when these little ones were about thirty days old they would give birth in the same manner. Now if you are a mathematician you might possibly estimate the number at the end of the year. It has been figured out by somebody who wanted to take the time to do it, and estimated that it would be about, in the latitude of New York where the season is a little longer than ours in Maine, three billions—three billions in the fall as the progeny of one female in the spring. So you can see whether they are a menace or not, and you can see how many times you would have a spray to kill them. Spray when they are crawling. How are you going to know when they are crawling? You would have to spray every day right through the year after a certain time almost. Of course you can fumigate by having tents to put over your trees and fumigating with hydro cyanic gas, but it would be very expensive.

WHAT MORE CAN THE SOCIETY DO?

D. H. Knowlton, Farmington.

Prof. Hitchings has given us a very concise and clear idea of the practical way in which the Department of Agriculture is meeting with the issue and attempting to control, if not exterminate, the insects that are invading the State.

The question as to what the Society can do—I didn't exactly know how to put it when I formulated it, and I thought it better be put in that way because it might give an opportunity of saying whatever the occasion might seem to call for. I don't know how the Society as an organization just now can do any more than what it has done. But at the same time I do feel that the Society ought to keep the fire burning and keep the interest up all the time, so that when future action may be called for we shall be ready to meet it.

The committee, in formulating and discussing the law, thought a good deal about the appointment of some special officers, a commission or something of that kind, and we decided that we had departments enough now in the State of Maine and that it was not best for us to formulate or to organize any more. So we placed it in the hands of the Department of Agriculture. And now it appears to me, and I think it appears to every one in the State who has intelligently investigated it, that the department has faithfully done its duty, and that here at our meeting we should give some expression of approval of what the department has done.

A great deal of literature has been published in the newspapers, a great many bulletins, etc., have been sent out by the Department of Agriculture and over to the Experiment Station where, I should say, they have been equally active along this same line in their departments bearing upon the habits and the life history of the brown-tail moth. I sometimes feel that all that work has gone for naught because the thing comes to me in certain ways. To illustrate what I mean. During the month of August some one over to Mercer sent word to me something like this: "We have got them in Mercer and I wish you would tell Mr. Knowlton so." Well, he didn't bring any samples with him, and I said, "What is it you have got over there? I would like to know. Something alarming the way you spoke." "Well," he said, "Mr. So-and-so says that we have got the real thing, the real brown-tail moth." Well, I told him that was certainly a very alarming situation, I didn't realize that they were so far into the interior of the State as in the town of Mercer. I thought—I certainly hoped there must be some mistake. But he said that they had surely got them. Then I said, "What is it about them?" Well, he talked away a little about them. He knew nothing about insects. After a little he told me what the insects were doing. Well, it happened that the State entomologist didn't get any job on that because from what little he told me about the habits of the insects I readily identified them, because only a little while before somebody nearer by had brought me some of them. They were simply the red-humped caterpillars. I judge they must be rather more numerous this year than usual. I felt somewhat chagrined that the good people over to Mercer didn't know those were not brown-tail moths.

Well, now, one thing I try to impress upon Commissioner Gilman, and every one in connection with this work is the importance of educating the people, educating the boys and girls, so they will know not only what these insects are but so that they will know what other insects are.

One thing as individuals we ought to do. In every way we ought to second the effort of the department to educate the people—boys and girls, men and women. If you have got an insect out on a tree that is troubling you, go and look at it and see what it is, and if you can't find out definitely what it is and it is making the least bit of trouble, why put it into a box and send it over to Prof. Hitchings and let him tell you what it is. And then if he tells you, try and remember it. Now we have during the year on all of our farms more or less troublesome insects. Some of them we know about. Some of them we don't. And there is an object for study. There is an object of thought. I suppose those insects were all created for some wise purpose. I suppose so—I don't know—because I can't very well call in question the wisdom of Nature's works. At the same time I can say that I have sometimes thought that these insects were just like some other things that we have—they are intended on purpose to make us work a little harder and make us fight better for a living than we should if they were not there. Sometimes it makes us stronger men and women. Sometimes when we allow them to run away with us, we don't recognize the cause perhaps, but they do us a good deal of injury. So then as individuals we want to cooperate in every way we can with the Agricultural Department. They are doing some fine work over to the State College in the Agricultural Department in educating the students who are there, in what this thing means. I wish more might go there. They have not got half as many as they ought to have.

Now I don't know that I can emphasize what I have said any more than I have, but there is one other incident which happens to occur to me just now. I enjoyed it very much, this particular incident. Quite a number of the cecropia cocoons have been sent in to me, in one case in particular a letter was written and a postage stamp was inclosed for a reply—"What is this? Is this a brown-tail moth nest, or what is it?" It was a beautiful cocoon, a large one and a very handsome one indeed, and I took pleasure in writing back what it was. That which gave me the most pleasure was what followed. One of my neighbors has a very sweet little girl in one of the primary schools, wide awake, looking for all the good things there are in life, and she came over to my house one evening. I said to her, "Ruth, I have got something for you." Well, she looked up as bright as could be, and I asked Mrs. Knowlton, who was near it, to hand her that cocoon. The little girl looked at it with a great deal of interest and pleasure and said, "I heard something about this the other day and I didn't quite know what it was and I am glad to find out." I told her how she must take care of it, and I did a little differently from what some of the Washington city teachers do. The principal of the kindergarten school there wrote me a little while ago, and she called attention to the custom which certain teachers had of sending west and south for cecropia cocoons to use in their schools as object lessons and then giving them to the children. The children examined them, carried them home, and then instead of destroying them as they ought to, had the fun of seeing the moths emerge from the cocoons and fly away to suit themselves, and nobody knows how many sections have been cursed by the introduction of these insects, which, however beautiful they may be, are harmful to fruit trees.

Now I wish to emphasize just this—I have already said it—help the department in every way you possibly can. Seek information from them. Give them information if you can. Let us all pull together and we will hold back this plague for some years to come and I hope permanently.

REPORT OF COMMITTEE ON NEW FRUITS.

Professor W. M. MUNSON.

Since the purpose for which fruit is grown varies greatly, as do also conditions of soil, climate, market and personal choice, he is indeed a brave man, or a fool, who will attempt to give a definite and categorical reply to a question as to the relative merits of varieties. However, in these days of progress along all horticultural lines, when each year brings forth new varieties or new types of fruit specially adapted to certain local conditions, it is necessary for the progressive fruit grower to keep in touch with advance made along lines in which he is particularly concerned.

The purpose of the annual report of the committee on new fruit, as provided for at the last meeting of the society, as understood by your present committee, is to inquire into the merits of such of the new fruits as are offered for sale in the State, and also to judge carefully the new seedlings which are of local importance to the State.

Within the limit of this report it is impracticable to refer to all of the meritorious fruits of recent introduction, or even to describe the seedlings which are of local prominence and possibly worthy of future dissemination. A few of the more important must suffice.

APPLES.

Of the newer apples which have been introduced from the southwest, little can be said as yet, as very few of them have yet fruited in Maine. It may be said, however, that like the Ben Davis, most of these varieties are probably better suited to the warmer climate of Missouri and Arkansas than to our own more rigorous conditions.

After a long and bitter discussion, it is generally conceded that there is a slight difference between *Gano* and *Black Ben Davis*, but it is too early to say that either of these varieties, if they are distinct, will take a prominent place in the Maine orchards.

Sutton, which has been considered more or less at the meetings of this society, while an old variety has only recently become prominent. It is a vigorous and upright grower, hardy and healthy under high cultivation, but it will not stand neglect. It is very doubtful if this variety can ever supplant Baldwin as a popular favorite, where the latter can be grown.

Arctic is one of the most robust of the newer varieties and is widely planted in a central part of the State. This is somewhat of the Baldwin type, though much larger, hardier, and of more vigorous habit. The variety may be described as follows: Tree very vigorous, spreading. Fruit medium, roundish-conical; greenish yellow, heavily overlaid with crimson on the sunny side, with splashes of a deeper shade and numerous lighter dots; flesh yellowish, crisp, juicy, brisk, sub-acid. Good December to March.

Among the more valuable of the recently introduced hardy apples is the *Northwestern Greening*. This apple is being widely disseminated in Aroostook and Northern Penobscot counties and seems worthy of planting. The variety originated in Waupaca county, Wisconsin, on the farm of Mr. J. J. Hatch, from seed planted about 1862, and was first propagated by E. W. Daniels of Aurorahville, Wis. It was first exhibited at a horticultural meeting in 1875, and at once met with favor, so that it is now widely spread over Wisconsin, Iowa and Minnesota.

The fruit is large, regular, conical, pale green in color; remrakably uniform in size, color, form and freedom from disease and insect attack. The stem is rather long, in a deep, moderately wide, flaring, but regular cavity; basin medium, calyx closed. Flesh firm, juicy, fine grained, white, a little tough and consequently keeps well. Good. Season December to March.

Collins is an apple which comes to notice from Cherryfield, and was brought to the writer's attention by Mr. David W. Campbell. The tree is vigorous, spreading, productive. Fruit large, roundish-conical, yellowish-green, washed and splashed on sunny side with deep crimson; stem medium, stout, inserted in a moderately deep, flaring, regular cavity; basin small, irregular, calyx closed; flesh greenish white; fine grained, crisp, tender, mildly acid. Good. November to February.

SMALL FRUITS.

The progress made in the culture of small fruits during the past twenty years has been rapid and substantial, but even at the present time the importance of this branch of horticultural work is not fully recognized by the people of the State. From the very nature of the soil and climate of Maine, we must look to intensive rather than to extensive operations for the most satisfactory returns. With the increasing importance of our summer resorts, new and extensive markets are opened; while the operatives in the factories are always large consumers of fruit. For this reason the culture of small fruits seems to offer a specially promising field at the present time.

With the small fruits there is often a marked change from year to year in the estimated value of the leading varieties. In fact varieties come and go, with the leading growers, before they are even heard of by the great masses of the people.

The particular kinds of small fruits in which the growers of Maine are, or should be, specially interested are the currant, gooseberry and strawberry. Our conditions are particularly adapted to the production of the best of all these.

Currants. To the well-known Fay, Red Dutch, and Victoria, Wilder (or President Wilder) was a welcome addition as a profitable market currant as well as a satisfactory home berry. It is a very productive red variety, ripening about with Fay, and is without the unfortunate tendency of the latter, to spread its outer branches and break down in winter.

Prince Albert is another sort, which while grown for a number of years in New York and other sections, is seldom met in Maine. This is a very vigorous and very productive variety and has two specially valuable characteristics, in the lateness of maturity—after all other sorts are past their prime—and in its relative freedom from fungous diseases which frequently defoliate other sorts early in the season.

Perfection is the latest claimant for honors and was awarded the Barry gold medal for a new fruit of superior merit, by the Western New York Horticultural Society in 1901. My attention was first called to this variety at the Pan American Exposition in 1901 and it was first commercially disseminated in 1902. The variety is the result of a cross between the Fay and White Grape, made by Mr. C. G. Hooker of Rochester, N. Y., in 1887. It was introduced by C. M. Hooker & Son of Rochester. The bush is a strong grower with excellent foliage, and bears the fruit chiefly on the old wood—like the White Grape parent. The fruit cluster as officially described by W. A. Taylor, U. S.

An orchard scene on farm of Stephen Spaulding, North Buckfield.

Department of Agriculture, is "long, cylindrical, tapering but slightly with long stem; berries spherical, uniformly large, adhering tenaciously to the short, stout pedicle; color bright crimson; skin thin, moderately tough; flesh tender, translucent, juicy; seeds medium in size and number; flavor slightly subacid; quality good to very good; both for dessert in the fresh state and for cooking." The variety fruited for the first time at the Experiment Station this year. While the clusters were not quite as large as those seen previously, the fruit was of delicious quality and of superior size.

Gooseberries. No new varieties of this fruit have come to the writer's attention during the past year. For home use and for market nothing is superior to the old Downing.

Strawberries. To attempt to describe, or even to enumerate, all of the new claimants to a position of popular favor would be both unwise and tedious. Local conditions determine the success or failure of a given variety of strawberry to a very large extent. It may be said that just at this time Dorner ("Uncle Jim") comes nearest to holding first place. It is a perfect flowering berry, of large size, good quality, and *very productive.* Dunlap, New York, and Sample, are popular with many. The latter is attractive in appearance and is productive, but is too sour. Gibson and Brandywine should not be overlooked in securing berries for the home garden. The latter is also a favorite market sort with some. But with all the new varieties the old Clyde and Glen Mary still hold a strong place in popular affection.

In concluding this brief report, your committee would urge the members of the society to keep in mind the new things as they appear; and in case novelties are urged upon them by the ubiquitous tree agent, to mention the fact to the officers of the society, or to the committee, for investigation. In this way only can the most effective service be rendered.

I wish to ask any member having seedling apples of local importance to call my attention to these apples and forward specimens to me at Orono that I may photograph them and look up their history. If they are valuable, this Society wants to know it. Share the good things that you happen to have in your section of the State.

STORAGE OF FRUIT AND INSPECTION.

HOME STORAGE RESULTS.

F. H. MORSE of Waterford.

This subject is one that is altogether too large for me to handle, but as I have had a little experience along this line which has been to the advantage of my own pocketbook, there may be those here who would like the advantage of that experience.

After twenty years experience in picking, storing and marketing apples—ten years without any special place for storing them and ten years with storage house built for the purpose, I am fully convinced that every orchard should be provided with some sort of storage room.

Under favorable circumstances some cooperative plan might be used to advantage. But as many of us are situated, as in our own case with no other large orchards near by, we have found that home storage can be used to great advantage.

Anyone who has helped to harvest the apples from an orchard of any size knows that with the present scarcity of help, a place very near where they can be safely stored until wanted for market, must be of great value. When we decided we needed such a building it was very hard to decide how it should be built. I saw in Thomas's Fruit Book a description of one built with two partitions and sawdust packings—as some ice houses are built. But after going to see two or three fruit houses and consulting several of our best orchardists, we decided to build on the dead-air principle.

Our house is built with four air-tight partitions, making three dead-air spaces on all sides. These were made by two thicknesses of boards with sheathing paper between. The outside and inside of the buildings are of sheathing boards, all the other parts are made of the very cheapest materials. The work needs to be very carefully done, as upon the tightness of these partitions depends the success of the building. We have two double windows fitted with shutters outside and in. For common use we have an ordinary door large enough to back our double team into. But when we shut it up for winter we have an extra door with an air space in it.

As an aid to cooling the apples when they are first put in and for ventilation there is a flue about ten by twelve inches. This opens from the floor opposite the door, goes down four or five feet then runs off about twenty feet into a hollow. There are also two small flues and a movable stairway leading to chamber above. The stairway is so constructed that when the stairs are put up it makes an air space like the rest of the ceiling over head. This ceiling is of two thicknesses of board and one of sheathing paper and the floor of the chamber is made in the same way, making an air space. The underpinning was carefully fitted and a mixture of lime and cement used for pointing. So it is supposed to be air-tight, except two small places that were left for ventilation.

We have been using the house for eleven seasons and have found whether the apples were packed in November, December or February, they have come out in almost perfect condition—except three years ago when the scab and black spot ruined so many, and that year they kept until the last of March when nearly all of them were in as good shape to evaporate as they would have been in the fall. We store them just as they are picked from the trees. In picking we are very careful about bruising, but do not stop to remove any leaves or stems that come off with the apples.

Our experience leads us to believe that apples can be stored in this way with as little waste as if shipped to cold storage. This largely because they can be put in here immediately after picking. And although not as cold as in the regular cold storage house the evenness of the temperature favors the keeping. We have known the house, after once being cooled down to about freezing to remain weeks without changing a degree. One year they were sorted the tenth of November but the buyer decided he would not ship them at that time. They were left in the barrels without heading. At the end of three months, when he wanted them they had kept so perfectly that it was not necessary to re-sort before shipping.

If an orchard is fitted with a storage house it enables the owner to use his judgment as to when to dispose of his crop instead of being obliged to sell as soon as picked. We made enough in this way on our crop in 1900 to more than pay for the building. And there have been a number of years when we have obtained from 25 cents to 50 cents per barrel more for our apples by holding them awhile. And as the shrinkage has been almost nothing the income from the orchard has been very much greater. Our orchard has outgrown the house, and we have felt so well satisfied with the working of it, that we have commenced on another and larger room on about the same principle.

Dr. TWITCHELL: Mr. Morse, do you put these in in bulk or in barrels?

Mr. MORSE: Both ways. For the last three years we have put part of them in bins and part in barrels. I think perhaps they keep fully as well in the bin. We leave spaces between each board and that gives a little more chance for the air to circulate.

Question: On the bottom as well as the sides?

Mr. MORSE: Yes, but of course as soon as the weather gets cold enough so that the room is cooled down, then we shut it up and there is no ventilation at all any way—it is air-tight—and we keep the dead air in that all winter. I may say right here that this building is a mile and a half away from home. This of course is a disadvantage as far as cooling it is concerned. If we had it at home, when it was cool we could go out and open all the ventilators and then in the morning close them, and thus cool it off better. Still it is really as nearly perfect in my mind as anything need to be in that way.

Dr. TWITCHELL: What is the size of your building?

Mr. MORSE: The outside of the building is 26 x 30, and the capacity set in in the barrel is about 600 barrels. In 1900 by putting them in in bins we put in enough so that we packed out 600 barrels of marketable apples from it.

Question: Do you put in any artificial heat, stove or anything of that kind?

Mr. MORSE: No, it isn't fitted for that, only as we have put in a lamp or something of that kind when it hadn't been shut up properly and got a little colder than it ought to be. Apples have been in there when it was 25 below zero and come out all right. In all the years we have used it we never have lost a peck of apples from freezing. We found a few two or three times when we were packing that were chilled a little, but by picking them up without touching them with our hands so as to spot them the frost would come out.

COOPERATIVE STORAGE AND THE OPERATION OF THE FRUIT MARKS ACT IN CANADA.

WILLIAM CRAIG of Auburn (formerly of Canada.)

Cooperative storage and marketing can be operated successfully by a number of fruit-growers residing within a radius of eight or ten miles incorporating themselves and securing a storage and packing house combined, near a railroad station. It usually consists of a good sized insulated building with basement in which the winter varieties are held until satisfactory prices are secured. Artificial cooling is not necessary. Temperature being regulated by ventilation or opening when cool. Dead-air spaces in the walls are absolutely necessary to resist fluctuating temperature. So much for the building.

A competent packer is engaged whose duty it is to supervise the packing, make sales and attend to the shipping. The fruit is sorted into 1's and 2's as soon as delivered by the growers. Culls are returned and each man is credited with his share of salable fruit. The cost of packing at a central station of this kind is from 10 to 15 cents per barrel. It is true in most instances that the individual grower loses his identity but does so for the benefit of the common cause. But there are instances where cooperation is carried on successfully, the individual putting his name and address on his fruit. These few points which I have touched upon briefly cover to a great extent, the cooperative system as practiced in many places.

The advantages, you can easily see, are many—as purchasing barrels and boxes in car lots, better prices are obtained, the fruit being of a uniform grade—lower shipping rates are secured, and the small orchardist by cooperating finds sale for his fruit; otherwise they are often overlooked by the buyers. In Canada they not only cooperate in packing and selling, but in purchasing spraying apparatus, carbonate of copper, Paris green, etc., at reduced rates. Local conditions regulate the rules in cooperation and each association forms rules to suit itself.

Next in order I will say a word about the *Fruit Marks* act passed in 1901. This going hand in hand with the cooperative system has worked marvels in connection with raising the standard in packing fruit. As you know it was passed by the Dominion legislature for the purpose of remedying some evils which existed; principally that of overfacing, also that of fake marking. Far too many different expressions were used. No. 1 choice was not sufficient nor was the name of the grower and address always marked. But under the act of 1901, every closed package must have the address of packer, name of fruit and grade, which must be one of six: No. 1, or XXX; No. 2, or XX; No. 3 or X. It is also enacted that no person shall pack, sell or have in his possession for sale, any package marked No. 1, or XXX that does not correspond to a definite standard for that grade. This section reads: "No person shall sell, offer, expose, or have in his possession for sale any fruit in a closed package upon which package is marked any designation which represents such fruit as No. 1, or XXX finest, best or extra good quality unless such fruit consists of well grown specimens of one variety; sound and of nearly uniform size, of good color for the variety, of normal shape and not less than 90% free from scab, worm holes, bruises, and other defects and properly packed."

In conjunction with the Fruit Marks act eight *inspectors* were appointed with a few temporary assistants for the busy season. Now this force has made a marked change not only in apples but in the general fruit trade of Canada. The inspectors have power to enter any warehouse, car or steamship. The cost of enforcing this act was not great. The Dominion government appropriates $20,000 annually and half of that goes towards educational purposes because the inspectors when not engaged in actual inspection of fruit are addressing fruit and orchard meetings.

Mr. KNOWLTON: Are these cooperative storehouses owned or operated by the government?

Mr. CRAIG: Oh, no.

Prof. MUNSON: These cooperative fruit houses are in actual, practical operation at the present time?

Mr. CRAIG: Yes. I have the addresses of men who are willing to give information on the subject.

Prof. MUNSON: May I ask further in regard to the marketing of this fruit after it is thus stored? Is there a cooperative association which attends both to the storing and to the marketing of the product?

Mr. CRAIG: The man that has charge of the packing also has charge of the selling the same as in the cooperative cheese factories. I suppose that that matter would rest with the people, whether they would appoint a salesman, an actual salesman, or have a packer who would be capable of making the sales. That would be a matter of local option, I think.

Prof. MUNSON: Two or three years ago I tried to present before the Society an outline of cooperative marketing, and urged upon the Society the importance of just the line of work which Mr. Craig has given to you tonight. I believe just as strongly today as I did at that time that cooperative storing and marketing is essential to the highest success in fruit growing in New England. As I have said so many times before, we have a lesson to learn from our California brethren. They have solved the problem of marketing. And until we Yankees get over our provincial characteristic of trying to get ahead of the other fellow every time, why we are not going to succeed so well as our California friends do.

I was talking today with a large shipper of fruit who is with us—and he has been interested in our Maine fruit for several years—and I was pained, but not surprised at the report which he gives us of the attitude taken in the foreign markets toward our Maine fruit. He tells me that Maine does not hold the place in the foreign market that she did three and four years ago, for the reason that our fruit is not packed properly. Now that is something we have been drumming and drilling on every year, but it has not been brought home to us as it is when a man comes to us directly from the foreign markets and says, "Here, you fellows, you have got to pack your fruit better or you are falling behind." Now that is just the condition we find ourselves in at the present time. This matter was brought up at our meeting last year, and in discussing this matter of cooperative marketing and of honest packing—I don't think any of those people are here,—but do you know, those other fellows said, "Why, I don't care what the fruit is after it is packed. I grow the fruit and if they are fools enough to put in all their old rubbish, why the money is in my pocket, I don't care." Now isn't that kind of a selfish way to look at it? It is just that don't care spirit that is ruining our reputation in the State of Maine. Now I desire for this Society and for the friends of Maine, for those who take an interest in Maine's reputation, to rise up and use not merely moral suasion but if necessary legal suasion to insure honest packing of fruit.

Mr. R. E. McLatchy: I have never said anything before an audience before, but I have had considerable experience in sending apples to the European markets. When I first came into the State five years ago, I found the business very satisfactory. The apples seemed to be of fair quality and they seem to have been packed in a better manner. Three and four years ago a lot of money was made by the buyers and dealers in shipping apples to the foreign markets. From that started the great competition in buying. The buyers went out over the country and they were very anxious to get the fruit. In order to be favored by the farmers in securing their apples why they would make concessions in the way of taking their poor stuff, taking the apples that in former years they had thrown out entirely. And since they commenced doing this I have noticed that the prices have dropped off as compared with what Canadian and Nova Scotia apples bring. Since the Fruit Marks law went into force in Canada the Canadian apples have been having a prestige over Maine apples with the exception of some western New York or Vermont. I don't know hardly what to suggest in regard to a remedy other than this, that the Maine fruit growers should have a regulation in regard to grading the same as they have in Canada. I think if that should go into effect that the Maine apples would again take prestige above the Canadian apples. I feel quite sure of it. The Maine Baldwins in 1900 and 1901 were invariably better than the Canadian. This year they are from two shillings to four shillings below the Canadian. That is as far as I know.

Prof. Munson: In your judgment the practice of selling number ones and twos together is detrimental to the trade?

Mr. McLatchy: I think it is, yes,—unless they have a mark and only put good apples in the barrel. They can grade their apples down to two and one-fourth inches,—face them up well and run two and one-fourth inches through the barrel. That class sells well. But when they go to putting in green apples and wormy apples, it make a great difference. I think it is the wormy apples and imperfect fruit that has hurt the market more than anything else.

Prof. Munson: We hear a great deal about farmer-packed fruits in a kind of a sneering way. Is it your experience that the farmer-packed is worse than the professional?

Mr. McLatchy: In 1901 I handled something like ten thousand barrels of farmer-packed fruit. The farmer-packed brought the top of the market and there was no complaint whatever in regard to their packing. In soliciting the business from the farmers they are very careful in impressing on them the way apples should be packed, and in many cases they were packed in a great deal better shape than the dealers pack them.

Mr. True: It seems to me we have got to have a radical change here in some way—I don't know how we are going to get at it—but the way it has been if a man comes to me and wants to know if I have got two, three or four hundred barrels of apples to sell, why, I have got to say, yes, I have. "Well, what do you ask for them?" "Well, I think I ought to have about so much." "Well, I will give you so much and come and pack them." Well, that is a square business transaction, sell him the apples and he comes and packs them as he sees fit, pays so much a barrel, and he puts in about everything there is there. And we get the money and we are glad of it, for that time. But next year—our fruit, as Mr. McLatchy says, is getting a black eye—and the next year he cannot pay us quite as much and we have to set our price a little lower. But he takes them all and we are glad of it. And the next year a little worse. Now what is going to be the remedy? We have got to have some radical change here in some way. All I want is the man to rise up and tell us just what we ought to do. Is the trouble with the packer or the grower? He comes and packs the apples but unless he cleans them all up the grower is on his back.

Mr. E. E. Hardy: I believe the trouble is with the grower. Just like the man up in Franklin county that makes maple syrup and wants to get rid of it all, and the market is a dollar a gallon for anybody who makes good stuff. He cuts the price to 75 cents and he gets $75 for his 100 gallons. The other fellow holds his price up to a dollar and gets $75 for 75 gallons. Now the fellow who would talk apples in that way would get good prices for them in the end.

Prof. Munson: There is one thing about this discussion, while it may not result in anything this year and it may not next year, if this Society keeps everlastingly at it the time is going to come within a very few years, I am satisfied, when the growers of the State of Maine, backed up by law, can say that the fruit which goes out from the State of Maine is just as good as the fruit which goes out from the Province of Ontario or the Province of Quebec. Some one will say very likely that the buyers will say "If we can't get Maine fruit without this inspection, why we will go to New York" and so on, but you know as well as I do that that is not going to be the case. There are lots of people that are going where they can be sure of getting the best, and I believe in the near future if we keep at it, keep agitating this subject, that we are going to get some laws which will help us to insure the sending forth of first-class Maine fruit with the Maine mark upon it. Let us keep at it.

Mr. DeCoster: This is an important question that should interest all of us. I was talking with a commission man who told me that it would pay him lots of times to go through barrels and sort them. You don't realize what a peck of apples means—pick out that peck of apples and thereby you can get a dollar more for your barrel. I tell you I believe the time is coming when we have got to look after this packing more than we do. I believe the time is coming when we shall have a little pride in the matter, feel like putting our name on every barrel that is shipped, stamp our name, have stencils of our own, and pack them accordingly.

Mr. Craig: I omitted in my remarks on the work of the inspectors, how it varied. It seems to me it would be the easiest way to get over the difficulty in Maine if you could have inspectors who would stay at the ports and railroad stations and not look over every barrel but one in a car lot and so on—that is the way they did in Canada. And the first year they prosecuted only two individuals, I believe, but gave warnings. The next year there were fifty-five prosecutions, and I understand that last year there were very few, only something like twelve. And now they prosecute every case they come across that is not up to par. They have, as you know, number ones and twos of a certain size, and if they are not up to the regulation, if the face is not a true representation of the barrel, they are prosecuted. Now I have an idea that that is about the only way you can get out of the difficulty here, to bring it about by public inspection the same as we have in Canada.

FEASIBILITY OF LEGISLATION, ETC.

The following recommendation was passed at the last annual meeting: Recommended that a committee be appointed to consider the feasibility of legislation regarding the grading, marking and inspection of fruit along the line followed in Canada and in sister states and report at the next meeting.

Report on above. Dr. George M. Twitchell.

What a mercenary spirit has got hold of us all! I wonder if there is a man present that does not feel like Brother True, that he wants to get all he can out of his apples and if he can squeeze a few dollars more he would like to have it. Now isn't that the spirit that is in us all, we want all we can get and a little more and then we want another dollar?

We have been discussing the growing of fruit, and this subject of storage and marketing comes in now as legitimate, and really as all essential. I believe if we would drop for a while this matter of new varieties, which always interests us, and would give our attention sharply and concisely, clearly, to the subject of storage and of marketing—how and when and in what manner, under what laws, that we would reach results which otherwise are impossible. The story is told of an old deacon and his wife on a stormy Sunday starting for church. The snow was deep and he could not get his horse out. She insisted upon going and he said, "Very well, then I will go ahead and you can follow me," and he started. But unfortunately she put her left foot where he put his right one, and the poor old lady has been walking cross-legged ever since. Now it seems to me that in this work we are talking of growing good apples, we are seeking to get the best varieties, we are studying the question of cultivation and fertilization, emphasizing all those lines, and yet it seems to me we are walking cross-legged in our work and because of that we are losing. We are selling to any buyer who comes who we think will give us a little more than the other fellow, and allowing him to pack and grade. I stood by the side of a farmer a few days ago as they were packing his apples, and I said to him, "Would you pack apples as these men are packing them if you were sending them to market?" He said, "No, sir." "Then why do you allow him to?" "I sold him the lot for so much a barrel right through." They go out as Maine Baldwins, were stamped No. 1 Maine Baldwins. No wonder they are from two to four shillings behind the Canadian Baldwins that are graded and inspected. We want all we can get and we think we are out from under the responsibility when a man comes and takes our apples and pays so much per barrel for ones and twos and packs them himself. And yet that very course continued is going to ruin the fruit prospects in the State of Maine. We are putting the stamp of the State of Maine on an inferior quality of apples,—that is what we are doing. We are saying to the world, "These are No. 1 Maine Baldwins, the best we can grow," and they are wormy and they are small and they are gnarly and they are inferior. Why? Because the man who bought them thought they would pass on the market. They grade them from a commercial standpoint solely. They are looking after the dollars and cents and they are grading from that standpoint entirely. They take whatever will pass as a No. 1 Baldwin, and you and I and others who are trying to grow Baldwins in the State of Maine have to take the responsibility when they reach the great markets, and the State of Maine is graded two to four shillings below Canada. If we are satisfied with that, let us let it go on.

How many wormy apples do you suppose there were in those boxes of Kings that Mr. Pope sent to Boston and got $2.50 for? Do you suppose that he could grade apples in that way and sell at any such price? That is this year, his Kings; selling his Gravensteins for $2.50 to $3 a box,—a bushel box, $7.50 a barrel. Do you suppose it would be possible if they were graded by one of these buyers? There is no criticism to fall upon these men. They are measuring the business purely and simply from a commercial standpoint. They are after the dollars and they are sharp too, and they are going to pay just as good profits as they can afford to pay, and they are going to put in the barrel everything which they think will pass in the market to which they are going and bring the price—measuring, I say, the business purely from a commercial standpoint. And that spirit of commercialism unless we look out is going to injure the State of Maine seriously.

This subject, to which Prof. Munson called attention two years ago, came up again last year and this resolution looking to the grading of the fruit was put into my hands and I was asked to look it up and report at this session.

I have here a letter from the chief of the fruit division at Ottawa, written in the spring of this year, which I would like to read. Touching the Fruit Marks act, he says:

"I am sending you a copy of the Fruit Marks act of 1901. This act is enforced by nine government inspectors appointed under section 12 of the act; there are also as many temporary inspectors appointed during the busy season. We examine only a very small percentage of the entire output of Canada but all packages are liable to inspection. We are fortunate in having the greater portion of the apple crop leave Canada at the port of Montreal, so that the examination at that port practically catches all the export trade till the end of November. The results have proved very satisfactory. The number of prosecutions last year was forty-three. It is not at all likely there will be as many prosecutions this year, though there will always be a necessity for inspectors and prosecutions. The packing and grading of fruit in Canada have been greatly improved as a result of the enforcement of the Fruit Marks act."

I will read a few portions of the Fruit Marks act.

"Every person who, by himself or through the agency of another person, packs fruit in a closed package, intended for sale, shall cause the package to be marked in a plain and indelible manner, before it is taken from the premises where it is packed" and then it provides for the marks.

"No person shall sell, or offer, expose or have in his possession for sale any fruit packed in any package in which the faced or shown surface gives a false representation of the contents of such package; and it shall be considered a false representation when more than fifteen per cent of such fruit is substantially smaller in size than, or inferior in grade to, or different in variety from, the faced or shown surface of such package." Then it goes on to provide for the penalty.

Under that law during the past five years, you have heard from those who have preceded me the results, the improvement—and naturally the improvement in price in the market this year.

"While in England last winter," writes Mr. M. E. Kyle of Oakville, Ontario, "I found the Fruit Marks act had done a great deal to improve the standing of Canadian fruit on British markets, although even yet some of the fruit shipped from Canada is not what it should be. Unless shipments of inferior fruit can be stopped, our trade will continue to receive more or less injury."

So you see our fruit growers across the line are working pretty sharply along this line. Now to some such legislation I believe we must come in the State of Maine. And yet I realize the fact that this legislation cannot be local. It must be National. We took the initiative in this State Society on this side of the line. The New York Fruit Growers' Association a few weeks ago discussed this same subject and appointed a committee to consider the matter of a law which should govern the grading of the fruit. Others are waking. Now are we to go forward in this matter or not? Are we as a Society to continue our work along this line and keep, as Prof. Munson says, everlastingly at it until something is gained and a law is passed which will necessitate the observation of certain rules and requirements, and insure as a result that uniform grading which will restore the State of Maine to its rightful position? Or are we to trust to the general work of education by the Society and by individuals which will arouse on the part of the growers more of pride in their work and pride in the State, and reach this by individual efforts?

Now one of the two courses alone is offered to us. We reach the result by one course through legislation which forces a man to do. We reach it in the other by the more indirect way, which is more difficult always to see and note the results and to secure that cooperation which is absolutely necessary.

I wish we could discuss the question of practical cooperation along these lines, as in the work which is being done in some localities, but tonight we are discussing this question of the Fruit Marks Act. How are we to do this, or how are we to take the next step? It seems to me the next step for us to take is right along the line of securing, or rather of working to secure National legislation because State legislation will fail us. We cannot reach and control the conditions by and through State legislation. We must have National legislation in order to reach results. This Society can do no better service to the fruit interests of the State than by taking up this question and kindling an interest in the great subject which will ultimately lead to that proper, rightful and just grading of our fruit which shall stamp it for what it really is and insure to the grower all that is possible as the result of his labor. This I believe to be essentially necessary for us. Or else, I say, we must fall back upon the other alternative and take up the work of individual education and stimulation of pride on the part of growers in order that they may come to realize the necessity, and the sure returns which will follow. If we feel it now, ultimately we may feel it in larger measure. Unless there is a more thorough and careful grading of our fruit, ultimately there is coming to us a larger measure of loss than we have yet met. We cannot sustain our reputation very long unless there is character behind it, and that character calls for honesty in dealing.

And therefore, Mr. President, I submit this resolution:

Resolved, That this Society, recognizing the substantial growth of our fruit industry and realizing the necessity for a more critical grading of the stock, for the protection of the grower, declares in favor of National legislation looking to a Fruit Marks Act, and authorizes the appointment of a committee whose duty it shall be to correspond with the officers of the Fruit Growers' Associations in the several states, and if a general sentiment is found favoring such action to arrange a conference for the purpose of outlining National legislation, said committee to be authorized to expend a sum not to exceed fifty dollars for postage and necessary printing and expenses, a full report to be made at the next annual session of this Society.

[The resolve passed and Dr. George M. Twitchell was appointed the committee created by the resolve.—*Secretary.*]

THE GOSPEL OF CHASE'S MILLS.

SOLON CHASE.

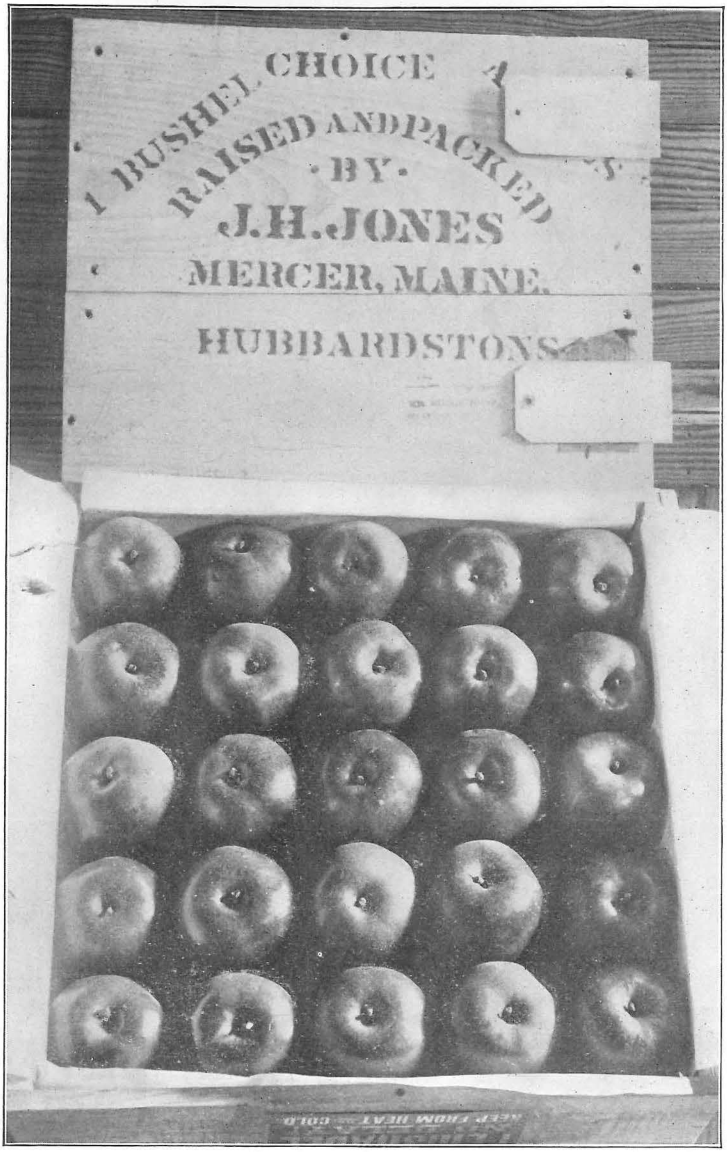
"The fault, dear Brutus, is not in our stars, but in ourselves."

What we need is to raise better apples and more of them. Now I have got a trademark that I put on one brand of my apples and it counts. Whenever I take out a barrel of Spies and put them steers right on, whoever gets that barrel of apples will want another one every time.

My friend Knowlton came down to Turner, my home town, a few years ago and addressed a meeting and I was there. I had begun orcharding then, and what I got from that meeting has helped me a good deal. I got in the first place an idea to raise small fruits. From that time to this I have had plenty of small fruits all the time for my use. I have not raised for market. I had then got my interest on Northern Spies. They call me a Northern Spy crank. Well, perhaps the time may come when they will call me a Northern Spy king instead of a crank.

Any fellow can pack a good barrel of apples, but the man don't live that can make a good barrel of apples out of inferior fruit. There is where it comes. It is right back there. We have got to raise better apples or get out of the market. That is what we have got to do. The possibilities of the Maine apples are just immense. I can see that. I know it. My method has been a liberal use of the harrow, the handsaw and the jackknife. I had rather plant a Northern Spy in a sand bank than in witch-grass sod. I put them steers on a barrel of apples and they will go anywhere. I have got three hundred of them in the cellar now.

I am interested in this talk about cold storage. I have got cold storage in my cellar for 300 barrels, but I can see prospects ahead for 1,000 barrels of Northern Spies. I am eighty-three. I haven't got to live many years more before I shall want cold storage for 1,000 barrels of Spies. Apples in my cellar will be in perfect condition the middle of next May—keep longer if you wanted them to. My cellar is not a warm cellar. It is a moist cellar—frost sometimes a little—if they do it won't hurt them any. All you have got to do is to let them alone. If they frost a little, they stand right where they are and don't ripen. If you have your cellar warm they will ripen and soon perish. The



Box of apples shown at Maine Pomological Society, 1905. Sent to Governor Cobb, with compliments of the Society.

man was at my house the other day who took them last year and the year before and he said to me, "Why, they are in as good cold storage here as any place in Boston." Ain't going to be fit to eat till along in April and May, and when we get at them they are good easy eating, I can tell you that.

Now here we are in the State of Maine with most of the apples growing wild like a beechnut. Beechnuts grow wild and they bear once in five or six years. Now I get a crop of Northern Spies every year. They are surer than corn. Most of the farmers don't deserve any apples and don't have any faith that they are going to get any apples, and haven't got faith enough to provide themselves with barrels. But today in the State of Maine we are getting more out of the apples than we are out of the corn, and sweet corn,—more in our town, and all of the towns where there are sweet corn factories,—get more out of the apples than out of the sweet corn—and when they all grow wild. What in the devil we are thinking about I don't know. They grow wild so well I suppose they think they will get them any way. But now let me tell you that if you will go into your orchards and cultivate your orchards as you do your corn fields, you will have no trouble about this bad packing, not the least mite of it. Cultivate the ground. The ground don't want to be over rich. A ground that will bear good corn is all right. The Northern Spy won't grow wild so well as some other kinds will; but it will stand culture. You may cultivate it as much as you are a mind to. There are more trees die of starvation than there are die with belly ache. Let them die if they want to, they will die in a good cause. If I pick ten or twelve barrels of apples off a Northern Spy tree, if that tree dies it dies in a good cause. My Northern Spies are better and hardier than anything else—grow well—grow right along.

Here we are finding fault with the packers, but don't go back to where the real trouble is. Now we want to educate the people. Perhaps your legislation may be all right, but we want education with elbow grease. You want to let the farmers understand that they can afford to put work into their orchards and have their apple trees clean, not let any witch-grass nor weeds nor anything else grow. Keep the harrow a going and you will be surprised.

The difficulty I have now is that I don't get red apples enough. Trim the trees out—but Northern Spies will bear and want a good deal of foliage. But pale Northern Spies, good large apples, ripen in the cellar and they are as good as the red ones, come out a kind of an orange color, and take them along in the middle of May and you can't get nothing better. The demand for Northern Spies, good apples, is growing all over the country. Today a lady came to me, introduced herself and wanted to know if I had Northern Spies; said she had two barrels of me two years ago and she never had any such apples in her life. Now last year apples were a drug in the market. A man came along, looked at my Northern Spies and wanted to know what I asked for them. I told him $2.50 right through. Didn't think he would take me up. They were selling Baldwins for a dollar a barrel then if they could get it. But he took me up. I might have got twice as much for them, but of course I stood my ground and he took the apples and made lots of money on them. That is all right, you know, but this year I calculate to hold them where I can stand out. I have been offered $3.75 for them and now they stand at $4 and they will rise on that before long.

You can raise good fruit if you will deserve good fruit in the State of Maine. Here we are, close to tide water—don't cost but little to carry a barrel of good apples to Liverpool. We are close to the shore. Freight is cheap. We have the soil and the climate that brings the apple to perfection. Suppose you plant a crop of corn and never go nigh it, only pick off the ears—how many ears do you get? It is so with the orchard, people only think about it at picking time and then what they pick they think is so much clear gain. But the result is that the quality of our apples is going down in the market. Now why not build that quality up? Why not try to cultivate our orchards and see the result? Then you will have no trouble about packers,—not at all. But I should like to see the man that would take a lot of wormy, bruised apples and pack them so they are in good shape and will go well. But you take good, smooth apples, uniform in size, no worms, and a little child can put those apples into the barrel and they are all right. The trouble is, you don't raise the fruit good enough.

If we would go to work in the State of Maine and plant our orchards and trim up the old trees and cultivate them, the boys would stay on the farms. Many farmers wonder why the boys and girls don't stay on the farms. Why, there is a good many of our farms that ain't fit for white men or women to live on. That is why they don't stay on the farms. I know farmers who have been working all their lifetime to put a sum of money in the savings bank and they have been doing that for sixty-five or seventy years. Well, the result is they have got a little nest in the savings bank, but the buildings have run down, the bushes have grown up in the fields, and no man can afford to go onto the farm and live. But you plant an orchard on your farm and I tell you the boys ain't going away. I have a boy, my youngest son, at home—took me some time to get him into this religion I have got, but now he has got so he is ready to drive the harrow. He don't object to seven or eight hundred dollars along in the spring—kind of a good thing—about equal to your potatoes.

REPORT OF COMMITTEE ON FRUIT PACKAGES.

By E. L. LINCOLN, Wayne.

[Mr. Lincoln had several boxes of different sizes to illustrate his discussion of the apple box.—*Secretary.*]

As I came into the hall I picked up a slip of paper giving shipments of apples,—and I note that it is all in barrels,—the unit seems to be the barrel.

This is a subject that is being discussed by many fruit growers at the present time. It is a question, whether the box or barrel makes the better package for apples and pears. But in my opinion, I should prefer the box for fancy fruit, the barrel for common or choice, and the box car to supply the canning factories.

Apples of a tender variety, such as are generally used for eating and table use should be packed in boxes. The Northern Spy, Yellow Bellflower, and other varieties which I could mention, do not want to be jammed in a barrel, but ought to be packed as carefully, and in as attractive a form, as the orange or peach. Take an orange and a Maine apple and roll them across the floor, each with the same usage, and the orange will come out in better condition, but still there is the most care taken in packing it.

We need to put our fruit in packages that will suit the market to which it is shipped. There is a demand for three grades of apples at the present time, that the grower will have to meet. The well-to-do, who will pay for a high grade, the common or poor people, who cannot afford the high priced and the canning factories.

One of the needs of the present time is some system and uniformity, in regard to using boxes for packing our fruit. We are not looking for the easiest way to pack and ship apples, but they way that will bring in the best returns to the grower and at the same time will be more convenient for the consumer. Oh, be content with the barrel system for choice fruit, we are often told. But if all people had been contented, there would never have been any progress. Discontent is the sign of awakening life. It has been said that the rich are not contented. They are trying to better themselves. And why should not the fruit grower do the same, and have a better system for packing fancy fruit? The box system of packing apples is attracting the attention of fruit growers in all parts of the country and it is my effort to awaken an interest here in Maine that will lead to the adoption of a standard size for a Maine fruit box.

The box should be uniform in size that is used everywhere so that the buyer may know what a box of apples is, as well as he knows the barrel. As it is today, the buyer does not know the quantity that a box contains. Why does not the orange grower ship his oranges in barrels and different sized boxes?

If a trader here in Canton wants a box of oranges, when sending to Portland or any other market, he knows just what he is buying in size and the grade he wants. And at the same time when a trader in any other part of the country wants a box of oranges he knows just what he is buying too. He is getting the same size there as the trader is here.

Now, why should not we, here in Maine, pack our apples in such a manner, that a trader in any part of the world who buys a box of Maine apples, will know that he is getting just what he orders? The same size in Maine or California.

Why is it that the commission men of Boston, prefer the barrel to the box? It is because there is no system in packing in the box. We have got to make progress and see if we cannot have a uniform box or package for apples, as we now have the orange or lemon box.

If you have been in the market in Boston, you would see that there are a number of different kinds of boxes in use. One of the best and cheapest, is the Colorado box. It has nice well dressed ends. The bottom and top are made of very thin material that is not dressed. When the box is packed the bottom and top spring out, but when the fruit settles, it closes up, and keeps the apples from rattling. This you can see, is a great deal in its favor.

The box is as cheap a form of package as the barrel, owing to the advance in the price of barrels, in late years ranging from 35 to 45 cents. By using the box, you can save in freight, over the barrel, by space taken up in the car.

There should be a uniform box package for apples for the export trade. The barrel may be desirable for a certain per cent of apples grown, but at the same time, Maine apples seldom reach Great Britain in perfect condition. And you well know that there are certain varieties which cannot be shipped in barrels and come out sound. When the buyer wants a fancy apple for table use, price is of no object, and bruised apples are out of the question. For the fine trade the box package is necessary.

Nearly all of the fine fruit imported, also all brought in from the western states to eastern markets are in the box form.

Now, why should not we in exporting, be up with them in shipping our fruit. We need to make a standard size box and put it in force by our actions. It seems beyond question that it would be a great benefit to the fruit grower.

In some sections of the country the cooperative plan in packing and selling fruit is being carried out in the form of a packing house with success. Each man sends his own fruit to the packing house where it is graded and carefully packed in a scientific manner. Being in touch with the principal markets the manager can often sell to a greater advantage than could otherwise be the case. To the small grower cooperation would be of great value, as he has not the facilities to pack and sell in small amounts. Fruit should be graded like corn and wheat that it may be quoted on the market by grade, then the buyer will be able to know what he is buying. But under the present system, with each man grading his fruit to his own liking, and packing in different size boxes, this is impossible.

Under this system of cooperation, the box package would certainly be necessary. Let us be up with the times and make some advancement for the interest of the fruit growers of Maine.

I have here some communications from growers and commission men: Mr. J. H. Jones of Mercer writes: "I have been thinking for some time that apples are being put on the market in a manner not equal to other fruits. As J. H. Hale says, the cost of a neat package is more than paid for by the consumer. After finding the size and shape of bushel boxes used in different places I chose one to suit myself—a box 15½ x 15½ x 10 inside measure, that size being easy to pack and handle. Of about 175 barrels, which were handled mostly in boxes, and with the exception of Harvey, which is a cooking apple, I got from seventy-five cents to one dollar a barrel more by the box than by the barrel. Mr. Page sold one load of my Williams, barrels $3.50, boxes $1.75. A very few of my boxes sold for $2.25, but the most for $1.75. As it is well for us to have a box of standard size and shape, and being interested in this work I think I will send you a box of apples put up as I ship them, for inspection."

Seaverns & Company write as follows: "We prefer barrels for fancy fruit although we have had fairly good luck in selling fancy fruit in half barrel boxes. We prefer half barrel boxes in place of bushel boxes. We think we can get full better prices for real fancy fruit in barrels than in boxes. Lots of buyers when we have really a half barrel box, it is hard work to make them believe it is a half barrel. We receive occasionally a very fancy lot packed in boxes where we are able to get a little more than barrel price, but not generally. If you go to sell a man a barrel of apples he knows just what he is talking about. There are so many different sizes of boxes coming that he gets mixed up on the size. The best one-half barrel box we have ever received is made up around Farmington and Wilton. It is a full one-half barrel box. Any fruit packed in them sells all right."

D. Crossley & Sons write: "Would say that for fancy apples the boxed package is a desirable package. The size and style of box preferred is the California style, a bushel box, each apple wrapped in paper, the four tier size. The grower would not get better prices for apples packed in boxes if the same quality was in a barrel, because apples are sold by weight in England and the retailers will not give a higher price because apples are in a box unless they are better apples. True, a small package is desirable and can be handled to private trade who would not want to buy a barrel."

I move you that this Society recommend the adoption of a Maine standard apple box of the capacity of one bushel—the box to be adopted to be the California style which is, inside dimensions, length 21 inches, depth 11 inches, width 10 inches.

Mr. POPE: I have been shipping apples in vegetable boxes. I corresponded with parties in Boston who were going to sell my apples and asked them to send me an empty box—a package which would suit them to sell apples in. They sent me the vegetable box, 18 inches square and 8 inches deep, inside measure. Everybody in that section knows that those boxes contain just a bushel. And they prefer them on that account, I suppose, to have them come in these vegetable boxes. I have shipped wholly in these. I will say while I am up that I corresponded with parties who were agents for Pritchard & Co. They discouraged shipping in boxes and said it was no use to think of shipping apples in boxes to the English market, the foreign markets, unless we propose to sort them to size, four tiers or five tiers, and wrap them in tissue paper, and they thought that until we were ready to do that we better let the boxes alone. That is the way the California people do. They all have to be sorted to size, so many tiers deep, and wrapped in tissue paper. It would be only our fancy eating apples that we would think of selling in that way.

Mr. LINCOLN: It is not so much what kind of a box we adopt, but to have a standard size of some kind, so that the commission men in Boston will know what they are selling. You give them a standard size box and they will call for boxes, that is where it is. There isn't any unit, there isn't any standard, so they can make the buyers believe what they are getting, and just as soon as you get a uniform box, then for fancy fruit the barrel will be done away with.

Mr. WALLINGFORD: I have reckoned the cubic inches in each of the four sizes suggested. In the first box (Jones) there are 2,335 cubic inches; in the second box, the Canadian box, 2,268 cubic inches; in the third box, the California box, 2,310 cubic inches, while in the standard box which Mr. Pope used, which is the vegetable box of Boston, there are 2,592 cubic inches.

There is quite a variation. The bushel contains 2,150.42 cubic inches. The box that Mr. Pope used is considerably over a bushel.

Mr. POPE: Allow me to interrupt you. A strict bushel doesn't make a bushel of apples. 2,150 inches would be a strict bushel and the law obliges us to give more than that.

Mr. WALLINGFORD: I think the statement was made that this Canadian box held just a bushel. Now the standard box which you use in Boston is 2,592 cubic inches. I have shipped apples to Boston in that box and I have tried it with the barrel, and three of those boxes are a little more than a barrel. And I think the statement was made here that these boxes would pack snugger in a car and therefore a man would get cheaper freight, and they were cheaper to handle. I think this is an error because they don't haul freight by the way it packs in a car but by weight. The box weight is given I think as about 60 pounds, and the barrel which would contain three bushels at 160,—so we pay a little more freight. While on the carting at Boston they charge by the package and the two boxes are charged the same for carting as one barrel. And the commission on the box is a little more in my experience than it is on the barrel because they have more packages to handle. I think before we take any definite action in regard to adopting the standard box and recommending it, we better not get our boxes too large but have one as nearly a bushel as we can.

Mr. LINCOLN: Three will hardly fill a barrel, especially with large apples. This is what they call the California box. And then, in regard to the freight I think the brother is mistaken, or else they don't carry their stuff as they do to our place. If we hire a car, we pay so much for the car and we can put in not to exceed so many thousand pounds. If we exceed that we have to pay extra freight for it. The barrels won't fill the car full enough to weigh what we are allowed to put in the car usually. And if we get in more, why we have to pay extra freight for it. That is the way we ship ours to Boston by car load lots.

Mr. WALLINGFORD: I will admit in the car load rate you might possibly get the weight there. But the minimum amount with which you are loading a car is 150 barrels which weigh 24,000 pounds. Now if we have more than that we have to pay for it extra. It is true you might possibly get the same freight if you had a carload of these and give the weight as you would on the barrels.

Mr. MORSE: I would like to ask if they realize how the barrels are. I didn't until this fall. I bought 300 old barrels and before selling our apples I thought it was worth while to know how much they held and I took some yellow-eyed beans and put in even full and shook them down so as to be sure of what I was doing. It took three quarts more to fill one barrel, six quarts for another and 14 quarts for another. Now you can see that there is about as much variation in different barrels as there is in boxes.

The small barrel was a new barrel, had a standard head. I tried it with a Washburn & Crosby Gold Medal flour barrel and that held three quarts more than the new barrel, and I tried it with two or three other kinds and they varied from 3 quarts up to 14. I may say right here that I put my old barrels off in the chamber and bought new ones.

Mr. CRAIG: In figuring the Canadian box—comparing that with the one that Mr. Pope used, the vegetable box, and you would be giving away every eighth box of apples. I had the pleasure of attending a number of fruit meetings last winter and this same question was discussed, and I understand that Ontario and Quebec and British Columbia have all adopted this size of box that you have mentioned—10 x 11 x 21 isn't it?

Mr. POPE: It seems that if this Society is to adopt any particular size that we must confer with the other states and have all New England and New York and all the eastern part of this country adopt the same size, or else there will still be this same trouble when our boxes get to Boston, if Massachusetts people have one bushel box, Maine another, Vermont another, New Hampshire perhaps still a different one. We are not overcoming this trouble at all. That is why they call for this vegetable box with fruit in it—they all know what that bushel box is, they are satisfied to pay the price if we sell them one of those boxes. Until we can all agree through the Eastern States on one size, we better not adopt in the State of Maine any particular size,—that is the way I look at it—so as to have uniformity through the eastern part of the country.

Mr. KNOWLTON: This matter of an apple box has been under discussion by the Society for four or five or six years more or less, and no conclusion whatever has been reached. Well, it has reached a point now where fruit growers in different parts of the State are seriously inquiring of us what kind of a box we recommend. They read the discussions here and they read the papers which tell about the advantages of selling in boxes, this box and that box, etc., and the question has come right home to me scores and scores of times the last two years, especially this year, "Why don't your State Pomological Society do something? Why don't you recommend something, so that when you talk about a box we will know what it means." And I have urged upon the committee, of which Mr. Lincoln is chairman, the importance of getting this matter in some definite form before the Society so that either at this meeting or at a future meeting we may feel like recommending to the fruit growers some box, and I hope that something of that kind may be done. As to myself, I prefer something like the bushel box. It is only my preference. I believe that a good deal in this world depends upon the appearance of the thing, and that size box, if it is well made, is certainly to me at any rate more attractive than either of the other sizes. That is only my individual preference. I don't care personally what size you take, but I think we ought to do a little something besides discuss it. Now you see from what has been said thus far we have run across a dozen different opinions, and it is likely, if every fruit grower would give his own, that there would be a dozen more. That shows conclusively that there is dissatisfaction with the barrel for fancy fruit.

Now if it is not best, if we are not prepared to take a definite step as to the size which Mr. Lincoln has recommended, let us take a step that will lead to it. If you want to do it in that way, it could be referred to another committee and let them chew upon it another year, and then when anybody comes to me or to any other officer of the society, we can say that the Society has got it under consideration in the hope of settling it next year. It is not very definite, to be sure, but if we cannot arrive at something I think we had better do it. I fear from the various expressions that have been given that the members of the Society are not prepared to say which size they prefer. As an officer of the Society I want something done, or hope something will be done that will lead up to a definite sized box. If it is a desirable thing to consult with other societies, very well. That is well enough. So far as the box in the market is concerned, the people in the West began shipping apples in boxes and they have kept it up ever since. We flatter ourselves when we get to eating their apples by the side of ours that ours are a good deal better than theirs, but just because theirs are put up better than ours they sell for more money than ours. It seems to me that if we only get at it right that there is some remedy which we can apply. I should like mighty well to have Eastern apples sell in New York for just as much money as California apples, to say the least. I think the fruit growers of New York and the East have the first claim, at any rate on the Eastern markets, and we ought to do what we can to win them and hold them.

Mr. LINCOLN: I think it would be well to refer this to another committee. My idea is the same as Mr. Knowlton's in regard to the box system. All I believe in is to have a standard size, a uniform box. I don't care what it is, only have something that is uniform, a standard, so that everybody will ship in the same size boxes.

Mr. WHEELER: Bro. Pope wanted to sell some apples and he wrote to a commission house in Boston to tell him what he wanted and they sent him that vegetable box. It is evident that they wanted that kind of a box. It is evident that the people there want that because they can sell it better. If the people want that and are ready and willing to pay for it, prefer apples shipped in that vegetable box, it seems to me that is the box we want to ship apples in and is the one that we should endorse here today.

Prof. MUNSON: I would move to refer back to the same committee the question of the size of packages to be adopted, and further that this committee be instructed to, if possible, agree with representatives of other New England and New York associations as to the size of box to be adopted by all societies and report at the next meeting.

[Professor Munson's motion was given a passage.—*Secretary.*]

OUR ORCHARD MEETING.

THE PLACE WHERE IT WAS HELD AND WHAT ITS PROPRIETOR HAS ACCOMPLISHED.

JOHN W. TRUE, New Gloucester.

"The orchard meeting—where it was held." To say that it was held at my house, my farm in New Gloucester, I think will answer that part of the question. There was quite a sharp rain in the morning which hindered a great many people from coming, but then it cleared off and we had a beautiful day. But not so many were present as there would have been had it been pleasant in the early morning.

I began farming in October, 1874, and in looking the situation over and getting advice from older people concluded that I had all the orchard that I could take care of. It consisted of four little orchards enclosed by stone walls and about sixty-five trees around the fields, most of those being small trees not in bearing. The two largest orchards were nearly all natural fruit, and the ground was full of boulders and entirely unfit for cultivation. I tried cutting the brush around the trunks and pruning, but I got no profit as I had no use for cider and did not care to *work up a trade* in the article. For the first five years I raised from ten to twenty-five barrels of grafted fruit. I was at about that time prevailed upon by a tree agent to buy ten Northern Spy trees, and I have had one or two good crops from them. They grew well and I got interested. I looked the farm over and I could see no place that I wanted to put into an orchard. At last I decided that the smaller cider-apple orchard could be used. I cut the trees down, took out the rocks and bought 50 trees, —25 Red Astrachans, 15 Ben Davis and 10 Baldwins, the intention being to graft the Astrachan to Baldwin. The Ben Davis came *Walbridge* and have proved valueless, both as they were and also as a stock for grafting. The Astrachans top worked to Baldwin have given the best results, making a fine tree, better than the Baldwin set from the nursery. In my work since I have never been able to take a good field for orcharding, as I almost worship a clear field. Instead I have taken small lots that were producing nothing of value, rough and full of rocks and then if I failed I lost nothing but my labor.

My method has been to clear the land, set the trees and then raise crops year after year as long as anything would grow under the trees so that I can feel that the orchards have cost me very little, if anything, and the land is now the most valuable per acre of any on the farm. I have learned that for me the Baldwin is the most profitable apple to raise, and that I can get the best results by setting some other kind and top work to Baldwin. I have got good results from using the Red Astrachan, Wealthy, Talman Sweet and Spy. The Baldwin set direct from the nursery makes, in many cases, a poor trunk, the limbs making a weak union and the tendency is to split down with the first full crop of apples. I have put in many bolts but water will work in and then the end is not far off. There are many things that have been made plain through the teachings of this Society that were unsettled when I began to work among the trees. One is the distance apart that trees should be set. I was told by an old orchardist that 20 feet was the proper distance to set Baldwins but I have found, and I think it is universally accepted, that 30 or 35 feet is the proper distance for Baldwins. Ben Davis can go a little nearer. I became a member of this Society in 1887 and from that time my interest in fruit culture has been on the increase. I enjoy setting trees and then shaping them into just what is wanted. In small fruits I began with a few strawberries, then raspberries and blackberries were added, then came five or six varieties of plums. There were a few currant bushes on the farm and those have been extended to four or five varieties so that in poor seasons we have all the fruit that three families require, and in good seasons there is a surplus that sells readily in the neighborhood. There are now on the farm about 1,000 trees and the hope is that in the near future they will produce 1,000 barrels of apples.

Prof. Munson from the Experiment Station, Orono, is trying some experiments in fertilization and in cover crops of which I presume he will make reports from time to time. The more I learn about the cultivation of the apple the more firmly I am convinced that it can be made a paying business on many of our rocky hills of Maine.

LESSONS LEARNED AT THE ORCHARD MEETING.

EDWARD L. WHITE, Bowdoinham.

I am rather a young man in this business, and of course when I went to Mr. True's orchard meeting, I took my trip there as a young man.

I would like first, if you will pardon me, to describe my trip there. I took a term and drove some twenty-five or thirty miles and then took a train and went to Mr. True's farm. In going there, I left a section of country that had supplied the creamery, and in looking over their farms one may see the same slope that Brother True has, the hills of Maine sloping down into the brooks and valleys, rocky lots sloping onto the clay, and in the creamery section you would see the fodder corn growing nicely, and upon the hill of course you would see the orchards scattered around—no leaves to speak of, that is, if there were any they were pale, no fruit,—that was evident. Once in a while you would see the hogs at work in them,—very seldom. But the corn patch to support those cattle—what was that? No weeds in that and it was good corn.

Going a little further I came into the section of the country that was supplying the corn factories. I didn't see any corn factories but you could see that it was sweet corn growing there. No weeds in the corn. Still the orchard was on the side hill, neglected. You could see their potato patches every little while—no weeds in the potatoes. Still the orchard situated just the same.

In getting to Mr. True's what did we find? We found his house situated on one of the hills of Maine, his farm sloping off to the eastward into the valley of a river. Down in the valley he raised his hay, you could see. In his orchard what did he do? Did you see his potatoes and corn down in the valley? No, he had the whole thing combined. It seemed as though he had his arms right around the whole of it,—his potatoes, corn and apples. No neglect there. His corn he cultivated so that you could hardly see the trees in some of his young orchards. His potatoes would cover the ground so you couldn't see the rows. Were his trees pale? Was the fruit scant? No. Take one of the leaves off of Mr. True's trees, feel of it in your fingers. It feels as though there was something to the leaf, some thickness there, good, solid green. And the fruit was fine.

That was my trip to Mr. True's orchard. That was the section of country that I went through and what I found there.

What were the lessons that I learned while I was there? Very often a young man of my age, particularly if he graduates from high school—I don't know as it is so much so now as it was then—if the principal happens to be a graduate of some college, he will come along to you—"Why don't you go to this college or that college, classical college, and take a course there and teach for a few years, and if you don't like it, take up some profession rather than agriculture, like a doctor or lawyer or something, and then after you get your money there, why retire and live on a farm?" Just the same as to tell me if I retired myself onto the farm at the age of eighteen or twenty when I graduated from high school, I would retire, get out of sight on the farm.

What do we find at Mr. True's? He left there when he was nineteen and came back when he was twenty-six. Did he retire when he came back there? No. You that are acquainted with the history of the town of New Gloucester will find how many years he has served on the board of selectmen and other municipal offices, and served his own town in various other capacities. And look up his record there? Did he retire from business? No. You find that a young man can go onto one of our farms situated on the hills of Maine and make an outside record.

We learned the cultivation of the orchard, of which I told you before. But the principal point, I think, with all of us was emphatically represented when we went to dinner and found the bountiful feast before us.

In driving into his orchard, looking on the right hand of the driveway the first thing that took our attention were the blue plums, bending the limbs down. In going out through the orchard, he showed us the different rows of trees grafted on the Astrachan stock, etc. Then in going out around we came to his corn patch,—a small corn patch situated outside—coming down around where the hogs were, where Prof. Munson is at work, and coming back a little back of his house, we found there the luxuries of city life, currants, gooseberries, strawberries, plums. The plums we could not see the leaves on the trees. And when we went in to dinner we found a feast set before us, something that you could not buy in any hotel for a dollar a meal, I will warrant you.

And the home,—what was it? A little remark was dropped while we were there. While sitting at dinner, some one looked up to Mrs. True and said: "Aren't you tired? Don't all of these folks cause a good deal of work for you?" "Oh, no! I have plenty of helpers." And as already stated, he has three families there with him. You see he has brought his children up to stay at home on the farm and make an ideal country home.

And is this home an expense? Is the fertilizer an output that he puts into his orchard? No, he has fixed it so that they all cooperate. His crops that he takes from them pay for his fertilizers. His corn, beans, potatoes,—all his garden stuff is there,—and his hay is in the valley.

So these are the three principal points that I learned when I went to the orchard meeting: That the hills of Maine can be converted into profitable farms, and that the young man does not retire when he takes up this work.

Secondly, that the cultivation of the orchard can be so arranged that it will not be an expense, the crops that he takes from it yearly paying for the fertilizer.

And thirdly, that there is an ideal home for a young man to live in.

RESULTS OF FERTILIZING AND CULTIVATING.

By V. P. DeCoster, Buckfield.

The time has come when we have got to put brain work into our fruit growing. When our farms were first cleared and we commenced to work the soil it contained all the elements required to produce good crops of fruit as well as other crops. Now we find the conditions different, for so much has been taken from the soil that trees and plants are hungering and thirsting for what they cannot find, and it becomes necessary for us to supply the missing plant food if we want to get the best results. We learn what is needed by experimenting ourselves or by studying the work and experimenting of others. Our Experiment Station at Orono is doing much to help us and I believe we underestimate the grand work being accomplished there. Prof. Munson who has charge of the horticultural work there is a sincere worker and has great faith in the future of Maine fruit growing.

Under Professor Munson's directions fertilizing experiments are being conducted in the orchard of Chas. S. Pope, Man-

"Orchard meeting." A group at the residence of John W. True, New Gloucester. Photograph by W. M. Munson.

chester, and in that of John W. True, New Gloucester. No doubt but he makes mistakes and failures but at the same time these experiments are teaching the fruit growers of Maine many valuable lessons. Above all they clearly show that we have got to do something for our orchards if we would succeed. I shall speak of these experiments later.

I believe that over one-half of the fruit trees that have been set out during the last fifteen years have never paid the first cost of the tree. The trees, as a rule, are all right but the fault is with us. We are allowing the trees to starve to death. Nothing on our farms will show good care quicker or make a surer return than a fruit tree. More than this there are thousands of trees by the roadsides and fences that are a damage to the owner and all his neighbors. They are the breeding-places of borers, coddling moth, trypeta and I fear we may soon add the brown-tail and gypsy moths. Now if a tree isn't worth caring for cut it down. Josh Billings says, "Advice is like castor-oil, easy to give and hard to take." Now I am ashamed to say I do not do this. There are lots of the best farmers who grow weeds with their crops, they know better but it is a fact. I sum it up like this: With the scarcity of help we fail to do as well as we know. Some of us are learning better and if you pass my way and find I am not giving these things attention, remind me of it and you shall have as good a dinner as the farm affords. When I find a nice piece of corn or potatoes or a fine orchard I make up my mind there has been some brain work as well as muscle work there. I am desirous to know how it has been done and what methods have been adopted that I may profit by it. Sometimes a person may do ever so well and then comes a freeze or a drouth or floods to blast his hopes but in the end such disasters usually work for our good.

I believe we are making a mistake in allowing our trees to bear too heavily. I believe a tree properly dressed, pruned and thinned will bear every year. When a tree is allowed to overbear it brings such a strain upon the tree that it takes years for it to recuperate. All small and wormy fruit should be picked off before it ripens. It is just as much a strain on the tree to grow the seed in a small or wormy apple as in the best specimen. And when such apples are picked they are good for nothing but to feed out. When I was at Mr. Pope's a little over a year ago, he showed me a Baldwin tree that he had thinned. This year I was in the same orchard and my attention was called to the same tree which was well loaded with good fruit.

I have made it a point to visit some of our most successful fruit growers and to ascertain what they are doing for their fruit trees and what results have followed. I wish to say here that I am not advertising or recommending any special fertilizer.

During the fall I visited Mr. W. O. Breed's orchard in Harrison. He believes Maine is to become a great fruit State. In going through his orchard I found it full of swine and they had worked over nearly the whole of it. When I asked Mr. Breed if he used any commercial fertilizers he said, "Yes, though I did not do it last year but had I done so it would have added $500 to my fruit crop this year. The year before I raised 1,600 barrels." We should realize that the tree must be fed the year before to grow and set fruit buds for the following year. His crop this year was about 500 barrels. He is making quite a success of growing peaches and picked five bushels from one tree this year. He uses a commercial fertilizer made from the Fisher formula which is as follows:

Nitrate of soda, 350 pounds,
Sulphate of ammonia, 150 pounds,
Sulphate of potash, 230 pounds,
Acid phosphate, 220 pounds,
Keiserite, 50 pounds.

The manufacturers as yet have not made the fertilizers and hence it has been necessary to buy the ingredients as above and mix them by hand with hoe or shovel. It is not a difficult task. The screened nitrate of soda works better than when taken from original packages, as it is finer and mixes without leaving lumps.

Mr. S. H. Dawes, who has the enviable reputation of raising more prize fruit than any man in Maine, owns the adjoining farm and I called upon him. He was busy gathering pears and such pears it would almost take a cantdog to handle them. He had a large crop of pears. He had just harvested 65 bushels of plums. He has raised the past two years large crops and it was too much for the trees. It has been his custom to fertilize only the fruit-bearing trees which I think was a mistake. He showed me one row of Baldwin trees which he had fertilized every year and there was a marked difference. From that row last year he got 18 barrels more fruit than from the row next to it to which he applied no fertilizer. He uses the Fisher formula and makes his fertilizers by it. Mr. Dawes called my attention to an orchard adjoining his where the trees were of the same age but had received no fertilizers and there was a marked contrast that showed the benefit of the fertilizer.

I also called upon Mr. F. H. Morse of Waterford, and I found him to be a man who had put in some brain work into his orchard and had used good judgment in his fruit culture. His home farm borders on a lake where he has a Stark orchard of 90 trees. They were grafted in the limbs on Talman stock, the trees having been set twelve years ago. In 1902 he raised 14 barrels of apples; in 1904, 88 barrels and in 1905 about 200 barrels. These trees have been grown entirely on commercial fertilizer, consisting of the following:

Muriate of potash, 600 pounds,
Ground bone, 600 pounds,
Nitrate of soda, 200 pounds.

This has cost him from 20 to 25 cents per tree, sown broadcast around the tree. The soil has been cultivated but no crop was taken off save the fruit.

One tree, standing in the corner was off in fruit as well as color of foliage. He told me that tree had received some fertilizer but was not cultivated. It was an excellent illustration of the advantage of combining fertilizing and cultivating.

I also visited his Baldwin orchard which is located some one and one-half miles from his home upon a high elevation. This contains about two hundred trees that have been grafted into Talman Sweet trees. In 1903 there were 375 barrels of fruit; in 1904, 750 barrels; in 1905 about 500 barrels. This orchard has been grown with commercial fertilizers and sheep. It has not been plowed for four years. He now uses muriate of potash and ground bone in equal parts and allows the sheep to supply the nitrogen. He sows broadcast around the trees at an expense of 20 cents per tree. The trees were making a good growth and the foliage was green and the buds were setting well for next year.

In Mr. Chas. S. Pope's orchard the Experiment Station is conducting some important experiments along the line of fertilizing and cultivating. There were several different chemicals used. To show the effect of the fertilizers check rows were omitted when the fertilizers were applied. You could see the difference in the color of the foliage. One plot was dressed with barnyard manure and it seemed to me the chemicals showed better results, especially those containing nitrogen. The expense in the different experiments was nearly the same. A portion of the orchard had been pastured with hogs and wherever they got in their work good results were apparent both in foliage and fruit.

It appeared to me in the orchards I visited that the continued use of commercial fertilizers, sown or spread upon the grass ground will cause the grass to become root-bound and hard and you do not get the results sought. Cultivation aids the chemicals so that better results appear than when omitted, and when cultivation without the application of any fertilizer has been employed both trees and fruit have been improved.

Solon Chase who raises from $250 to $750 worth of Northern Spies every year uses no commercial fertilizer but uses the plow and the harrow. He applies what home made dressing he makes on the farm and raises corn and potatoes among his trees. His trees were healthy and growing well.

Mr. Chas. S. Phinney of Standish is making a great success in growing fruit on commercial fertilizers. He uses the Bowker fruit fertilizer and sows at the rate of 500 pounds to the acre. He supplements this with cultivation. His trees look well and show good care.

Mr. A. S. Ricker, who is one of the largest producers of fruit in the State, believes in cultivation. He applies all the barn manures of the farm and supplements it with commercial fertilizers of some kind.

The result of my observation is that the orchardists who are getting the best results are fertilizing and cultivating their orchards. Some are doing it in one way and some in another. The neglected orchards in the State show what the absence of fertilizers and cultivation is doing and the contrast is so strong that one may read the lesson every day as he drives about the country. Many are profiting from these lessons, but the sluggard learns slowly and sometimes turns about indifferent to all he sees. The wise man, the thoughtful observer is not so and therein comes the great value of the several orchard meetings we have held in the State.

Mr. HARDY: I would like to ask the gentleman what time, what size or stage he would recommend thinning the apples.

Mr. DECOSTER: They should be thinned the first of July. It is not all apples that need thinning. Rhode Island Greening, Northern Spy, don't need thinning. I don't know as the Ben Davis does. I am not a Ben Davis man, don't raise but a very few. But more especially the Baldwin, they should be thinned by the first of July. I wish you would experiment, gentlemen, and note the results.

Dr. TWITCHELL: In the President's address this morning, you remember he emphasized the necessity of cultivation and fertilization as solving the questions in the future relative to our orchards, and Prof. Munson said to me coming up yesterday that they had taken three or four successive crops of Baldwins from certain trees and he believed that it should be credited to the cultivation and fertilization of the trees. If that is so, then we are to solve some of the vexed problems of the future by higher fertilization and cultivation. Having tried a little experiment this summer on the farm, I took a photograph of some of the trees and brought one of them with me simply to illustrate what can be done at very little expense. We applied some of Fisher formula to 200 trees, leaving out some, so that I might see the difference. Mr. Gilbert was there in August and went over the trees and expressed his surprise at the thickness and strength and hardiness of the leaf and the growth of the grass underneath, and also the marked growth of new wood. I have a photograph taken about the 12th of September which shows the second crop of grass growing about the trees, covering the space where the ten pounds of fertilizer was spread. What is most marked, these trees are old, have not been touched for ten or fifteen years, nothing been done to them,—and yet those old neglected trees made a wood growth this year of from two feet to two and one-half feet, giving promise of something in the future which I hope may be of value. Now I do not think that can be attributed to anything excepting the application of ten pounds of Fisher formula, costing about twenty-eight cents a tree. I would not follow that another year, but I would put in some other form of fertilization, or cultivation—something different—but to give old trees a start and set them at work in the right direction with a view to improvement, I thought it might serve as an object lesson.

EXPERIMENTS IN ORCHARD FERTILIZING.

Prof. W. M. Munson.

According to Prof. Roberts of Cornell University, the average value of the fertilizing elements taken from an acre of soil by apple trees during a period of twenty years, counting in ten crops of fruit, is approximately $377. Of this amount $147 or a little more than 39% is in the fruit; $160 or about 42.5% in the leaves; and $70 or about 18.5% in wood for the growth of the tree.

The total amount of nitrogen, exclusive of that used in the growth of the tree, is about 1,300 lbs.; of phosphoric acid 310 lbs.; and potash 1,900 lbs. per acre. "To restore the potash alone, as above, and that used by the growth of the tree, it would require 21.69 tons of high grade ashes containing 5% potash. To restore the nitrogen would require 16.19 tons of commercial fertilizer containing 5% nitrogen."

When we add to the amount here mentioned the large amounts of fertilizing elements removed by crops of hay, or grain, or by pasturing the orchard without giving extra food to the animals, is it any wonder that some of the older orchards of the State are beginning to look feeble and are in many cases ceasing to be productive? How many orchards in Maine during the past twenty years have received the equivalent of an average of a ton of ashes and 400 lbs. of nitrate of soda per acre each year?

Of course the fact should be taken into account that a portion of the material above referred to is returned to the soil in the way of fallen fruit and leaves and in the excrement of animals; but with a liberal allowance for these returns the value of fertilizing elements actually removed from the soil during the period named will probably not fall short of $200, or $10 per acre.

Now while the old hillsides of New England constitute a vast storehouse of food material, and our apple trees are best fitted to abstract the store and put the material in a form suitable for the use of man, there is a limit beyond which the tree can not go without help. As is well known, tillage, the stirring of the soil, no matter by what means, is the best way to unlock the natural supply of fertilizing material; and this is the first help which should be given the tree in its struggle—I almost said struggle for existence. While the importance of tillage can not be urged too strongly, this is not all. A check book is a convenient medium by which to draw money from a bank, but the supply of money in the bank must be replenished from time to time or checks are of little value.

In studying the methods of fertilizing of orchards, of course we recognize that the same general principles apply as in the management of other farm crops. The essential constituents must be the same, but unlike ordinary farm crops, orchard crops do not give an opportunity for rotation. A certain amount of nitrogen is essential to the vigorous foliage upon which depends the life of the tree. Potash also is important, not only because it constitutes a large part of the ash of the wood of fruit trees, and more than half of the ash of the fruit itself, but also, as suggested by Voorhees, it forms the base of the well known fruit acids. Lime, as likewise pointed out by Voorhees, "seems to strengthen the stems and woody portion of the tree, and to hasten the time of ripening. Fruit trees growing on soils rich in lime show a stocky, steady, vigorous growth, and the fruit ripens well, while those on soils which contain but little lime, particularly the clays, appear to have an extended period of growth, the result of which is that the wood does not mature and the fruit does not ripen properly."

How to fertilize a bearing orchard is one of the special lines of investigation with which the Experiment Station has been concerned for some years past, and in which every progressive orchardist of the State is interested.

In 1898 an orchard of eighty trees, Talmans and Gravensteins, on the farm of Charles S. Pope was selected for a comparative study of the use of stable manure and concentrated fertilizers. One-half of the orchard was cultivated and the remainder was mulched. Careful records of the growth and yields of these trees, as well as of adjacent trees, which received no fertilizer, have been kept from year to year.

The results obtained up to the close of the growing season of 1902, were published in Bulletin 89 of the Experiment Station and need not be dwelt upon at this time. In general terms, it was there shown that, "With a single exception, in which two trees had particularly good advantages, the growth on the mulched area was less than upon the corresponding cultivated plat. On the cultivated soil there was little increase in growth from the use either of stable manures or of commercial fertilizers; while on the mulched land the growth was noticeably (2 to 5 inches) greater, as a result of adding plant foods. These facts would indicate that there is enough plant food in the soil to produce a fairly satisfactory growth, if the mechanical treatment is such as to render it available, and other plants are not allowed to rob the trees."

Subsequent developments have justified the statements here made. For several years the unfertilized trees held their place very well, both as to growth and to yield; but during the last two years the need of additional plant food has been plainly manifest, even on the cultivated area.

Without going into details (for these will be published in a few weeks in a Station Bulletin) it may be said that on the particular soil on which these experiments are conducted, somewhat better results seem to have followed the use of the stable manure than that of the concentrated fertilizer. This, no doubt, was partly due to the humus which was required to put the soil in the best mechanical condition.

THE "RENOVATION ORCHARD."

Three years ago, because of the manifestly favorable results following the treatment given the orchard above referred to, one hundred trees were set apart for specific experiments in the renovation of an orchard. The trees in question were about thirty-five years old, planted on the western slope of a dry gravelly hillside. They were divided into six groups, as indicated in the bulletin above referred to, with appropriate check trees.

One plat was given a complete fertilizer made up of muriate of potash, acid rock and nitrate of soda; a second was given a muriate of potash and acid rock without the nitrogen; a third nitrate of soda and acid rock, without the potash; while the other three plats were given one element each—acid rock, muriate of potash, and nitrate of soda. The orchard has been well pruned and clean culture has been practiced every season.

At the end of the first growing season it was noticed that, as might be expected, the plat receiving a complete fertilizer presented the best appearance. The use of nitrogen alone increased growth to a marked degree (though less than the complete fertilizer) but there was a noticeable lack of color in the fruit. Trees on the plat receiving acid rock alone, in general seemed no better than the adjacent check trees which were cultivated but not fertilized. Potash alone on the other hand, produced a distinct improvement."

Succeeding years have to a large extent repeated the experience here recorded. This particular soil is evidently in need of nitrogen and potash, while the phosphoric acid is not required. In every case the plat receiving complete fertilization has given the best results both in growth of tree and in fruit.

In 1903 a very serious injury to both trees and fruit was apparently the result of a too free use of nitrogen on the plat receiving nitrogen alone. The foliage dropped; the fruit cracked, and much of it dropped, while the remainder was as soft and mealy in October as it should have been the following May.

In passing, it may be said, that since the first year, this orchard has made a good growth and has yielded annual returns of fruit; thus showing beyond question that Baldwins may be made to produce every year if fed with that in view. Taking at random some of the trees in this orchard, we find that tree 11 in 1903 produced 4½ barrels of fruit; in 1904, 1 barrel; in 1905, 2.8 barrels. Tree 25 produced 8.5, 4, and 5.8 barrels for the three years respectively; tree 53 gave 5, 2.7, 3.3 barrels and so on. It must not be understood, however, that all trees bear every year, for such is not the case. For instance, tree 43 has a record for the three years of 0, .7, and 0 barrels. Tree 75 is gradually improving, the record for the three years being 0, .8, and 1 respectively.

THE FISHER FORMULA.

As is well known to some members of the society, a comparison is being made in the orchard already referred to, as well as in the orchard of John W. True of New Gloucester, between the highly nitrogenous fertilizer made after what is known as the "Fisher formula" and a less expensive, because less highly nitrogenous, fertilizer compounded for our own work.

Briefly stated, the Fisher formula is composed of about 8.6% nitrogen, 11.9% phosphoric acid, and 3.3% potash, being made up as follows: Nitrate of soda, 350 lbs.; sulphate of ammonia, 150 lbs; sulphate of potash, 230 lbs; acid phosphate, 220 lbs.; kieserite, 50 lbs. Unquestionably this fertilizer produces a most vigorous growth, resulting in large, though not always well colored fruit, and on uncultivated land is regarded with favor by many growers.

The Station formula contains about 3% nitrogen, 5½% phosphoric acid, and 8 % of potash, being made up of 200 lbs. nitrate of soda; 75 lbs. sulphate of ammonia; 225 lbs. muriate of potash; 500 lbs. of acid rock—in each 1,000 lbs. The Fisher formula costs about $21 per 1,000 lbs., or 21 cents per tree for each application; the other $16 per 1,000 lbs., or 16 cents per tree.

Twenty Baldwins and five Talmans are being used for the specific test of each of these formulas. The Baldwins are kept under cultivation; the Talmans are in sod. The work has been in progress for two seasons, which time is of course not sufficient to warrant conclusions. Both lots of trees have responded freely to the treatment, and yielded a good crop of fruit this year. The Talmans also bore well last year, while the Baldwins were in an exhausted condition when the work was commenced. All are now making a remarkably strong vigorous growth, and promise well. It should be said, however, that as in the experiments first mentioned the stirring of the soil, and the decay of the turf in case of the cultivated trees, obscure any specific difference in the relative merits of the two formulas up to the present time.

Mr. MORSE: I would like to have Prof. Munson explain a little about the variation in these fertilizers. Some who have been buying have got low grade material.

Prof. MUNSON: I should say in all of these it pays to buy the best grade of everything. In buying commercial fertilizers, you cannot afford to pay freight on coal ashes and sand, and that is what it amounts to when you buy low grade fertilizers. I would simply say that in buying fertilizers of this kind, the proper way to do is to make out a list of the amounts of material that will be needed to cover the number of trees that you have and send that list to the Bowker people or the Sagadahoc people and get them to give an estimate as to what they will furnish the material for, and specify that only high grade goods are to be employed; and then order it where you can get the best terms.

A LADIES' NIGHT.

A WOMAN'S WORK IN FRUIT GROWING.

LILLA M. SCALES, Temple.

In the good old days of our great grandmothers, a well ordered garden was as necessary to their existence as the spinning, knitting and weaving of wool and flax for the household. What good dame thought of attending meeting of a Sunday morning in summer without her bunch of clove pinks and southernwood! carefully gathered on Saturday and left out of doors to keep fresh and sweet in the dew over night.

In those quaint old gardens often bordered by hedges of clipped box, grew lovely damask roses, bee larkspur, hollyhocks, great clumps of purple lilacs, beds of sweet lavender for the linen chest; the kitchen herbs, too, grew there—sage, summer savory and the mints; while in secluded corners were the medicinal herbs, sweet clover, motherwort, the beautiful crimson balm—simples to be gathered in mid-summer or they would lose their healing virtue.

Those gentlewomen were proud of the well kept rows of red and white Dutch currants from which yearly were made dainty jellies and preserves from famous receipts, which have been carefully handed down to their descendants with the cherished pewter and rare old china. Those fine old gardens were not left entirely to the care of a gardener. In a recent magazine article entitled "When Longfellow was a Portland Lad," the author says, "Mrs. Zilpath Longfellow, the mother of Henry Wadsworth Longfellow, was one of the garden loving dames, and spring and summer was seen with a negro servant working among her flowers. Sometimes, a little nankeen figure strayed by her side—a dancing sprite that wandered off among the flowerbeds and caused her to call chidingly, 'Henry, do not hurt your mother's posies.' The great poet as an elderly man often thought of his mother's garden in the Forest City, where the robins and the bluebirds came back every spring to flit over shrubs planted by her hands."

Martha Washington's garden at Mt. Vernon was laid out in squares, triangles, hearts and other devices, each separate bed bordered with box, a garden wherein she delighted to work.

The Nation owes an immense debt of gratitude to a woman, a Mrs. Pickens of South Carolina who for many years labored unremittingly for the restoration of Mt. Vernon; with the aid of Washington's papers and the help of the gardener she was enabled to restore this picturesque and historic old garden.

In these modern days we have heard a great deal about "The Man With the Hoe," but the "Woman With the Hoe" is rapidly coming to the front and not only with the hoe but the saw, pruning knife, wax and scions for fruit growing as well as gardening seems especially adapted to women. However to any one who is desirous of making a specialty of any particular line of small fruit I would say, "First, consider carefully your soil, elevation and distance from a prospective market before investing in what may prove to be an uncertain crop with only an indifferent market for your products." For instance, currants with us under apparently the most advantageous circumstances are never to be depended on as a fruit for profit. Early in May we had three rows each seventy-five feet long in full bloom, the bushes bending heavily with the weight. We awoke one morning to find there had been a severe freeze during the night and leaves and blossoms were frozen stiff. By carefully spraying each row twice with cold water before the heat of the sun had begun to thaw them out we hoped that the injury would prove slight, but alas! the cold the next night was more intense and while spraying the next morning icicles an inch in length would form all over the plants; we saved the foliage which was our chief aim in spraying and a small quantity of fruit.

In our next neighbor's garden on sandy loam and in close proximity to a large stream the currant bushes suffered no injury, the elevation above ours so slight as to be scarcely perceptible. Fortunately it was too early in the season to affect the strawberry crop. The strawberry it seems to me is the one small fruit for women to raise and it requires the most work too. Leave your beautifully clean rows for three weeks and then behold them; weeds galore have sprung up; the runners are every where except in the right place, and you feel at times that if you were sure of the munificent sum of ten cents a day for your labor it would be more than you could reasonably hope to receive.

We set our plants exactly two feet apart in raised rows which are made three feet apart using the late runners from the bearing bed. We have tested many varieties but all have proved worthless with us except the " Crescent Seedling " and " Lovett's Early." Just now we are experimenting with the " Glen Mary " and " Marshall," the latter we think will prove especially desirable for under the most adverse conditions, the roots eaten by the grub, the ground tunnelled by the mole in search of the white pest, yet where there has been anything left of the root the plant sends out large dark, glossy leaves, and every late fall runner sends up a flower stalk; the color and size of the fruit is exceptionally fine.

While no rain fell the past summer during the picking season and the weather was excessively warm our strawberry crop did not sustain the least injury from drought or the scorching rays of the sun. The plants were so large and vigorous, that the fruit was sufficiently nourished, and entirely protected by the heavy foliage while a deep mulching of pine needles spread on the fall previous prevented the moisture escaping from the ground.

We find as a rule the strawberry a sure crop and if the berries are kept up to a high degree of excellency, carefully picked into perfectly clean baskets there is no lack of market.

I have never heard or read anything in regard to the pollenization of strawberry plants by bees but have noticed whenever the bees work the strawberry blooms the fruit is more perfect. This year the blossoms were uncommonly fragrant and the bees worked them more than they ordinarily do; we never found an imperfect berry and we had no more fertilizers than usual.

We have vainly endeavored to raise cherry, plum and pear trees—the flamboyant pages of fruit catalogues advertising the " earliest known varieties;" that will give a paying crop the third year from planting, and flourish in any soil from Labrador to Florida, have no longer any charm for us—we have wasted too much of our substance, not only in new varieties but in standard sorts as well. Also they have been planted and cultivated with care; in a year or two the leaves of the plum and pear turn yellow, the bark of the cherry cracks open; soon all are consigned to the brush pile. However, we have not despaired of a small plum and cherry orchard in the future, for on a well drained, gravelly knoll we have planted many of the pits hoping to raise some hardy stock for grafting; although this may not be practical it seems to be our only solution of the problem at present of raising these delightful fruits.

We also aspire to an apple orchard for the orchard is the crowning glory of our Maine farms.

To quote a Japanese writer: "Our old New England orchards are as beautiful in spring as the flowering of the plum and cherry trees in Japan." There the whole world takes a holiday and goes forth to worship the beauties of nature. If we do not emulate our Oriental friends and take a holiday, we perhaps appreciate the beauty as much. Do you not all watch for the first signs of fruit buds ere the snow has fairly disappeared? How fearful you are lest the "Rough winds do shake the darling buds of May."

The orchard in early June with its "glorious burst" of bloom, all pink and white, the delicate green of the leaves hardly perceptible, the busy hum! hum! of the bees gathering nectar, the softly falling petals, the call of the oriole, the light flickering through the branches, the purple haze on the distant hills give an undefinable atmosphere of rest. "Such peace as the town, save in dream, knows never." But not with the passing of the spring does its beauty depart. The foliage deepens and nearly hides from view the tiny forms of the apple that are soon to become rounded into glorious spheres of red and yellow and crimson by the sun.

The advice of that veteran enthusiastic orchardist, the late, lamented Mr. Gideon K. Staples was: "Plant apple trees, plant apple trees, if you lose ninety out of every hundred keep right on planting," that was his experience and we all know the result of his labors.

Some of our native trees and shrubs, wildings of the woods and swamps are most beautiful in flower and fruit and deserve a better place than is usually given them or rather where they are allowed to grow; and also are of great value as they call to our homes and gardens many song and insect-eating birds which would otherwise not be found there.

Among these is the June berry the first of the great rose family to greet us in the spring, with its branches full of long, loose racemes of bloom; place two or three of the slender sprays in a tall, clear vase for the dining table or living room and if you have never used it before for decorative purposes you will be delighted with the result.

The tree itself has such a trim, neat habit that properly pruned it is pleasing to the eye the year round.

Our native hawthorne or wild thorn is most exquisite in bloom and especially so after the fruit is matured. The leaves drop early in the season but the sharp thorns give an artistic setting to the dark tipped scarlet berries.

Another is the wild high bush cranberry. It bears transplanting well and responds readily to cultivation; the bush honeysuckle, so universally planted, cannot compare with it, the berries are a most brilliant red and the foliage remains on till late in the autumn and after the first frosts lights up a perfect blaze of glory in the sunshine.

Multitudes of our native little brown birds in search of food fill the branches of the Virginia creeper which partially covers our house soon as the leaves have fallen.

But the elderberry is the bush par excellence to entice the birds around the premises, not only are the great creamy white cymes of bloom very effective, when seen at a distance, but later as soon as the berries begin to turn purple the birds congregate on them early every morning, before the sun has fairly risen, the bushes will be actually blue, so many bluebirds come for their breakfast, perfectly fearless of any one standing near or passing by. This by no means completes the list of wild fruits both useful and ornamental. I do not believe in a tangle of wild shrubs about the house simply because they are beautiful growing in their native woods, but a few judiciously planted are most attractive or when left to grow beside a country road where they do no harm and are much more desirable than the worthless alder bushes which spring up everywhere.

Nature covers old walls and unsightly fences with clematis and woodbine, young trees grow up and conceal the blackened stumps of the denuded forest; even on the barren desert where there is a spring of water the weary traveller finds green grass and the comforting shade of the palm.

Life should not be all sordid and practical but in harmony with nature's teachings, "beauty is an all-prevading presence" and the more pleasing our surroundings the more enjoyment in living.

Vines, flowers and small fruits should not be considered luxuries but necessary adjuncts to the farm home and if the women on the farms could realize what they might accomplish with a little labor the city would be far less attractive for the young people who every year so eagerly flock to our great centers of industry in search of employment—and enjoyment.

Country life is often called "isolated" and "dreary;" no doubt it was in the past to a great extent but the rural mail carrier with his daily round and the many "farmers'" telephone lines have changed all this and the remote dweller in the country is now in touch with the whole world.

Some of the most famous prima donnas are more than amateur gardeners. Calvê retires in summer to her country home among the mountains and donning the peasant costume, deftly wields hoe and spade, often sending baskets of fruit and vegetables of her own raising to her friends in Paris. She says she owes her voice and superb health to wooden shoes and potatoes.

An English countess has at great expense opened a "school of horticulture" for young women where they are given scientific training, also Fraulein Bertha Krupp, the owner of the largest gun works in the world, has recently become interested in gardening and will start a school at Essen where girls may learn the trade. Such examples ought to be a great inspiration to the women of today as they show the high esteem which is placed upon horticulture as an employment for women.

Mrs. Hemans in her delightful poem "The Spells of Home" paints an exquisite picture of rural life:

"By the soft green light in the moody glade,
On the banks of moss where thy childhood play'd,
By the household tree through which thine eye
First looked in love to the summer sky,

"By the dewy gleam, by the very breath
Of the primrose tufts in the grass beneath,
Upon thy heart there is laid a spell,
Holy and precious—oh, guard it well.

"By the sleepy ripple of the stream,
Which hath lull'd thee into many a dream,
By the shiver of the ivy leaves
To the wind of morn at thy casement eaves,
By the bees' deep murmur in the limes,
By the music of the Sabbath chimes,
By every sound of thy native shade,
Stronger and clearer the spell is made.

* * * * *

"Yes, when thy heart in its pride would stray
From the pure first loves of its youth away,
When the sullying breath of the world would come
O'er the flowers it brought from its childhood's home—
Think thou again of the moody glade
And the sound by the rustling ivy made—
Think of the tree at thy father's door,
And the kindly spell shall have power once more!"

A WOMAN'S WORK IN ORCHARDING.

Mary Augusta Bass, Wilton.

When your secretary asked for a paper giving the experience of my sister and myself in orcharding, my first thought was that such a paper would be short and uninteresting. But after a little consideration of the subject I found it a longer tale than I had imagined.

The original seven acres of our orchard land was purchased by my father, Mr. S. S. Bass, with the first money earned by him after he became of age. He afterward added adjoining land making in all a tract of about twenty-five acres, seven acres of which was wood land and the rest grass and pasture land.

He did not begin to plant trees until about 1870 after he had moved to Wilton village. The trees were set, a few at a time, during a period of twenty or twenty-five years, until the eighteen acres of cleared land bore nearly nine hundred trees. For many years he devoted to the orchard only the time which he could spare from his other business but as the orchard grew and required more attention, he became more and more in love with the work and came to have a firm belief in the future success of the business. He set native trees of natural fruit because he thought them more hardy than New York trees. More than half of them he grafted to Baldwins and nearly all the rest to Harveys and Ben Davis. All kinds of orchard work he did with his own hands—setting the trees, grafting, trimming, mulching, fertilizing, bridge-grafting, spraying, fighting insects and mice, harvesting, packing, shipping. About ten years ago he built a storehouse in the orchard to receive the apples while harvesting. There being no cellar, however, the fruit cannot remain there long.

During the early nineties, as you all remember, the apple business was at a low ebb and the caterpillar years which followed made matters still worse, so after my father's death in '99 we found it impossible to sell the orchard except at great sacrifice. Consequently we decided to keep it for a while and carry it on as best we could. Ere long we found that we, too, had caught the orchard fever and we have already refused to sell for more than twice the amount which we were first offered. This is how my sister and I have come to be in the orchard business. As she is a teacher, the management of the orchard has fallen largely upon me.

Our first year was a discouraging one, being the worst of the caterpillar years. We were fortunate, however, in securing a reliable man to spend his whole time in the orchard during caterpillar time and he did his work so faithfully that the foliage was saved and the trees were uninjured. The apple crop, nevertheless, was small.

The next spring we hired a man to remove the caterpillar eggs from the trees and burn them. That year, as you doubtless remember, the caterpillars hatched in large numbers but were soon destroyed by a parasite, so that orchards suffered little.

Just before the harvest time there came a high wind which left us with about one hundred fifty barrels on the ground. What to do with them was a serious question. There seemed only two ways open—either to sell them at the cider mill, or sort out the best and destroy the others. We saw that the matter of selling apples for cider must be decided once for all. We considered carefully and decided against the cider mill. We could not take the position we wished on the temperance question when there was a possibility that our financial gain had been the means of some poor fellow's undoing. We resolved that we would never knowingly sell apples for cider unless we were sure that it was to be turned into vinegar. We have kept our resolution.

But what should we do with those one hundred fifty barrels of windfalls? A good friend who approved of our decision, came to the rescue, and obtained for us a chance to send them in bulk to the coast of eastern Maine. So we dumped them into a car and in due time received for them the same price that we should have got at the cider mill. Of course those apples were of better quality than are usually called cider apples, as the early windfalls had been carefully picked up before the wind storm.

You may like to know how we usually dispose of the refuse apples. As we keep no pigs ourselves, we sell to those who do. There are livery stable men who often buy large quantities of such apples to feed out to horses and pigs, paying from twenty to thirty cents without the barrel. Last year we sold nineteen barrels to one man.

One of the difficulties in the way of our success as orchardists has been the scarcity of help. As we are unable to do the work ourselves, we are obliged to depend entirely on hired help. The orchard being a mile from our home it is impossible for me to personally superintend much of the work; hence it it necessary to employ reliable men who understand their business. Such, of course, command high wages. Consequently the orchard yields a smaller profit to us than it would to a man who could devote his own time to it and superintend the work in person. We have been very fortunate, however, in obtaining good help. For several years we have had the same man to take charge of the harvesting—one whom we can trust and who has the name of being one of the best apple pickers in our vicinity. Before him another equally good had the care of the gathering. The latter several times picked twenty-seven or eight barrels in a day just to see what he could do.

There are "exceptions to all rules," however, and we sometimes have unprofitable workmen. One, who was sorting apples a chilly day in October, as he lolled on the sorting table, remarked that he should like to sort apples if he had a chair to sit in and a fire to keep him warm. We thought a few games of football might help the young man.

The matter of spraying has caused us more trouble than any other. Any one who has tried it knows that it is not agreeable business. Comparatively few men in our town will do it for themselves and it is next to impossible to get them to do it for others. However, we sprayed two or three years, and as our spraying invariably brought an immediate shower or rain storm, we have decided that we might as well spend our money some other way.

In fertilizing we meet with another difficulty. We believe in breaking up the soil and have done it somewhat but, having no team of our own, we are obliged to hire the work done and we find it hard to get it done properly and at the right time. So we have decided that top dressing is best for our smooth fields. One rough piece was several years ago fenced for pigs and they have kept the ground well plowed. The result has been a great improvement in the appearance of the trees and in the quantity and quality of fruit. Next year we hope to fence our Ben Davis orchard of about one hundred young trees which have scarcely begun to bear. A man of our acquaintance stands ready to put in fifteen or twenty pigs as soon as the hog fencing is up. Thus far we have used only barn dressing and wood ashes for fertilizing. Next spring we intend to try a commercial fertilizer.

One or two years we were troubled by mice. As a safeguard against them we used tarred paper with good results and stopped mulching the young trees. Whenever a thaw came in early winter we had the snow trodden hard around the trunks of the trees.

The matter of trimming the trees is a serious one with us. Few who understand the business have time to work for others. For the past two or three years comparatively little has been done in this line and the trees look sadly neglected. We have a few trees in the garden around our house. The last time these were trimmed for lack of better help I hired a man whose knowledge of the art was as limited as my own. So I told him to cut off simply the dead limbs and suckers. At first I kept an eye on him but, as the first two or three trees were done all right, I soon went about my household duties which were rather pressing just then. Later in the day I went out to see how he was progressing and was dismayed at the naked appearance of the trees. One tree in particular I remember—a Garden Royal, the whole top of which had been grafted to Ben Davis, leaving only a few lower limbs of the early fruit for our own use. He had cut off nearly every one of those cherished Garden Royal limbs. When I expressed my disapproval and asked why he did not follow my directions he replied, " Wal, I knew them natural fruit limbs ought ter come off so the grafts in the top could grow. I thought you, bein' a woman, didn't know, so I follered my own jedgment." And I, "bein' a woman," was filled with speechless indignation and turning on my heel went into the house. My sister, "bein' a woman," went out and gave him a piece of her mind.

Occasionally, when there are difficult matters to settle or things seem to go wrong with us, some jocose friend says, "Why don't you get married and have a man to manage your business for you?" And we reply that it is easier to manage an orchard than to manage a man.

During the season of 1901 and '02 if I remember correctly, apples sold for a high price. We wished to try our hand at shipping instead of selling to speculators as we had usually done. We decided to consign them to a London firm and having less than a carload ourselves we secured the consignment of other lots sufficient to fill the car, made all the arrangements, had a man at the station to look after the loading and sent them off. The returns were satisfactory. Later the Maine agent for this firm asked me to act as their permanent agent for Wilton and adjoining towns in securing consignments. I felt flattered but declined the offer. Since that year we have sold to speculators or shipped to some Liverpool firm as seemed best at the time.

Two years ago we, like others in this part of the State, were overtaken by a much larger crop than we were prepared to handle. Such a hurrying and scurrying as we had for barrels, buying in all about four times as many as we had ordered the first of the season. The barrels arrived. You should have seen them. Big barrels, little barrels, good barrels, poor barrels, white barrels, black barrels, clean barrels, dirty barrels, barrels with hoops, barrels without hoops, barrels with heads, barrels without heads. Since then we have bought factory barrels, paid less and got more. That year we sold seven hundred barrels of marketable apples besides windfalls and thirds.

Sometimes we sell early, sometimes late, according to the condition of the fruit and the state and prospects of the market. Sometimes we get a top price, sometimes we get caught. But on the whole we have been as fortunate as many of our more experienced neighbors.

This year the orchard yielded four hundred thirty-five barrels. We sold our Harveys at the orchard for $2.50, shipped twenty barrels of windfall Baldwins which netted us $1.82½ at Wilton station and have put into the cellar all our winter apples with the exception of fifty-five barrels which, for lack of storage room, have been shipped to a Liverpool firm.

The average income from our orchard has been fairly good. Some years we have realized quite a sum from it, other years our receipts and expenditures have been about equal. In addition to the apple crop we usually cut seven or eight tons of hay which helps to pay expenses.

An orchard is like a horse, in order to do good work it must be well fed. As you well know, however, in the opinion of many every apple grower is little less than a prospective millionaire. They forget the feeding and remember only the yielding. They think only of the years of plenty and forget the years of famine which intervene. After the big apple crop of two years ago some of our acquaintances scoffed at the idea of our ever needing to work again or to deny ourselves any luxury. Nevertheless, we still find it necessary to do what all other orchardists may expect to do till the end of time—earn our living by the sweat of our brow.

But there is another side to this occupation which brings no small reward. From an aesthetic point of view, what is finer than an orchard of several hundred thrifty, well kept trees! What more beautiful than these trees in full bloom with their pink and white blossoms against the delicate green foliage! Then the delight of watching the apples grow from their tiny beginnings until they develop the size and coloring of the perfect fruit! Every apple grower knows with what a thrill of pride he views his orchard of ripened fruit when ready for the harvesting. Are not these things a part of the reward of the orchardist? We think so.

Men often dislike to trade with a woman. They have an idea that she expects them to give her the best end of the bargain and accommodate her at the expense of their own interests. They do not know how to meet her on a business basis. They do not seem to understand that she expects only the same treatment that honorable men accord to each other. For instance: A stranger called one evening introducing himself as a member of a prominent firm of commission merchants. We expected to hear of the business of his firm and the inducements which he could offer. Instead, he entertained us the whole evening with talk on various subjects—bits from his personal experience, amusing anecdotes, current news, etc. In the words of Whittier,

"He spoke of the grass and flowers and trees,
Of the singing birds and the humming bees;
Then talked of the haying, and wondered whether
The cloud in the west would bring foul weather."

In short, he made himself as agreeable as possible. When he rose to take his leave he said in a casual way that he hoped we would consign our apples to his firm, yet he had not given us the remotest reason for so doing. We appreciated the effort he had made but we gave him no consignment that year.

In our business correspondence my name is usually used, signed M. A. Bass. Much to the amusement of our friends many letters come with a Mr. prefixed. But when some of the men who have so long solicited our patronage chance to discover that their Mr. M. A. Bass represents only two old maids after all, we are often dropped like a hot coal. Our own townsmen have become accustomed to the situation and are not afraid of us.

Perhaps men have some grounds for avoiding business transactions with women. Women who are compelled to be their own businesss managers are sometimes heard to complain that men are always ready to take advantage of them; that men charge them a higher price for labor than they would charge a man; that men are not willing to work for them, etc., etc. There may be some truth in these charges. People are apt to be about as good as you expect them to be. When a woman is suspicious and exacting a man often meets her with a like spirit. If she expects to be cheated he does not want to disappoint her.

As for ourselves we have no complaints to make. From the first we have had many friends among the men of our town. They have been interested in our venture and anxious for our success. Some of them have done work for us when they have refused to work for men. They are pleased when we make fortunate sales and disappointed when we are unsuccessful. We consider every man our friend until he has proved himself unworthy of our confidence. We never try to drive sharp bargains but intend to give value for value and expect to receive the same from others. Only in rare cases have we received other than honorable dealings from men. We have reason to trust them. We realize our ignorance of many of the unwritten laws of business and doubtless we often transgress; but we have found men very lenient toward us and we are gradually learning the ways of the world.

Right here I wish to acknowledge our indebtedness to one of the orchardists of our town, Mr. R. C. Fuller. To him we have gone more than to any other for advice in orchard matters. Although a very busy man, he has spent many half hours in listening to our plans and perplexities and giving his opinion and advice. He himself, as some of you know, was for a period of years the owner of two orchards, one of which numbered one thousand trees, set by his own hands. Although he has now sold these he is still interested in orchard matters and is the same kind, disinterested friend and wise counsellor as before.

Such is the story of our experience in orcharding. There is in it nothing striking or unusual. It may, however, encourage some other woman into whose hands such work has been thrust.

A WOMAN'S WORK IN BEAUTIFYING THE HOME.

Mrs. KATE B. ELLIS, Fairfield.

It is said that our minds are receptive to a certain point and then they refuse to receive anything more. It does seem to me that tonight, after the two days' excellent meeting, after the many grand, good things you have had poured into your minds, your minds at this point must have ceased to be receptive.

A few years ago I went into a school and the teacher called the geography class. She called on a little girl to recite on the continent of Asia. The little girl got up and with an air of finality remarked: "There are three facts about Asia;" then she very coolly proceeded to give the three facts that there were about Asia. Well, now, I cannot tell you tonight that there are three facts to make your home beautiful, because you know, and I know that there are a great many facts and a great many fancies that go into the home beautiful. It is said that God divided man into men that they might help each other. And if there is anything that seems to us to make our home a little more beautiful, it is just that one thing, that we can tell each other in hopes that it may do something toward making their home beautiful.

I am going to be, perhaps you will think not courteous at first, for I am going to ask you to stand with me outside the home before I invite you into the house. But one of our leading horticulturists has said that the yard is the outdoor parlor of the home. So I may not seem so discourteous as at first. You are indeed blessed if you have near your home some old elm trees. You are blessed if you have near your home trees of any sort. If you have not, one of the first things that you will want to do will be to plant trees. A man who plants a tree is a public benefactor. Stephen Girard, the founder of Girard College, said: "If I knew that I were to die tomorrow, yet today would I plant a tree." We have different tastes. It is perhaps well for quick growing to plant maples. Let me urge you to plant the horse-chestnut because of its beautiful foliage; and then when it is in blossom it is a beautiful bouquet. There is perhaps some liquor that comes from it. That can easily be taken care of. And then for another reason, it is a tree that pleases the children. I remember a few years ago taking some of my pupils into the yard of a friend who had had a horse-chestnut tree for a number of years, and showing them the little horseshoe that is formed out where each twig joins, and much to my astonishment my friend had never noticed the hundreds of little horseshoes that there were all over the horse-chestnut tree. That I think is where it derives its name. Perhaps some of you may have the horse-chestnut tree and possibly may not have noticed it, but it is a very pretty and perfect horseshoe with every nail set in its place regularly. The horseshoes are of different sizes. This is one thing that helps please the children besides giving the beautiful shade. I perhaps may differ in this respect from others but I would not have near my home many evergreens. The pines are beautiful if we do not get them too near our houses, but there is enough sombreness that comes into our lives without bringing the dampness and shade too near us. A strip of clean green grass in front of the house looks to me more beautiful than anything else. It seems a little strange that in even the planting and sowing of our lawns the National colors can come in. I have read that the best seed to mix for lawns is the redtop, the Kentucky blue grass, mixed if the lawn is sandy with the white clover seed, which you see gives us the red, white and blue. It struck me as a little peculiar.

Many of us like shrubs and bushes about our house. If we have them let us choose them with an eye to getting some that shall not be unsightly when they have gone out of bloom. And it is very pretty to put them in groups so that when one shrub has ceased blossoming another may be there ready to blossom with the other shrubs for a background, a part of a beautiful bouquet. We all want the lilac, particularly because that pleases the children. You perhaps may think tonight that I shall refer a good deal to the children, but having been associated with them over twenty years in the schoolrooms, and having one of my own, you will pardon me, I know. If you have no children of your own, you will find plenty of other children that will be glad of your lilac bush. It is a perpetual pleasure to children while it lasts.

After the lilac comes the bush honeysuckle, then we get the spirea, the snowballs, and what we must have,—roses. Lately there is a shrub come into quite general use all over our State and that is the hydrangea. It hardly seems possible that in 1874 it was introduced into our country from Japan. It is now planted to such an extent that we find it nearly everywhere. I, perhaps, am not as fond of it as I am of a great many shrubs, because I like the good, old-fashioned posies myself and I like those that have an odor.

I am going to take you now for a few moments into my flower garden. In the first place, if it is possible, plant your flower garden where the most people can get the good of it. For years I was selfish and had my flower garden out back of the house because it was easier for me to get at it there, but afterwards I moved it right down across the road and I have been astonished to see the people that have stopped to get the good of my flower garden, and oftentimes people to whom I could give flowers that would not have had them in any other way. So if it is possible for you, put your flowers where they will do the most good.

If I could have but one flower, it should be the sweetpea. You perhaps will not all agree with me. I don't expect you to. But there are several reasons why I would plant sweetpeas. First, because they are very easy to cultivate. If you plant enough of them and plant them in different places each year you won't be troubled much. I had this last year over fifteen rods of sweetpeas and it was a great pleasure to me to pick them in big bunches—and I want them in big bunches—to give to my friends; and it was a pleasure to me to pick them in big bunches and take into my own home, that when I opened a door they would send out a welcome to me.

I want to say just a word about carnations too. I think many of you don't know what an easy flower the carnation is to raise. I have now carnations in my garden that have been there for three years and have never been touched and they blossomed this summer just as freely. I get my seeds, perhaps a package of ten cent Marguerite carnations, and when they are in blossom, if you give them proper care or good earth which is about all they need, you will find the blossoms just as beautiful as those you can find at the hothouse. I plant my seed in boxes of soft earth in the house; then we have a little hotbed out of doors which we prepare in the fall, my boy and I—it is an easy matter, you know the preparation of a hotbed so I won't speak of that. We prepare it in the fall and have it covered up with our sashes. In the spring when it becomes warm enough, oftentimes before the snow is off of the ground, when our boxes in the house get too full of the pinks and asters and pansies and things that we raise, we set them out in this hot bed. The only thing you have to be careful about is, don't keep your sashes covered too tight in the day time when the sun shines so that your plants will be burned up, and at night be careful to throw something over them. My carnations that I plant in the house I usually plant in lines; when they are large enough I transplant them to boxes; when my boxes get too many I transplant them to the hotbed. They are put out into the ground in the summer and in the early fall my carnations begin to blossom and during the winter I do not even have to cover them. Perhaps if you have an exposed place you might put a little over them. The next spring my carnations are there, almost as soon as the snow is off of the ground, green and healthy and ready to go to blossoming. A year ago this last year I set out 57 new carnations and I think I shall not exaggerate if I say that last July I had hundreds of blossoms on my carnation bed, of all varieties, besides the buds and half open flowers. And it gave me no trouble at all. I never have had any trouble in raising them. This year I set about 125 aster plants. There has been some trouble lately from the aster turning yellow and dying. There is no way to obviate that. Plant a few more plants so you won't miss losing them. Plant them in different places. If you plant them in the same place year after year, you will find that this little insect stays in the ground and will kill your plants in spite of you. So plant them in a different place if possible. If not, pack tobacco stems and leaves about the roots and that will kill off the insects.

Nasturtiums,—yes—

"A tangle of bright green leaves all over the garden border,
A mass of wonderful bloom parading its gay disorder,
Yet such is their charm and delight one pauses, half ready to flout them,
For oh, at its midsummer height, what were the garden without them!"

Pansies,—we must have them. And Shirley poppies—if any of you have never tried them, let me advise you next year to get some packages of Shirley poppy seeds, which are only five to ten cents. My bed of Shirley poppies was the most beautiful thing in my whole garden. They are so delicate and they toss their little heads so daintily, and every morning almost there is a new shade, a new tint to greet you. Mignonette is so nice if you wish to carry a bouquet to a friend, it is so fragrant in the house. And we all must have the pansy, heart's ease, one could gaze for half a day upon this flower and think of the different tales of love and sorrow that gave it this gentle name.

But one of the best things of all about our garden is that it takes us out of doors. A lady once said to me, "Doesn't it make your hands black and how can you get the dirt out of your finger nails?" I told her that I could easily get the dirt out of my finger nails, and that it did make my hands black, but that I didn't mind the least bit in the world for to me the greatest pleasure in a garden is getting out of doors and digging and putting the things in myself and seeing them grow. It has been said that we have outgrown the sincerity of a life near the soil, but we can prove to people that we have not outgrown the sincerity of a life near the soil. Gardeners ourselves by birthright, the sacredness of earth and heaven still clings to the tiller of the soil. I presume many of you here have read that beautiful little story "Elizabeth in her German Garden." Although it is a beautiful story I cannot at all agree with Elizabeth, because she hired a gardener and an assistant gardener to do all her digging and put all her little plant children into the ground. And it tells how one Sunday, while her gardener and assistant gardener were eating their dinner, she crept out of the house and got her spade and some plants and planted them herself, and she was very much delighted in so doing. When she got through she said "Digging in a garden is not graceful work and makes one hot, but it is a blessed sort of work and if Eve had had a spade in Paradise and had known what to do with it, we should not have had all that sad business of the apple." And I think it is so. If more of us had a spade and dug in the garden there would be a good deal less melancholy in this world and a good deal better feeling with us all.

It is sometimes said, "Does it pay to have flower gardens?" It does pay. Nearly everything that is needed to make the farm beautiful in the long run will pay in dollars and cents. I am not urging it solely on that account. Life is more than meat and the body more than raiment. It pays to elevate life, mind, tastes, thoughts.

Now I am going to ask you for just a few moments to step inside the house. First of all, let your home be within your means. Next, let your home be harmonious. Do not go to one store and buy a carpet, at another and buy your wall paper, at another and buy your shades,—without any thought of the other. Let it be harmonious. It is said that some of our leading physicians now in some of their most dangerous cases, particularly of nerve trouble, are simply putting their patients in harmonious surroundings and that the cure is wonderful. But I do not say by this that harmony makes the home beautiful, for I can imagine the home beautiful even with a red carpet, blue paper and green shades,—for the home is what the heart and the soul make it.

I remember when my little boy was between two and three years old we visited at the home of an uncle. He had just had a most beautiful new house built. It had stained glass in many places, it was polished and made of the most beautiful wood. We stayed there two weeks and when we went back to our home, our farm, which had none of these beauties, he sat down in his little chair in the dining-room, and as he rocked back and forth he looked all about the walls and I thought, "He is contrasting his home with his uncle's." But he looked up to me with a smile on his face and he said, "Mamma, my home does look better to me than Uncle Hennie's house." And that was it, his home looked better to him than some one else's house. That is the home beautiful, that looks better to us than any one's house.

I am going to speak just here about the most beautiful of all plants, and that is our children. This question should be turned in our minds, Are we doing the best that we can for our children? Not, are we giving them the most? Are we giving them everything they want? but—Are we doing what is best for them. So many times, I think particularly we that live upon the farm, if there is but little comes in we give it all to our children. Is that right? We are laying up for them a harvest that is going to cause them trouble in future years. They are going to feel sorry that they have taken it all. I think in every home the parents should give to the children and the children should give to the parents. It should be mutual. Have your children do for you, as you do for them.

Another thing that I want you to cultivate in your homes, that I am trying to cultivate in mine, the greatest plant of all, is the plant of courtesy,—the plant of courtesy and love. We are so apt to forget to be courteous to our dear one. How many times our children will do some little thing for us and we will forget to say "Thank you;" we will forget to preface our requests by a "Please;" we will forget to say those little words "Excuse me" when we have hurt their feelings, when we would use them to a stranger—and they are dearer to us than the whole world. Let us not forget to be courteous to our dear ones, for that is one of the greatest elements that goes to make the home beautiful. It is said that courtesy is one of the qualities of God himself, who of his courtesy giveth his sun and his rain to the just and the unjust. Courtesy is the sister of charity which quencheth hate and keepeth love alive.

"Farmer packed" apples. Object lesson at Maine Pomological Society, 1905. F. B. Perley packed 'em. R. E. McLatchy (commission man) said such packing means $4.00 a barrel.

SECRETARY'S PORTFOLIO.

LET THE GOOD WORK GO ON.

What with the daily press urging people to eat less meat and more fruit and vegetables; every Sunday paper printing a beauty page in which a fruit and vegetable diet is strenuously urged; physical culturists' physical culture shows urging the same thing, the butcher ought to be all a-tremble, even if every fruit grower and fruit dealer isn't already rich. Vegetarianism undoubtedly is making mighty strides, and we don't mind saying it's all the same to us.

Apple a day, keep the doctor away—
Apple at night, starve him outright—
Apple each meal, and one for sleep,
Kill him and shroud him and bury him deep!
Maids who seek a rosy cheek
Orchard-way go faring,
Apples ruddy, apples sleek,
Six a day seven days a week—
Show nor stint nor sparing,
Pluck and eat, sour or sweet,
Seed and core and paring.

Vaithful and vruitful and vree,
Yere's to the apple, lads, yere's to the tree!
Vriend o' the varmer, lads, ne'er may 'e vail
Till turnips be rosy, lads, and cherries be pale—
Huzzay, the apple tree.

—*Fruit Trade Journal.*

RICHARD H. LIBBEY.

Dr. Geo. M. Twitchell.

As we gather this year to arrange our exhibits and organize the work of these sessions, we miss the hearty greeting, the willing service, the earnest cooperation of one member of our executive committee and are made conscious that the lifework of Brother Richard H. Libbey has ended but for that influence which remains to inspire us to greater service. I knew him well, yet would not stand here for a moment to eulogize. Rather would I emphasize certain traits of his character which it were well for us to emulate.

What first won my admiration was his bold, fearless, outspoken criticisms of shams, whether in men or things.

He may have kindled animosities and prevented close friendships by his freedom of speech, but looking back over the years, I fail to recall an instance when his voice was raised against better conditions, higher aspirations, nobler practices. He condemned unsparingly the petty meanness of men whose only thought was to grasp for their own benefit what came within their reach, those who measured public service solely from the low standard of personal ends.

He was severe in criticism of measures, public or private, which thwarted the best good of any individual.

We smiled at his caustic thrusts and sometimes regretted the sharp personal allusions, but today can see that what he antagonized were the greed and selfishness of individuals, what he desired was to help to better conditions in public and private life.

He believed in his town and never hesitated to sing its praises. Especially did he believe in Hillside Farm and its small fruits, and it was here and among these that one saw the real side of his life.

You who knew him will bear testimony with me to that unselfish spirit which prompted the most hearty assistance to any and every man who desired to know more about small fruit culture, and many a visitor has gone from this farm, not only stocked with advice, but with plants and slips, when it was known that the product was to come in direct competition with his own.

Going home from our annual gathering at Skowhegan, where he had labored so untiringly for the success of the meeting, he said, as he struck his hands together in that manner peculiar when emphasizing a thought, "Oh, if the farmers of Maine would only wake up and take hold of these questions what a revolution we could work!"

"I wish I was a young man. How I would cover Hillside Farm with gooseberries, plums and currants and make things hum!"

Here was the spirit of the man, and to help quicken desire and love for the fruits of the garden and field was to him always a pleasure and a source of satisfaction.

Such men are helpers. Such men are missed. Such men are the builders whose work is seen long after they have rested.

Could he speak today he would ask no resolution of recognition of service performed, but would he not say to you and me: "What are you doing today to make this fruit gathering better, more complete and helpful than last year's? How are you shaping things to accomplish most for the trees, shrubs and vines, in whose companionship I have labored for years and which have never failed to give me good returns?"

In that pleasant home on the hillside, overlooking the lake and village, as well as orchard and shrubs, I have turned many times when worn with the cares of business and suffering from the burden of disease, and always was the welcome earnest and cordial, bringing rest and vigor to body and mind. Realizing there the intensity of this man's desire for better conditions, I came inevitably to measure him, as you and I hope to be measured, from the best side, and to realize that in his death, the village, town, county and State lost the active services of one who sought to build up those substantial industries which would endure and to stimulate love for those special lines of work to which so many years of his life were devoted.

May the mantle of his enthusiasm fall upon each and every one of us and through renewed efforts may we labor for the realization of his desire that every hillside shall bring forth a bountiful harvest of fruit and every garden yield its wealth of berries and plums.

I can close these brief remarks in no better manner than to use his words, as one day we were talking about the going out of one we both knew.

Said he: "Let's have a sympathy for those who remain which will mean something more than mere words, and then let's take hold and go to work and do something."

HON. CHARLES A. MARSTON.

It is a singular fact that two of the life members received by our society in 1904 should die the following year. Mr. Marston first met with the Society at our orchard meeting in Manchester. Interested himself in fruit growing and pleased with the work of the Society he then and there became identified with the Society. At our annual meeting for that year held in Skowhegan he made an exhibition of excellent fruit and made a very pleasing address of welcome.

He was born in Waterville, May 26, 1851, the son of Isaiah and Eliza Coburn Marston. He was educated in the common schools and Bloomfield Academy. He settled in Skowhegan and became identified in one way or another with many of its material interests. He has served in both branches of the legislature. For fifteen years he was a member of the Republican town committee, being chairman ten years of the time. He was a member of several secret orders and a Mason of high standing.

His farm is in the southern part of the town and is said to be one of the finest estates in the county.

FRANCIS FESSENDEN.

General Francis Fessenden was a son of Senator William Pitt Fessenden. He was born in Portland March 18, 1839. He was educated in the old Portland Academy, Westbrook Seminary, and graduated from Bowdoin College in 1858. He studied law in his grandfather's office and attended the Harvard Law School. In 1861 he was in Minnesota and when President Lincoln called for volunteers he promptly tendered his services to the government. He was appointed captain in the regular army. He had an honorable war record and after a long service, was retired as major-general. He attended the exhibition at Auburn in 1903 and was so much delighted with what he saw that he became an annual member of the Society and in 1904 he became a life member of the Society.

He died at his residence in Portland January 2, 1906.

FARMER-PACKED APPLES.

At the close of the fruit exhibition at Canton Mr. F. B. Perley of Vassalboro gave an excellent demonstration of the Vassalboro style of packing apples. The fruit was King taken from the exhibition tables, and the demonstration was witnessed by a large number. The lace top and the corrugated strawboard apple cap and stencil were brought in by Mr. R. E. McLatchey, a dealer in fruit and farm products. The fruit as packed made a fine appearance as shown by the illustration.

GOOD WISHES.

The Hon. Fred Atwood of Winterport was one of the earliest members of our Society. Circumstances have prevented his meeting with us in recent years, but like others the secretary knows he has a warm place in his heart for the Society. In a letter before our last annual meeting he writes: "I am one of the originators of the Society. A few of us gathered in the Augusta House parlor and formed the Society. Most of them have passed away. I have always had an interest in the institution and for its success in the early days took quite an active part. I do hope you will have a nice meeting. I trust that the association will advise and press upon the farmers of Maine the desirability of putting out fruit. An apple orchard is worth more today as a sound, solid income than an orange grove in Florida. There is no reason why an orchard well located and cared for will in a few years produce an income to support a good family. To do this they should buy their stock of known, honest people and have intelligence and education with some bone and muscle and a pick and some ground bone to fertilize and care for their trees. It is a pleasure to me to know of the society's success, as you remember I was one of a very few that were in at its birth."

WORDS FROM AN ENGLISH BUYER.

During the autumn of 1905 Mr. Fred Pritchard, who is widely known as the member of an English house, wrote a letter to one of our Pomona granges from which the secretary is permitted to copy the following:

"I argue the orchardist should export the product of his labors as a concentration of interests; for instance, I have known sections in Maine on the occasion of a medium to heavy crop being entirely neglected by the speculator who at the same time is making large profits in fruit bought by him in other apple producing parts of the country. I also advocate the grower shipping his own apples on the principle of economy. Why should he not earn the quarter of a dollar which is deducted from the price of the fruit to pay the packer? It is argued by speculators that if the farmer packs and exports his apples the trade will be ruined. He will pack everything and there will be no money in the business," says he, "as prices will rule low on account of the all round poor quality of the fruit."

I assure you I received dozens of parcels of apples from growers in Maine last season infinitely better packed than any of the old legend mark of the speculators which have made the Maine apple famous. I have seen growers' stencils sell higher than some barrels with the heads all stencilled over with "Highland Baldwins," and so forth.

Grading is a very important point and one very simply dealt with. I would grade apples, ones and twos separately, only when they will pack 75% ones down to 2½ inches. When the proportion of twos is more than 25% I would pack ones and twos together, culling closely to make a good all-round sample. I have no specific reason for this advice except that my experience in selling Maine apples dictates it.

In Canada the government has a law for the packing of apples as to grades, and government inspectors visit railway stations and steamers loading to see it strictly enforced. The grades are XXX, culling for 90% of the contents of the barrel to be of fruit without blemish, not less than 2½ inches and the face of the barrel is to denote the contents; XX calls for smaller fruit of proper form free of spot or blemish and the face shall denote the contents; X may contain inferior quality but not culls.

Should this law not be complied with the offender is subject to fine and his apples marked by the inspector, "Falsely described."

Such an act I should like to see in your State. Great confidence has been brought about in Canadian apples since the inauguration of the act and purchasers for European account have largely increased. And does it surprise you that such is the case when contracts can be made as follows: "A quantity of apples (varieties mentioned) 75% to be XXX stock government inspection."

There is a ridiculous side, however, to most things, and only this week I saw in a Liverpool catalogue the sale of some Canadian fall apples described as "Falsely described" sold at 18-6 per barrel.

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When being sold by auction apples are catalogued in lots of 20 or 30 barrels depending largely upon the size of the parcel or mark. A rule of the auction is that no small lots (or lots less than 20 barrels) shall be sold until all the large lots are disposed of, so it is to the interest of growers when shipping to send not less than 22 barrels which allows of a large lot of 20 barrels being sold and of two samples being shown. Samples are sold altogether. In case of small lots, equal or as nearly equal as possible qualities are put together so as to make a large lot. The landing, selecting, selling and delivering is performed in a very short space of time especially on a strong market, when buyers are eager to fulfill their contracts.

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The question of package is an important one and no barrel is superior to the old round hoop flour barrel. Some new barrels are all right; but many, especially the white wood ones, are too frail. I would strongly advise shippers in new barrels to have their cooper put on two extra quarter hoops inside and touching the present ones. These extra hoops strengthen the barrels materially and if placed where I suggest, the barrel rolls on the hoops instead of the bilge. The extra cost is one cent per hoop if the cooper is honest.

I have often been asked about shipping in boxes in recent years. Now if the barrel were discarded entirely for one season in favor of the box it would never be reinstalled, but on account of the conservatism of the English buyer and his leaning to the old package, I cannot recommend any one for the present to make a business of the box shipping. Occasionally boxes sell well especially in Glasgow and repay the extra expense but the extra cost of packing make the business a laborious and precarious one. It must not be forgotten moreover that apples in boxes do not pay unless they are packed four tiers to the bushel box and each apple wrapped in paper.

A BUYER'S ESTIMATE OF THE CANADIAN FRUIT-MARKS ACT.

At the instance of the secretary, Mr. H. W. Lowell of Farmington, a large buyer and exporter of fruit, gives his estimate of the value of the Canadian Fruit Marks Act. Mr. Lowell has been in the business a long time and handles both American and Canadian fruit. This year he bought several orchard lots of fruit in Ontario. The fruit was gathered and packed by Mr. Lowell's men. Mr. Lowell's views are well worth the attention of our fruit growers for he is thoroughly conversant with the whole business.

The grower finds that it pays him better to give his fruit more careful attention as it is the 3 X grade that contains the profit, and that there is absolutely no money in raising scrubby, inferior X or 2 X stock, as it can no longer be palmed off under cover of fine facings at the ends of the barrel.

The Ontario farmer is attending to his orchard much better than formerly, by plowing, fertilizing and pruning.

The regular apple packer who may be employed either by the farmer or dealer is doing his work as a rule strictly in compliance with the Fruit Marks Act. Occasionally through lack of judgment he may be fined but these instances are now very rare as the government inspectors are alert, and the chance for fraud or ignorance in packing to go unpunished is now so small that it is unworthy of consideration.

The buyer has a great advantage from the fact that he can safely bank on getting the grade of fruit he buys. If he pays for 3 X fruit he knows he will get it, or that the Canadian government will severely punish the seller who attempts to defraud him. This enables him to pay more for the goods than he could afford to if there was any lurking doubt in his mind as to the quality. His customers come to know that they can depend on the grade of Canadian 3 X so that today in the English markets Kings, Spies and Russets are selling on an average from 50 cents to $1.00 per barrel higher than the same varieties of American apples put up for No. 1 or fancy.

I am heartily in favor of having a similar law in the United States but I fully realize that it would meet with opposition at first and no doubt would embarrass the packers and growers for a time, especially the small growers who in many cases never seem to want to learn how to properly select and pack their fruit, but these matters adjust themselves in a short time and I think in a few years everyone would be pleased with the results of the enforcement of such an act.

Of course there would be a tendency to place the packing of fruit in the hands of trained experts, but I see no obection to this as every grower can become an expert packer if he will or can afford the time to educate himself in the proper selecting and packing of his fruit.

The chief advantage to Canadian fruit is the fact that the world's markets have come to know that they can get exactly what the brand on each package indicates, and also a standard well made hard wood package—never a soft wood, straight, or weak half coopered, undersized barrel. Canadian packers would not dare to use such barrels as many Maine apples are shipped in.

INDEX TO AGRICULTURAL REPORT.

INDEX TO EXPERIMENT STATION BULLETINS.

INDEX TO POMOLOGICAL REPORT.

ANALYTICAL SUBJECT-INDEX OF AGRICULTURE OF MAINE FOR 1904 AND 1905.

The abbreviation "Sta." signifies the Experiment Station Report, and the abbreviation "Pom." the Pomological Report.