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1910

BEING THE

ANNUAL REPORTS

OF THE VARIOUS

DEPARTMENTS AND INSTITUTIONS

For the Year 1909.

VOLUME I.

AUGUSTA
KENNEBEC JOURNAL PRINT
1910

State Farm in Monmouth, for Experimental Work.

AGRICULTURE OF MAINE

EIGHTH ANNUAL REPORT

OF THE

COMMISSIONER OF AGRICULTURE

OF THE

STATE OF MAINE

1909

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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 hereby submit my eighth annual report as Commissioner of Agriculture of the State of Maine, for the year 1909.

A. W. GILMAN, *Commissioner.*

AUGUSTA, January 1, 1910.

ANNUAL REPORT OF THE COMMISSIONER OF AGRICULTURE.

Substantial progress has been made during the past year in the various branches of the work of the Department. There has been an increasing recognition of the importance of agriculture all over the country. The president's Commission on Country Life, and the results of its investigations, have given an impetus to the betterment of rural conditions and the advancement of agricultural pursuits.

Prices for agricultural products have been well maintained, and while the cost of production has necessarily been high, on account of the high price of feeds, farm labor, etc., yet the intelligent, progressive farmer has been able to secure a good margin of profit. The possibilities of farming, when conducted in accordance with the most improved methods, have never been more fully realized than at present.

There is no longer a lack of progress due to the isolation of the farmer. The telephone and rural delivery place him in connection with the world; the agricultural press, the Grange, the farmers' institutes and the many co-operative associations which are now being formed, are keeping him in touch with the advanced knowledge in agricultural lines, and doing much to place his work on a business basis. The farmer is becoming a man of affairs in the state and the nation.

FARM CROPS.

The yield and quality of most farm crops was above the average. The hay crop of the State was materially reduced by the drought of 1909 and the preceding season, but many of the farmers had prepared somewhat for such an emergency by the planting of supplementary crops, both for pasturage and for winter feeding. The dry season was also unfavorable for the corn crop. Some of the farmers who had selected early maturing varieties and given their corn fields special care and cultivation so as to preserve the moisture, raised exceedingly fine crops. The corn crop of Maine is receiving more attention than formerly. The acreage was above the average this year, and indications warrant us in making the assertion that it will be much larger next season. The fine exhibit of corn at the State Dairy Conference held at Skowhegan in December is another evidence of the increased interest that is being taken in this crop. The demonstration in judging given by Prof. W. D. Hurd, and the class in judging, were very instructive, and the further work in this line which it is the intention to do at the next Conference, will undoubtedly be productive of much good, in placing before the farmers the ideal towards which they should work in the growing of this crop, and furnishing the basis for intelligent seed selection.

The acreage planted to potatoes exceeded that of any previous year, and the yield was also above the average in most parts of the State. In Aroostook County the unfavorable weather in the fall caused some injury to the crop. From the time the early varieties were placed upon the market until the close of the year, potatoes have brought a good price and have been a profitable crop for the farmer.

OUR FRUIT INTEREST.

The apple crop of the State was light in most sections. There is no branch of husbandry of so much importance that has received so little attention from the average farmer as orcharding. More attention has been given of late to the other industries, and this has not kept pace with the changing conditions of the times. The increased number of insect pests for the last few years has made spraying essential. Neglect in pruning, spraying, cultivating and fertilizing is seen in all sections of the State. There are a few orchards, however, in different sections, that have had the best of care and are yielding some of the finest fruit that is grown anywhere in this country.

The Department of Agriculture was fortunate in securing for the farmers' institutes this fall, the services of a speaker who had been connected with institute work in the apple growing sections of the West. He made a comparison of the amount of care and attention that the orchards in those states were receiving with that given to the Maine orchards, showing that the western orchards are given a great deal more attention. If the orchards of this State were receiving the same care, orcharding in Maine would be as successful and profitable as in any other part of the country. As a result of these lectures, and of the interest awakened by the New England Fruit Show and by the prize which Mr. James J. H. Gregory has offered to the State in the interest of better fruit, many of the orchardists have taken new courage along this line of work, and there is a pronounced revival of interest in this industry. The possibilities in orcharding have never been realized by the Maine farmer. In this, as in other branches of farming, it is largely the man behind the tree that produces the result.

The value of organization in this industry is also beginning to be realized. A fruit growers' association which has been organized by the farmers in Oxford County is doing very helpful work. Steps have already been taken for the organization of the Kennebec Valley Fruit Growers' Association, and it is hoped that the work may be extended much farther the coming year. It is the intention of the Department to encourage and assist in the formation of these associations as far as time and funds will permit.

THE GYPSY AND BROWN-TAIL MOTHS.

The funds of the State for the extermination of the gypsy moth have been expended along the line of the work done by the United States Department. Consultation has been frequently held with the field agent of the government and the field agent for Maine, and the agent of the general government has assured us that we are doing as efficient work in the extermination of the gypsy moth as is being done in any of the infested states. The State is very fortunate in having for its field agent such an able, energetic man as Capt. E. E. Philbrook of Portland, whose report of the gypsy moth work will be found in another part of this volume.

The active work of suppressing the brown-tail moth is being done by the municipalities and the individual owners of fruit and shade trees, as the law requires. The cities and towns in the infested sections are manifesting a great interest in this work. They have taken it up in a systematic way, and the owners of real estate in most instances are co-operating with the officials in using their utmost efforts to exterminate this pest.

NURSERY INSPECTION.

The nurseries of the State have been inspected and certificates granted, in accordance with the law. The amendments to the law relating to nursery stock, passed by the last legislature, requiring the licensing of agents and authorizing the State Entomologist to inspect stock coming into the State, have been of assistance in preventing the introduction of dangerous insect pests. Many orchards have also been inspected, and information given, not only in regard to the suppression of insect pests, but also in relation to the general care and treatment of the trees. This work has been faithfully prosecuted by the State Entomologist, Prof. E. F. Hitchings, whose comprehensive report, embracing the nursery and orchard inspection and the general insect situation, will appear farther on.

LIVE STOCK AND DAIRY INTERESTS.

We regret that our farmers have not awakened to the full importance of the live stock industry. With a better selection of animals and more intelligent feeding, stock raising would show a balance on the right side. The number of farm animals should be increasing, but the returns from the local assessors to the State Board of Assessors show a decrease in most classes. The short hay crop occasioned by the drought of the past two years has undoubtedly had much to do with the depreciation in the number of cattle. The stock raisers must make a special effort to raise more forage crops. There should be more intensive cultivation and a better fertilization of the grass fields, so that a larger crop may be produced, thus making it possible to keep more farm animals. The crops of the farmer are largely the measurement of the wealth that he is producing.

Dairying has always been one of the leading industries of Maine. The farmers the past year have manifested an increased interest in this branch of our agriculture. The cow test associations that have been formed and are now in successful operation in many dairy sections of the State, informing the dairyman of the individual value of each cow, have been a great stimulus to the industry. Several breeders' organizations have also been organized during the past year, which is a step in the direction of better dairy stock for Maine. Much credit is due to the State Dairy Instructor, Leon S. Merrill, for his ability and untiring energy, in arousing an interest among the dairymen in these associations. The impressive manner in which he has addressed the dairymen, and his clear presentation of the subject, have led them to see the value of co-operation in these lines. The increase in the appropriation made by the last legislature, by which it has been possible to extend this work, has been of much benefit to the farmers. A detailed report of the cow test associations and breeders' associations which have been formed during the past year will be found in the report of the Instructor.

The legislature of 1909 imposed upon the Commissioner of Agriculture the duty of investigating the dairy products of the State, and as an aid to this investigation, required the registration of all dealers in milk with the Department. This Act became a law July 3rd. Some time was spent in preparation for this work, and in conferring with boards of health and local officers, before the active work of investigation began. During the last three months of the year, many samples of milk and other dairy products were taken by Mr. P. F. Skofield, Agent of the Department, the analyses of which will be published, in compliance with the law, in a Bulletin of the Dairy Division of the Department, which will be issued in February, and the publication of which will be continued quarterly. This work will protect a large number of consumers of dairy products, and also benefit the dairy interests of the State, in protecting the honest dairyman from the man who sells a dishonest product.

FARMERS' INSTITUTES.

The farmers' institute has been an important factor in the development of our ariculture. It has furnished a special amount of agricultural knowledge and reached a certain portion of the farmers who get but little public instruction save this. The interest in these institutes is increasing. The average farmer is more intelligent than in former years and more ready to take advantage of the instruction received. During the past two or three years the meetings have been more largely attended than formerly. It has been the intention of the Department to hold these institutes in every agricultural section of the State, so that the farmers living in the more remote sections should receive their part of the benefits to be derived from the appropriation. In the rural districts the population is scattered and the attendance is small, but the people come for the purpose of receiving instruction and justice demands that these sections should receive their proportional number.

The farmers are demanding the best agricultural speakers in the country, and it has been the policy of the State for a long time to secure the best speakers possible. As a rule these institutes are addressed only by the most practical, successful farmers, as well as scientific agriculturists, men who from their personal experiences can impress upon the farmers the importance of intelligent, progressive work. These are largely men who come fresh from the farm and have made a success of their farming, and they are also thoroughly trained men who can present their subjects in a clear, concise and convincing manner.

The Agricultural College and the Experiment Station for many years have been ready to assist us by furnishing some of their most practical workers in agriculture.

Forty-seven regular farmers' institutes have been held as follows: Nov. 1, Calais; Nov. 2, Columbia; Nov. 3, Milbridge; Nov. 5, Washburn; Nov. 6, Caribou, Nov. 9, West Eden; Nov. 10, Orland; Nov. 11, North Bradford; Nov. 12, Plymouth; Nov. 13, Orono; Nov. 15, Monson; Nov. 16, South Sangerville; Nov. 17, Clinton; Nov. 18, East Vassalboro; Nov. 19, Albion; Nov. 20, Liberty; Nov. 22, Lincolnville; Nov. 23, North Haven; Nov. 24, North Warren; Nov. 26, Bristol Mills; Nov. 27, South Newcastle; Nov. 29. Jefferson; Dec. 3, Harmony; Dec. 4, Fairfield Center; Dec. 6, Berry Mills; Dec. 7, North Jay; Dec. 7, evening, Wilton; Dec. 8, Temple; Dec. 8, evening, Farmington; Dec. 9, Wales; Dec. 10, Durham; Dec. 11, West Minot; Dec. 13, North Buckfield; Dec. 14, Andover; Dec. 15, West Paris; Dec. 16, New Meadows, Brunswick; Dec. 17, South Bridgton; Dec. 18, Intervale; Dec. 20, Limerick; Dec. 21, Lebanon; Dec. 22, Kennebunkport; Dec. 23, Woolwich; Dec. 27, Eliot; Dec. 28, Alewive; Dec. 29, Hollis; Dec. 30, Pownal Center; Dec. 31, Cornish.

In addition to the above, speakers have been furnished by the Department for 61 meetings of granges and other agricultural organizations.

The following are some of the speakers who have addressed the institutes: John Jeannin, Jr., West Sand Lake, N. Y.; Calvin J. Huson, Penn Yan, N. Y.; Lowell Roudebush, New Richmond, Ohio; Prof. J. W. Sanborn, Gilmanton, N. H.; Prof. V. R. Gardner, Orono, Maine; Prof. P. A. Campbell, Orono; John A. Roberts, Norway; D. H. Knowlton, Farmington; B. W. McKeen, Fryeburg; E. P. Mayo, Waterville; Dr. G. M. Twitchell, Auburn; Prof. E. F. Hitchings, Waterville.

AGRICULTURAL SOCIETIES.

There has certainly been a marked improvement in the fairs of the State. The educational features have been more pronounced, and the special attractions and midways have been less conspicuous. The returns show that a larger amount of agricultural products were exhibited than usual, and presented in a more inviting manner. There were never before so many of the essential farm implements on exhibition and in such prominent places, at the fairs in the different sections of the State. The stock in most cases was in fine condition and a large amount was exhibited. Large numbers of thoroughbred animals were exhibited, representing practically all of the breeds in the State.

The following figures show the business of these societies in 1909:

Number of horses and colts exhibited,	2,058
Number of neat cattle exhibited,	7,534
Number of sheep exhibited,	1,743
Number of swine exhibited,	489
Number of poultry (coops) exhibited,	8,466
Amount of premiums and gratuities awarded,	$43,744.35
Amount of trotting purses,	$30,874.03
Per cent. of premiums and gratuities to total awards,	58

SEED IMPROVEMENT.

One of the wisest acts of the legislature of 1909 was the appropriation of a small sum which could be used to promote increased production of farm crops through the selection, growing and dissemination of superior strains of seeds. The work of seed improvement by selection and breeding is one that has been much neglected. Three principal factors determine largely the value of any cultivated crop, namely, yield, quality and adaptation to climate and soil. Breeding for strains which will be superior in these points is a matter of much importance. Believing that co-operation in this work will be productive of good results, it is the plan of the Department in the near future to organize seed improvement associations and in every way possible encourage the selection and breeding of better seed. It is our purpose to organize an association which will cover the entire State, and it is hoped that many of the farmers in every section of the State will join in this movement, so that a State wide interest can be awakened. In every section attention will be given to some of the crops that are especially adapted to that portion of the State, all sections receiving their proportional part.

AGRICULTURAL STATISTICS.

One of the acts passed by the last legislature makes it the duty of the Commissioner of Agriculture to gather statistics of information concerning agriculture and publish the same annually. Work in this line was begun in August, agents being sent to the different towns in the State, to secure statistics in relation to farm crops and gneral farm conditions. Up to the end of the year about thirteen counties had been covered. The work will be continued until every town in the State has been visited, and the results will be published some time during the coming year. The information thus obtained will enable the Department to reply to many inquiries that are continually being received, and will make available much valuable information regarding the resources and productions of Maine which will assist materially in the advancement of our state and the promotion of its agriculture.

AGRICULTURAL EDUCATION.

President Roosevelt's message to Congress, in which he urged the conservation of the natural resources of the country, stirred the people from the Atlantic to the Pacific. The greatest natural resources of the State of Maine, or, in fact, of the country at large, are the boys and girls who are brought up on our farms, and the best opportunity which the state can offer them will consist in the establishment of agricultural and industrial schools in the rural sections. Agriculture is a subject that can and should be taught also in the common and secondary schools. Ex-Governor Hoard of Wisconsin says: "Our common schools recruit the academy, the college and the university and they in turn recruit every profession but farming. Our young men flee to the towns and cities because we have educated them to do so."

That teachers are not prepared to give proper instruction in agriculture is no apology for its elimination from the course of study. Teachers must be encouraged to prepare for agricultural and industrial teaching. An advance in their salaries to enable them to prepare for the teaching of nature studies and elementary agriculture, will do much towards solving the problem of the teacher. One of the superintendents of the public schools in Illinois says of agriculture as a study: "No other teaching squares more nicely with accepted pedagogical ideas. It deals with those things with which the farm child is already familiar. It is largely a training of the senses. It enters consciousness by every avenue of the soul,—hearing, seeing, tasting, smelling, feeling. It deals with things and not with words alone. It relates to what is near and not to that which is afar. Its lessons are on the lawn, in the tree tops, in the shower and by the roadside. It does not deal with abstractions, but with concrete, living, growing things, with the flowers and plants, and colts and lambs, and birds that are growing with the child."

The main purpose of education is the training and quickening of the faculties of observation and reasoning, and the study of agriculture is as well adapted to the attainment of that purpose as any other. The French Minister of Education says: "Instruction in the elementary principles of agriculture, such as can properly be included in the program of primary schools, ought to be addressed less to the memory than to the intelligence of the children. It should be based on observation of the everyday facts of rural life, and on a system of simple experiments appropriate to the resources of the school, and calculated to bring out clearly the fundamental scientific principles underlying the most important agricultural operations. Above all, the pupils of the primary school should be taught the reasons for these operations and the explanations of the phenomena which accompany them. The mental exercise of discipline derived from such studies is much greater than is usually accredited to them, as the material for study is ever present, constantly stimulating the mind to activity."

The government has spent millions and millions of dollars upon research and investigation, resulting in the collection of a large amount of knowledge bearing directly upon practical and scientific agriculture. In order for the State to receive the most benefit from its investigations, these facts must be reduced to school form and be added to the curriculum of studies in our public schools.

Agriculture occupies a position of too great importance in the economic affairs of this nation to be subordinated on any grounds or for any reason whatever. The majority of the people always have lived, and always will live, in the country. The farming population is the "sheet anchor of the nation."

PUBLICATIONS.

Requests for the annual report of the Department have been very numerous during the past year, showing that the farmers all over the State are becoming more anxious to secure the information contained in them. The usual bulletins have been issued quarterly, and these are also in growing demand. The number of pamphlets, circulars and leaflets of information in various lines issued during the year has been considerably in excess of that of former years. The correspondence of the office has also largely increased. The farmers are evidently getting in closer touch with the Department and realizing that its purpose is to serve them in every way possible.

We wish to acknowledge the assistance received from the grange, the various agricultural organizations of the State and the agricultural press. With all these forces working together for the upbuilding of this great industry, much will be accomplished.

INSTITUTE PAPERS.

PLOWS AND PLOWING.

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

Agriculture was first in point of time, and is the under girder industry upon which all other industries are erected. The plow is the primary implement of agriculture and since the beginning of history has been its emblem. It preceded written history and was at the very dawn of hieroglyphic records. Its development has been continuous from its first crude forms until now, and it is still in the process of evolution. Its progress has been the measure of the progress of agriculture and through agriculture the measure of all industrial progress and of course of human progress. Macaulay in his brilliant history of England made good roads the most important of human inventions, "the printing press and the alphabet alone excepted." But without the plow, or that for which it stands, the human family would have remained motionless.

Even in this generation Mexicans on favorable soils plant corn with the peaked stick. The practice can be seen among races low in the order of development. This implement preceded the plow proper and was used as its substitute. But early in the dawn of progress when man was passing from the nomadic to the settled agricultural life, the crooked limb was drawn through the soil by women. On ancient coins and works of art evolving plows were depicted with women as the draft animals. The earliest reference to plowing is found in the book of Job, and mentions oxen as the propelling force. Oxen were largely used for this purpose by the more advanced of the nations of the earlier civilization.

The importance of the plow has not escaped the attention of thoughtful minds in the various stages of man's progress. Our God ordered Adam out of the Garden of Eden to "till" the soil and ordered his first steps. The patron God of Egyptian agriculture, Osiris, is represented with a plow hung over his shoulders. Ceres, the Greek Goddess, first taught Triptolemus the art of plowing, on the plains of Thessaly. This prestige given to the plow and to agriculture in early religious thought was supplemented by honors from kings and others of the great among men. In China it is an old and stately custom for the King and the more exalted of the state officials to repair annually to the sacred field and trace a furrow, and after it to offer sacrifice on an altar of earth. This example is followed by princes and ministers and by governors of the provinces. This kingly attitude was common in earlier days and represented the attitude of great minds of the times and of succeeding times. Roman emperors maintained this spirit. The glad return of Cincinnatus to his plow from his several divorcements from it to maintain his country's existence, was a frame of mind common in the glorious days of Rome. When this spirit declined and Rome entered upon its enfeebled era, Pliny, the master of good writing, in noting the decline of Roman agriculture, says of the better days: "What was the cause of all this abundance? Was it because the ground was tilled by the hands of great generals, the earth delighting as was natural to be upturned by laurel-crowned plowshares? Or was it because they laid out their ridges with the same care that they marshalled battalions and sowed them with the same skill that they won battles?" Though not germane, I continue quotations from his elegant passages: "Nowadays the same fields are given over to slaves in chains and malefactors given over to penal servitude, on whose brow there is a brand. Earth is not deaf to our prayers. We give her the name of mother; culture is what we call the pains we bestow upon her. But can we be surprised if she render not to slaves the recompense she paid to generals?" Pliny was quite right. Only those who have intelligence and direct personal interest in the soil can best get its bounty. But the spirit of Pliny did not wholly die with the Roman empire. Later the great Charlemagne exhibited it and succeeding great minds continued it. Thomas Jefferson while coaching through Europe in his several trips was wont to stop his coach and repair to fields to study plows and plowing. Later he became the first to apply mathematical principles in the construction of plows.

Timothy Pickering, Daniel Webster who invented the big plow, and other American statesmen were students of the plow. During a crisis in eastern affairs, when the spectre of war loomed up, Premier Salisbury was found by agitated parties in his laboratory studying the problem of electricity as applied to plowing. Thoughtful men turn instinctively to the progress of the plow as emblematical of the progress of agriculture and of mankind.

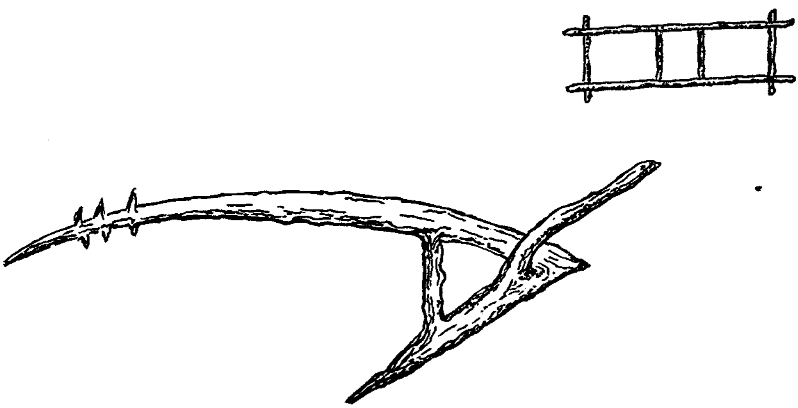


Fig. 1. Plow held by Job.

THE FIRST PLOW.

The peaked stick, with which on fat, soft soils seeds were dibbled in and covered with the foot, preceded the plow proper. It was used, however, as a substitute implement to accomplish the end for which the plow is designed. The A shaped implement,

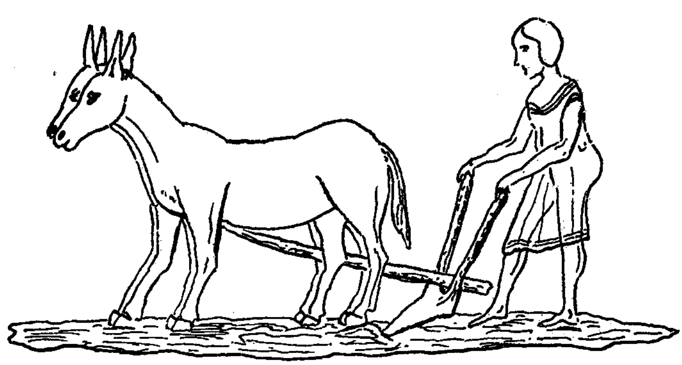


Fig. 2. Ancient Egyptian Plow.

with one arm longer than the other for use as a handle for striking or even dragging through the soil, followed as a stage of progress. It was bound together by a cross-tie to prevent breakage. This implement, it is held, suggested the A of our alphabet, so that, at least in part, this alphabet is of farm origin.

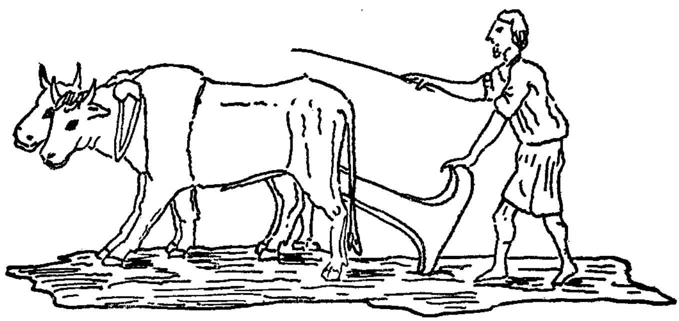


Fig. 3. Early Roman Plow.

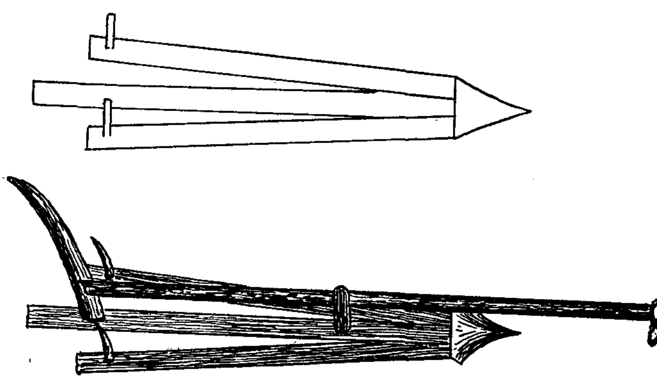


Fig. 4. Later Roman Plow

A few types of plows, tracing back at least 2,000 years before Christ in some countries—and as yet they are but little modified—are here shown. In China, Japan, India and the most of Asia, and in parts of Europe and some countries of this hemisphere, wooden plows are in quite common use. While anticipating following material at this point, I may note that the wooden plow with iron strapping did not wholly disappear from American use until little over half a century ago. I have seen as late as the last of the fifties the awkward old wooden plow with its iron strappings in use in road making, where a stout plow was required.

In the earliest civilization, the Egyptian, the plow made little progress, owing to the very favorable soil of the Nile Valley, its silt being easily penetrated and requiring little depth of tillage. Before the dawn of the Christian era the Greeks and Romans had overlaid the points of their plows with iron, merely to save wear. Not having the advantage of cast iron, the plows as well as other implements were restricted in their development.

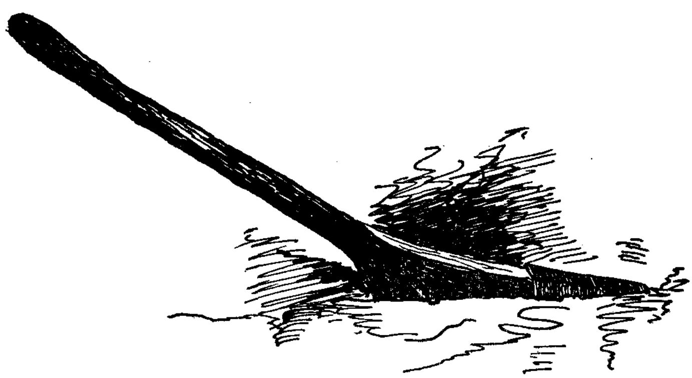


Fig. 5. Hindoo Plow centuries in use.

The Jews in early times, quite as early or earlier than others, tipped their wooden plows with iron, using this iron in the stress of war for the production of swords. The Jewish seer in his prophetic vision or in the longing of his soul for the calmer times when strife of man shall cease, saw the period when swords should be beaten into plowshares. This in its way typifies the best application that man can make of the energies wasted in war, and is a notable tribute to the place the plow holds in human affairs.

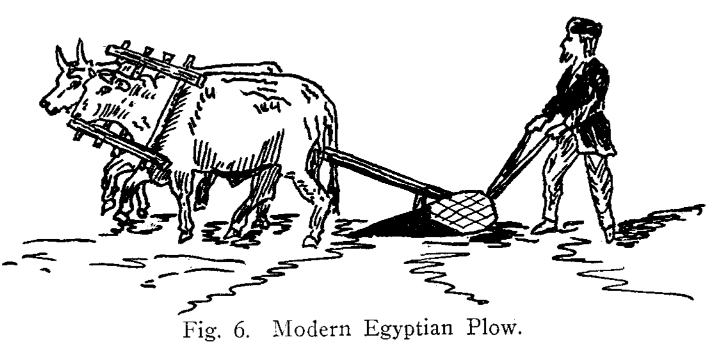


Fig. 6. Modern Egyptian Plow.

At the zenith of the Roman power the plow was carried to its highest point of development prior to the 15th century and the printing press. The wooden plows of Roman farmers were hewed on one side to push the earth laterally.

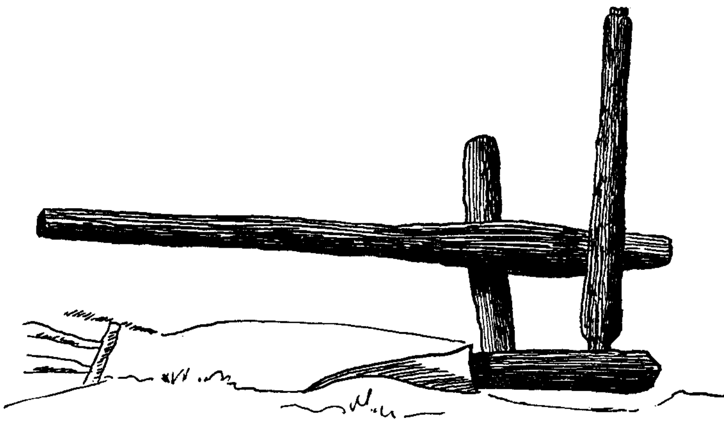


Fig. 7. Chinese Plow.

Plows were made of pieces coming together at the point, for the purpose of double lateral pressure. Handles, unknown in earlier times, became a common adjunct to the plow. Plows with one and two wheels, and it is said with three, were made, but those shown were applied at the end of the beam nearest to the draft point. Although the Roman plow, the best of the past ages, had many forms, yet it lacked most of the essentials of a plow, as we now perceive, in the way of conveniences. It had some advantages in draft adjustment and breadth of furrow, but markedly and fatally it had not as yet anywhere in the ancient world reached the mould-board and the inversion of the furrow. It scratched the soil, pushed it one side and ridged land, but fell short of soil inversion.

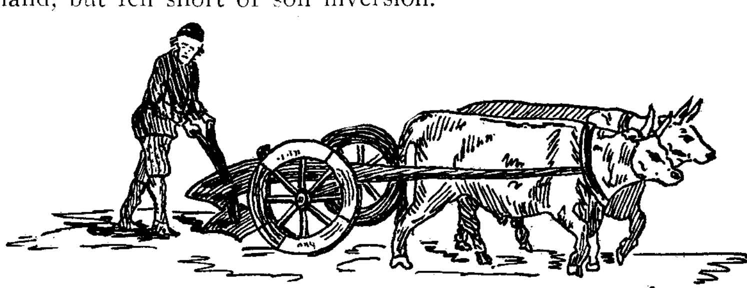


Fig. 8. English Plow of Fifteenth Century.

For the thousand years of the dark ages, or from the 6th to the 15th century, the plow for the most part retrograded. It was discouraged by the unstable order of events. It gathered some encouragement under Charlemagne in France. So far as I am informed, the plow in his reign for the first time had the regal privilege of being drawn by the horse, an animal that had been bred for the noble purpose of war and not to be degraded

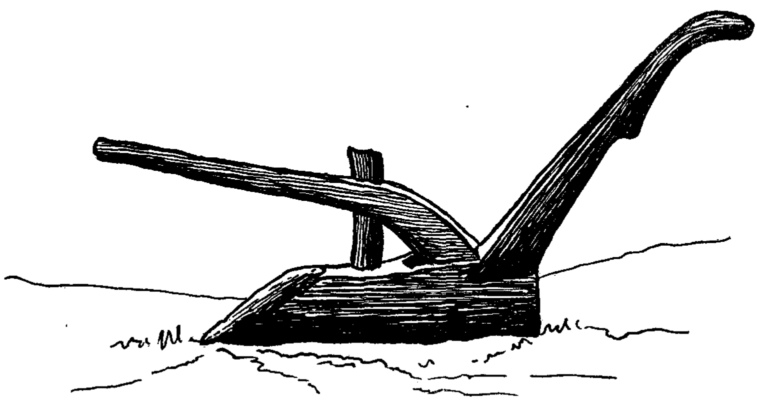


Fig. 9. Mexican Plow.

by servile service save as he ministered to royalty and wealth for their limited land travel. From the fifteenth to nearly the close of the nineteenth century, the plow made little growth beyond the better types of Roman plows of 1,500 years before. Wheels under beams were more freely used. Iron points over wood and sometimes strips of iron on the so-called mould-boards were used. But the inverting mould-board had not as yet appeared. A sample plow of Southern France belonging to

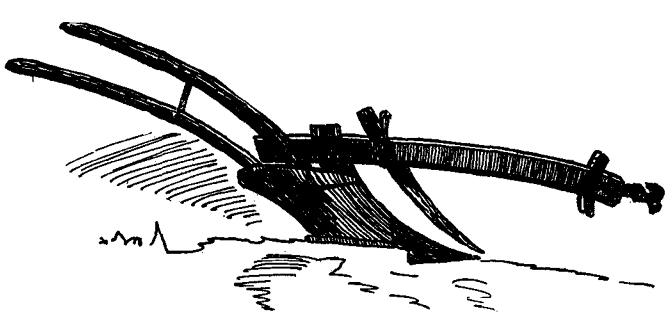


Fig. 10. Early Eighteenth Century Plow; covered with sheet iron.

the seventeenth century had reached approximately the point of inversion. The Flanders plow approached it. Over the mouldboard was spread sheet iron nearly complete.

These plows were the product of the farmer or a nearby smithy and varied with the skill of the maker. Those of special merit disappeared with the hands that wrought them.

The reader has noted from the cuts used, the crude methods of attaching the power that drew the plows. When drawn by women ropes of various origin, including twisted sticks, were used, or more often the beam of the stick from which the plow was made extended to the length required, with projecting pins or branches for handles. When drawn by oxen, aside from the methods shown, the beams of the plows were attached to a cross-stick which in its turn was fastened to the base of the horns so that it was pushed from the neck rather than drawn from the shoulders.

The Irish plowman down to recent times often drew the plow from the tails of horses. This practice was closed out by the interference of the British Parliament, which method was regarded as an oppression.

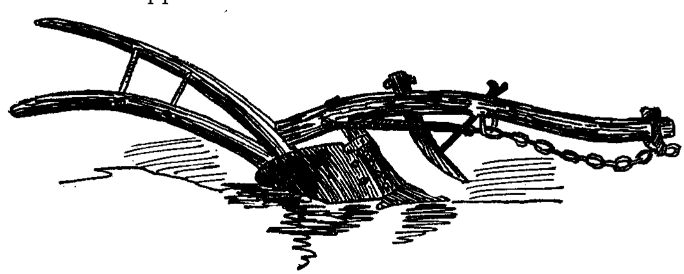


Fig. 11. Small's First Cast Plow.

THE CAST IRON PLOW.

It is said that if you scratch the skin of a very successful man you will reveal a Scotchman. James Small, a Scotchman, about 1763 as I recall from memory, invented the first cast iron plow. In 1776 J. A. Ransom invented cast iron points. Ignorance and prejudice failed to appreciate these plows and they did not for a long period come into any extended use. They, however, assumed such moment that a committee of the British Parliament investigated Small's plow and its work and reported, "We be of one mind that it doth poison the soil." Possibly the committee's mind was poisoned by the objection of everywhere present makers of the ancient plows with their vested rights. But it is noteworthy that a committee of a Pennsylvania Farmers' Club in the early part of the next century made a similar investigation of the American cast iron plow and its work, and reported unanimously against it, or that it "makes the weeds grow." It was in 1796 that Jefferson announced the conclusions of his long mathematical study of plow construction, laying out the mould board on geometrical lines. It was a stunt affair whose height was twice its width at the base, which was nine inches. It was only two feet long, with an overhang for the mould-board of but 11½ per cent. But it was the parent of the inverting mould-board, for which the world had for long ages waited. Charles Newbold cast the first American plow in one solid piece.

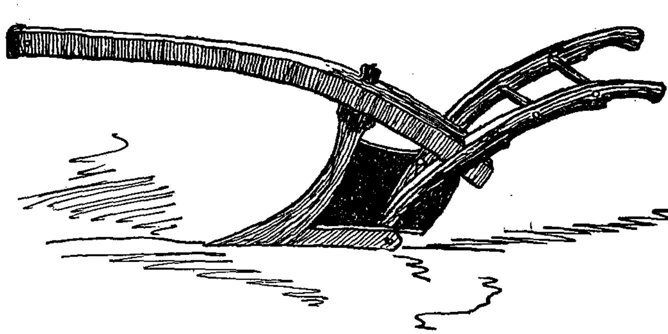


Fig. 12. Newbold's Cast Plow.

It broke in an orchard and closed its career at a cost to the inventor of $30,000. J. Stanton Gould, an able writer upon whom I draw heavily for the history of American plows and for cuts, credits Jefferson with the discovery of straight lines from the base to the top of the mould-board as the proper form; and English inventors made plows with straight transverse lines meeting in zero point, while vertical lines varied to fit soils, straight for loams, convex for clays and concave for sands, the latter not requiring the pulverizing or rather the opening or cracking effect of clay soil plows. In 1804 Daniel Peacock cast a plow in two parts with a third part of the wrought point. Gideon Wells in 1818, observing that previous plows were in the center, cast the mould board on spherical lines. In 1820 Timothy Pickering, the American statesman, overcame another fault, that of holding dirt in the center of the concave boards. He cast them with straight lines from front to rear. Nourse, the same I suppose who became famous in the Boston trade and who had been a worker on old time plows, took hold of the Jefferson plow, which was like all of its following inventions too stunt, failing to turn well. He beat out a pattern in lead empirically, though following Jefferson. By 1841 he sold 25,000 annually and for the first time the cast iron plow took hold sharply of the public confidence and rapidly drove the wooden plow out of existence.

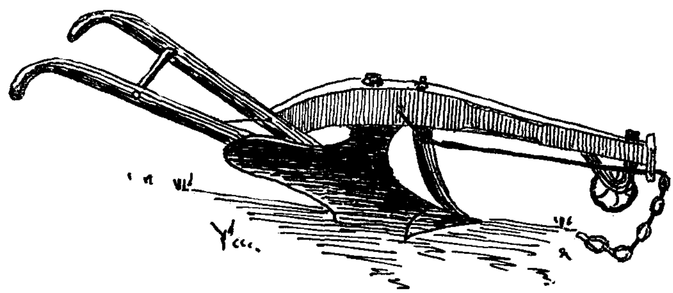


Fig. 13. Nourse's Plow.

I omitted to say that Jethro Wood in 1819 cast plows in sections. All lines from front to rear were transverse. He had for a time fair sales. During the same year Zadock Harris put a small truck under the front of the beam, where the ancient Romans and early British farmers used two large wheels. An important contribution was made by Means in 1817, who to avoid the unsteady action of current plows, studied out the problem of center of draft and met it by inclining the land side in.

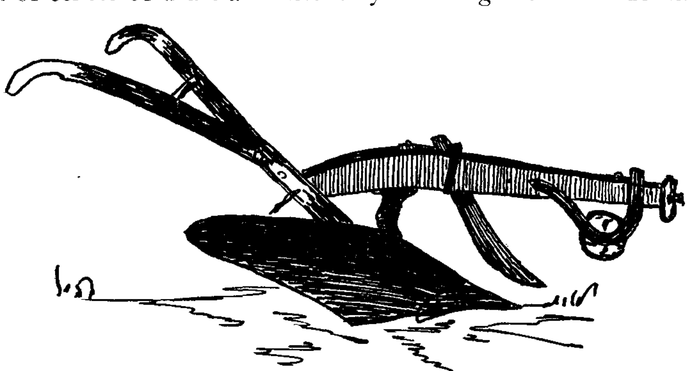


Fig. 14. Holbrook Plow.

The great Daniel Webster plow now at the New Hampshire Agricultural College is well known to most New Englanders. It is twelve feet long, landside four feet and breadth eighteen inches. The share is 15 inches long. Governor Harvey, Webster's bosom friend, said that when he first held it in the pres-

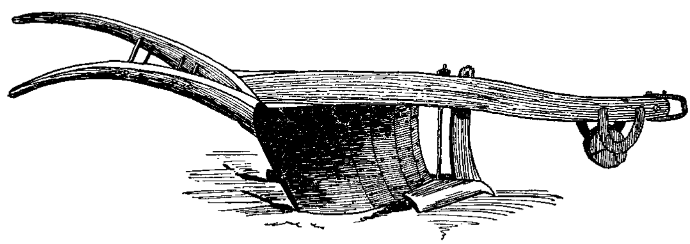


Fig. 15. Webster's Great Plow.

ence of his friends of public life invited for the occasion, for the breaking of new rough land, he said: "When I have hold of the handles of my big plow in such a field as this with four yoke of oxen to pull it through, and hear the roots crack and see the stumps go under the furrow out of sight and observe the clean, mellowed surface of the plowed land, I feel more enthusiasm over my achievement than comes from my encounters in public life at Washington." Such has been the inherent attractiveness of agriculture through all times to the great whose

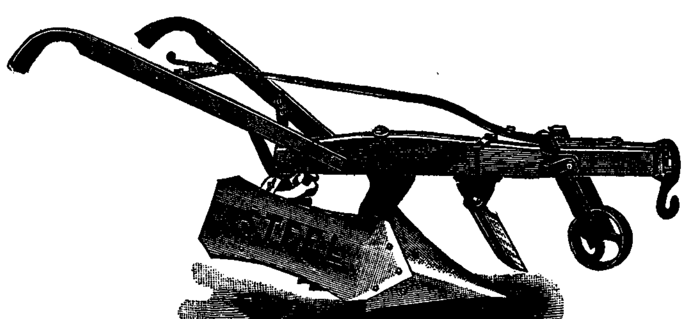


Fig. 16. Swivel Plow.

minds perceive the superiority of nature to art and to the formal of life. With the Nourse Mason plows and later the Holbrook plows further improved, known to all old farmers, there came so close a type to the correct that invention while still concerned with the ideal tock more varied form. Talents were applied to types of plows for all forms of soil, to plows for varying depth and forms of furrows, for easy draft, long mould-board and concave surfaces for sands and convex for clays, and those designed for lap and for flat furrows. The subsoil plow was exploited. To avoid the dead furrow of the land side and the up and down hill run, the swivel plow was brought into existence in manifold forms. The sulky plow for one way, and then successfully for two ways, followed. And now the steam plow, a cut of which is shown, of eight bottoms—and they are built for more—carries, so it is claimed, 50 or more acres per day at a great reduction of acre cost of plowing. The electric plow now in experimental operation in Europe is the last step in advance, if advance it is.

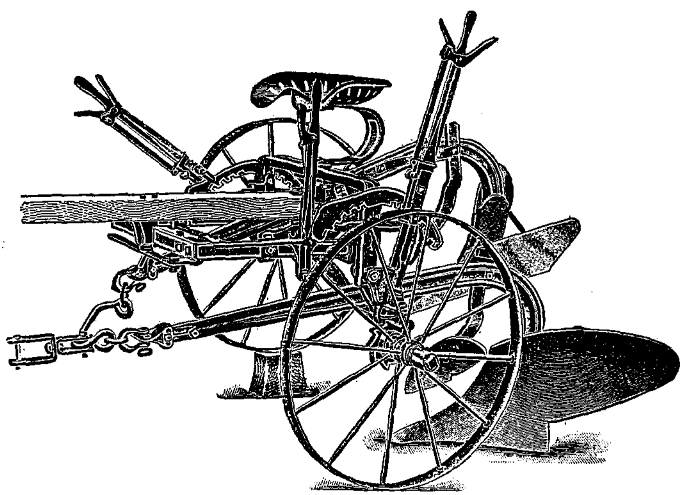


Fig. 17. Sulky Plow.

It is not my intention to trace the evolution of the plows now being evolved at this time. In all there had been when I last noted it, a dozen or more years ago, some 15,000 inventions on the plow. Their following would make my theme endless. Those familiar with plows know of the economies introduced in the way of ease of shifting the line of draft either laterally or perpendicularly; of the economes of sub-points; of the lightness and comparative ease of draft of the modern plow; of the efficient and poetic side of the sulky plow; some of us of the economy of the two-plow sulky plow; of the value of the sharp-

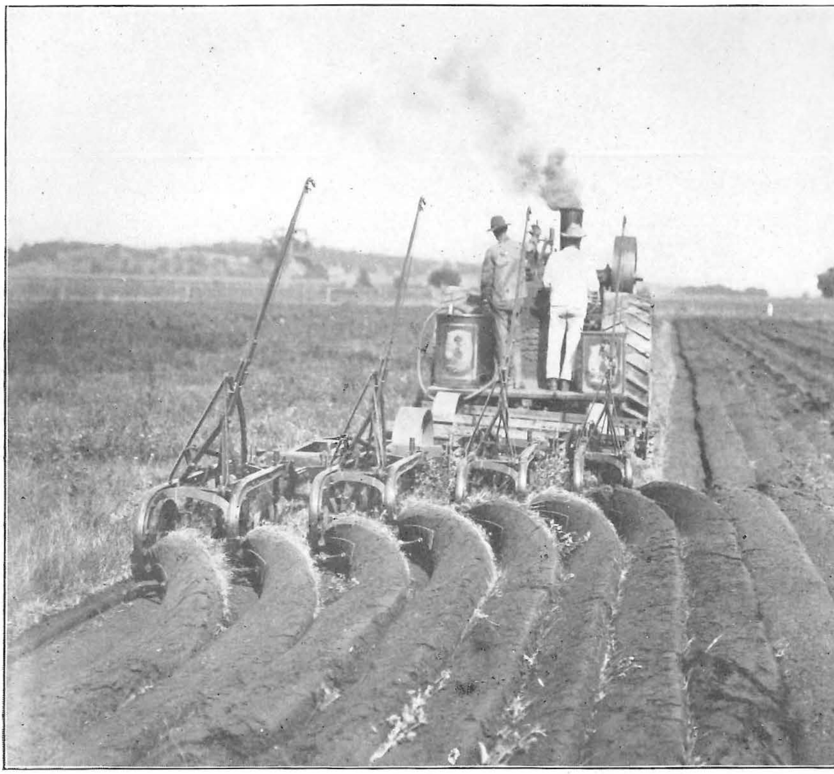


FIG. 18. Steam Plow.

er steel plow points for ease of draft, and of many other perfections of the modern plow, all the product of our times. The improvements of little over a generation far exceed those of all previous time and very greatly economize the operations of agriculture. The growth of the plow keeps up with or precedes other industrial development.

THE UNSUCCESSFUL QUEST.

The success of spade husbandry in ancient and modern times and now sometimes exemplified in gardening has led to a long tireless hunt for the successful spading plow. The moral of Æsop's fable bearing upon good tillage like a star of promise is still leading a quest for a successor to the plow of spading propensities. Many implements have gone to the wall that were to have settled the problem. Also many inventions have been made to lighten the draft of plows by substituting a wheel or some other device to take the friction of the land side off the bottom friction of the plow and to curtail that of the mouldboard. But the pressure of the wheels in the soil has added all that has been saved in friction, while complicating the plow. Coulters of all forms have been added to lighten draft and to perfect the inversion of the furrow. Of these I shall speak later. Plow trucks are now being offered to steady the plow in the hands of the plowman operating the non-sulky plow. These are helpful and an economy to those not feeling able to possess a sulky plow. They are attached to the beam and adjustable to the several ends designed in plowing.

Many farmers have the mistaken idea that sulky plows are not for rocky soils. It is on such soils that we find their economy the greatest. Only the driver is required and the weight of the plow holds the share to its work where often three men—one at the beam—would not be able to do half the work of the sulky nor nearly as well. Their draft will be from 5 to 10% greater than that of the walking plow, dependent upon the skill in adjusting the center of draft right.

PLOWS IN ACTION.

Modern plow-makers, so far as I am informed, no longer follow fixed mathematical rules laid down by any of the early students of the proper mechanical lines to follow. The early laws laid down did much to bring out the proper form of mould-boards. But the problem of varying soils, of pulverization in plowing, of adhesion of certain soils to the mould-board, made it necessary to modify strictly mechanical principles early laid down. The ideal shape as seen by manufacturers, mechanical principles aiding, is made and the idea embodied in the plow tried out. If not satisfactory the maker modifies the form until the desired effect is secured in practice. Plows are modified by wealthy firms for adaptation to the type of soils of sections into which they are sold and are very numerous in the shades of their variations.

The dynamometer or draft measuring instrument has been brought into use to determine the draft of plows, the relation of depth of plowing to draft, the width of plowing to draft, the influence of wrong adjustments as related to center of draft on draft, draft with different forms of cutters, with or without the small truck under the fore part of the beam, the draft of sulky plows against walking plows and the different type of plows against each other, and sundry other problems.

It has been held that trucks under the beam increase the draft, not only because friction of the truck is involved, but because those using trucks fail to have the center of draft right, thus bringing often into play opposing forces. In every trial by the writer with a modern and accurate dynamometer the draft was increased in the absence of the truck. If the soil offered like resistance at all points it would appear theoretically that plows perfectly adjusted should "swim free" and draw easier without the truck. But the soil presents a different condition and there can be no doubt that even on a perfectly adjusted plow the truck saves draft by about 10 to 15% as an average of personal trials.

European authorities and some American writers have held that the keen steel cutting edge of the sword or coulter should ease draft over the dull cutting edge of that part of the plow that cuts the perpendicular line for its passage. Coulters add another friction body and much of the time a double cutting of the perpendicular side. The rolling cutter has champions that favor it over the stationary coulter or knife. I have tried several kinds and find that all of them add something like an average of 15% to draft.

There is no certain or material difference in the draft of the several kinds of cutting instruments. In rocky soils the rolling cutter rises over rocks, lifts the plow and injures the furrow. It makes a difference whether they are sharp and well adjusted. When the plow does not follow the cleft made by the coulter a second cutting must be made at a material loss.

In the west where steel shares are used and sharpened by the local blacksmith the point is often dropped and the feather edge is not kept a true line, or where the share is by any means put out of proper shape the draft is increased. If such shares are used in Maine they will be found when wrongly sharpened to increase the draft and cause the plow to lose something of the nice equilibrium of a well adjusted plow. These factors of loss or gain are modified by the type of soil, as I found in trials in Missouri and Utah.

Some there have been who have held that a deep furrow or a broad one draws harder per square inch of soil turned. Gould quotes European trials, showing that the draft of a plow is made up of 5.8% friction on the mould-board, 15% on the bottom of the furrow, 35% cutting the land side of the furrow and resistance in cutting by the coulter and share is 42%. Now if a furrow 8 by 12 inches is cut, 72 square inches are turned, while one 18 by 8 inches turns 144 square inches. The length of the former cutting surface is 8 and 12 inches, or 20 inches, and that of the latter is 26 inches. The large furrow involves the cutting of but 30% more slice length while turning 100% more soil. It is evident that inasmuch as the greater proportion of the draft is caused by the cutting of the furrow, other things being equal or nearly equal, the larger furrow must be cut with less expenditure of force for a given amount of soil moved. My trials showed that always, though the broad furrow must be lifted higher than the narrow one, the large furrow handled an inch of soil with the use of much less force. Thus:

A 16 inch furrow had a draft of 522 lbs. or 4.64 per square inch.
A 14 inch furrow had a draft of 499 lbs. or 5.09 per square inch.
A 12 inch furrow had a draft of 454 lbs. or 5.40 per square inch.
A 10 inch furrow had a draft of 456 lbs. or 6.51 per square inch.
An 8 inch furrow had a draft of 405 lbs. or 7.30 per square inch.

The lesson of these data is clear. It requires less power to plough an acre in broad furrows than it does in narrow furrows, and this saving is a very material one. But this saving is emphasized by the fact that it requires only two-thirds the time of men's labor to plow an acre of 18 inch furrows that it does of 12 inch furrows. The larger furrow may require the use of the third horse. This will be an economy, as greater speed can be made with three horses on an 18 inch furrow than on a 12 inch furrow since it requires less force per horse to handle it.

Objection is raised that narrow furrows for chemical and biological reasons are more productive than wider ones. This matter I tried out in field crop test. In every trial in both Missouri and Utah the broad furrow gave a better yield than the narrow one, gaining about 2 bushels per acre of corn and 100 lbs. of fodder. Several reasons may be assigned speculatively for this result, but just now I am dealing with another problem.

LINE OF DRAFT.

The line of draft is a straight line drawn from the point of center of resistance on the plow in the process of cutting and turning a furrow to the point of attachment on the team drawing it. When the plow is properly adjusted this line should exactly touch the bridle without in the process of drawing the plow in the least deflecting the beam. If it falls below the bridle on application of the draft it will pull the beam down and the plow will rise on its toe, compelling the plowman to bear down on the handles to maintain the proper position of the plow in the soil or the mould-board at the proper angle to the furrow to secure a well turned furrow. A few days of this sort of effort tires the boys with the farm and gives a poor furrow. Again, if the line of draft rises above the bridle it lifts the plow so that it rides on its heel and compels a lifting action by the plowman. If it passes either to the right or left of the clevis the plow either takes land or shies from it. It is a prime essential to good and to easy plowing not only for the plowman but for the team, that the line of draft be perfectly adjusted so that the plow "swims free," as it is termed. In this case on an even soil the plow will often run alone, only requiring a steadying hand to meet the deflecting action of rocks or spots of uneven resistance.

Modern plows have ampler provisions to meet the change of line of draft by changing from tall to low horses, by the warping of wooden plow beams, by the change in the depth or the width of the furrows, or by the warping of the poles of sulky plows. The change of the relation of width to depth of plowing requires readjustment of the line of draft. More bad plowing and hard work for men and teams occur over failure to comprehend this problem of the line of draft than over any other dealing with plowing. Operating through hired men I have found this matter one of the most troublesome ones that I have had to deal with, as a considerable changing of men and teams is going on.

Some plowmen make of holding the plow so hard and forced work that it has been assumed that the result is shown in the draft. Tests in England seem to show that draft varies materially on change of plowmen. I made a test of this problem with the following result: Plowman No. 1, draft 519 lbs; No. 2, 545; No. 3, 561; No. 4, 565. These results are not as marked as those secured by Gould but are confirmatory of his results and make it probable if not certain that a poor plowman is a burden to the team.

Before dropping this very abbreviated presentation of the problem in hand I will note a test by me of the relation of the angle of draft to draft. The pull of the horse is at an angle with the direction of the plow and of course involves loss of force. The longer the distance of the point of draft from the center of resistance on the plow the less the angle of draft and the easier it is. On the usual hitch I found the draft to be 5.3 lbs. per square inch of soil turned; with chain 9½ feet long, the draft was 5.2 lbs.; with the draft chain 13¼ feet long, draft 4.9 lbs. Tall horses close to the plow have a draft materially harder than low horses at greater distance. While at the Exposition held at New Orleans I saw on the great Ames plantation many teams plowing and each or most of them had the tugs carried back towards the loins and suspended by straps dropping to each side of the horse to suspend the tugs above the direct line of draft, presumably to save the horse from stepping over the tugs while turning the ends of the furrow, or rather to save the indolent Negro drivers from handling the plow to obviate this trouble. But it increased the draft very materially and created a downward thrust on the loins of the horse and resulted in a badly moving plow that really increased the work of the plowman. The manager of course acquiesced.

Proper width of furrows when sulky plows are used is secured by shifting the angle of the plow beam to the line of direction of plow with the horses. However it may appear theoretically, I found in probably two hundred trials that an increase of draft resulted. So far as possible these plows should be so put up and kept true as to line well with the movement of the team.

Another point of importance in use of the Sulky plow, a plow that draws slightly harder than the walking plow, is found in its increased weight over the walking plow. This weight does not matter on level ground, since little more than friction of the axle is involved. On uphill plowing the weight of the plow makes a material difference in the draft. If to this is added the weight of the driver, a decided increase of draft follows. On going down hill draft may be decreased by the weight of the driver. The driver should walk up hill and ride down hill. When we consider that the draft of a plow on a timothy sward for a furrow 7 x 14 inches is 500 pounds, and that the normal horse power of a pair of horses is only about two-thirds of this, it will be obvious that no extra load should be put upon horses already under high tension. This draft also enforces the necessity of the third horse in plowing sward land if the horses are to follow plowing for any length of time. The problem of plowing so far as draft is involved is an important one. I found that a generally badly adjusted plow required 50 per cent. more power than one nicely adjusted.

HOW TO PLOW.

I have already noted the economy of the broad furrow and the strong team. Shall it be a lap furrow or a flat one? The lap furrow is the popular one here and in Great Britain for the heavier type of loams and clay loams. Better aeration and the consequent increased bacterial activity and direct oxidation result. This furrow contains air spaces between the laps that induce, it is thought, circulation of air and depth of freezing, and the disintegration of more frequent freezing in early and late spring frosts. The question is one open to speculation save as the trials above related carry direct weight. The lap furrows are subject to more waste by winds, and give at their lapping edges freer opportunity for grass to grow between. It is doubtful whether they induce air circulation, forming as the spaces do sort of dead air chambers. On side hills and perhaps on most soils these spaces facilitate drainage off of water that otherwise would find storage in the soil. These dead air spaces are opposed to depth of freezing and to the free return of capillary moisture to the following crops. If defects these are, the flat furrow in a measure reverses these defects, making a closer connection with the soil below and aiding the freer circulation to the soil below of air and water and avoiding some of the drainage.

Shall the plow be used as a pulverizing instrument? Gould makes the point that the early American inventors lost sight of this important function of the plow and lays down principles that should prevail in the construction of plows for the various types of soil and for cracking open the furrows crosswise and lengthwise. If the furrow board is constructed to make the inverting furrow travel at sufficiently unlike rates of speed whether lengthwise or crosswise the furrow crackles or parts when it passes its degree of flexibility. This varies very much with types of soils and Gould shows it to be in elastic clays capable of a stretch of 7 inches without breaking, and for sands not an inch. Other types of soils vary between these extremes. Of course the object in cracking the soil in plowing is to admit air for its decomposing effects. This pulverizing the soil with the plow is, I believe, though not valueless, of over estimated value, as if it was the end of tillage. Since we have learned that plowed ground should be tilled immediately after plowing to conserve the moisture, we in practice obliterate this falsely so-called pulverization and break the mass of upturned soil into more minute particles and level as we should the surface of the ground. It has become a fair question whether for the little and doubtful good accomplished we are justified in imposing the increased draft on the team. This point is of some moment since our plows are in the main drawn by one pair of horses, imposing a draft of 30 to 50% more than the normal pulling power of a pair of average horses. In looking over the several types of plows that I have I do not notice that pulverization is intended to be a prominent feature. The trade seems to demand plows of easy draft, the buyers evidently not caring for this feature or not knowing of the principle involved.

Before passing from this subject I will remark what is apparent to all, that for light and sandy soils a flat and compact rather than a rent and open furrow is required. Such soils are deficient in humus, have low water holding capacity and are subject to rapid decomposition of their already deficient organic matter. To further encourage decomposition by increasing the movement of air in the soil by plowing calculated to open the soil would be illogical. For such a soil the long mould-board cylindrical in shape that gives a uniform movement of the furrow in its inversion, tending by its shape—a wedge—and pressure of the plow to further compact, is the one to use. It results in a flat furrow.

HOW DEEP TO PLOW.

Horace Greeley said: "Unless reason is a fool and mathematics a lie deep plowing is better than shallow." So men have reasoned at fitful seasons for ages but more especially since chemistry has shown that the elements of plant food abound to the full depth of the soil. Why not use the resources of the soil to the full depth of plant rooting and why not encourage roots to go deeply by loosening the soil as deeply as possible. This easy logic was the progenitor of the subsoil plow, an instrument that begins where the sod plow stops and merely stirs the soil below without bringing it to the surface or inverting it. This loosens the soil for roots, if roots will only be so considerate as to occupy the space. It also, if reason does not err, increases the water holding capacity of the subsoil. A trial in Missouri of a subsoiled section against one unsubsoiled resulted in a crop of corn that gave 56.1 bushels of corn, while the unsubsoiled gave 56.4 bushels. Likewise a two years average for rutabagas gave 100 pounds more for the unsubsoiled area. A review of many trials at other points fails to reveal an average advantage for the practice.

Roughly stated 90 per cent. of the weight of roots of plants are found in the first 3 or 4 inches of soil and there they persist in growing. I had occasion to test the weight of the roots of most of our staple farm crops while connected with the Utah Experiment Station for each inch of soil to the depth of 12 inches. The results corroborated those of European investigation and were more radical. Roots nestle in the organic materials which are in greater abundance near the surface of the soil and near the genial influence of the sun.

As the organic matter is richer near the surface and roots grow there, what is the decisive advantage of deep plowing?

Plowing more than 6 or 7 inches deep, as will be seen by above statement based on careful data, turns down the organic matter upon which crops feed for their nitrogen to a depth to which it is not natural for roots to penetrate and places at the surface poorer soil for the struggling minute roots of young plants to feed upon. The agricultural soil or root growing area is in a narrow belt. As our New England crops are secured mainly from the artificial supply of plant food and but little from the natural supply of the soil, is it not logical to enrich mainly the area that plants naturally occupy and make it friendly to roots rather than to attempt to fatten a sub area unnecessary until the surface soil reaches its maximum power to hold supplies of fertility?

The proper depth of plowing will vary with the soil and the crop. Light soils repel deep plowing and the diffusion of their limited humus in a large area. A full discussion would lead us into an extended field.

The few tests that I have made favor plowing to a moderate depth, giving a greater yield for approximately 6 inches than for 8 and 10 inches in depth of plowing. But results vary with the crop and soil. In one test for grass the depth of plowing varied from 2 to 10 inches deep increasing by 2 to 3 inches on each passage down. One plat was thoroughly harrowed to the depth of 2 inches in lieu of plowing 2 inches, a depth difficult to secure. The shallow tillage gave the best results.

The two years' average resulted as follows:—

Harrowed	2 inches deep,	8160 lbs. hay.
Plowed	4 inches deep,	5346 lbs. hay.
Plowed	7 inches deep,	6067 lbs. hay.
Plowed	10 inches deep,	5734 lbs. hay.

The surface harrowing was made very thorough and with a smoothing harrow since a deep running harrow would have gone too deep.

Was this result due to the organic matter being left on the surface, or was it due to the fact that grass loves a compact under soil, or was it due to the greater holding power of moisture below, due to the fine dust mulch formed It was in part due to these data that Mr. Clark's famous grass experiments took their well known turn, as I judge from private correspondence. For the annuals for a two years average I obtained the following figures:—

Deep plowing 8 and 10 inches, 41.1 bushels of corn and 1870 lbs. fodder.

Shallow plowing 4 to 6 inches deep, 45.7 bushels and 2000 lbs. fodder.

Crop from harrowing the surface well, but 25.7 bushels corn and 1530 lbs. of fodder. These data must not be relied upon too much, for seasons, soils and crops give varied results.

In discussing the problem of depth of plowing as a means of lightening and pulverizing the soil it is not to be overlooked that water is between every particle of soil and that in its freezing it expands and thrusts these particles still further apart and more uniformly and completely than tillage can and that this force operates every season. Soil will not fill the hole from which it is taken. Tillage of under soil would doubtfully increase its openness.

It has often occurred to me that our cutaway harrows might be a partial substitute for the dream of inventors, the spading plow, many of which have been invented but without successful action. Trials with the dynamometer gave the following results of force required by the old process of plowing and harrowing and of cutting up alone with cutaway harrows. The force required to fit the soil for corn crop by the cutaway harrow alone was, when compared to plowing and harrowing as 8.77 is to 8.03 or so far as the force required to fit the soil for crops is concerned, taken from the unplowed ground nothing was gained by cutting the plowing out. For some years for non-stubble land I have fitted for oats and also for Hungarian by the use of harrows alone. The result has been so far as I can determine by the eye alone as successful as combined harrowing and plowing and at a considerable gain of time. This system has the advantage of opportunity of spreading the time by single harrowings each week over some weeks of time. This enables the formation of frequent earth mulches that retain the moisture to an especial degree. During the past dry season it was especially satisfactory.

TIME TO PLOW.

This question, like each section covered by this talk, involves material for a full lecture. I can only continue as thus far I have continued, to make a mere cursory survey of a few points involved. Fall plowing is advocated as a means of partial extermination of Couch grass by the freezing of roots more exposed than under the sod; as a means of securing more and deeper frosts for pulverization; as a means of killing worms by more freezing, those turned up in late plowing being so numbed that they are caught before they seek shelter deeper down. If early plowed, weeds may be destroyed, while by the same early plowing soil decomposition may be secured, providing plant food for the ensuing crops.

King has shown that fall plowing conserves soil moisture and so plowed, more water is held to the soil than when spring plowed. This is often a very material point and accounts for the greater yields sometimes resulting from fall plowing and yet not always appearing. Science offers further reasons for fall plowing. Among them Prof. Johnson says of the kaolin of clays, the material that binds in a glutinous way the particles of moist clay, that frosts precipitate it. Schubler says that frost throws the point of contact of the particles of fine clay further apart and gives them better consistency.

Opposed to the advantages of fall plowing is the blowing off of fine particles, the best of the soil, and the washing off of similar materials. Furthermore, if some years needed moisture is saved, in other years of excess the leaching becomes greater and correspondingly more plant food is lost. But time forbids the pursuit of the endless.

Tests are the final measure of values to farmers. I have made several tests and others have. They are not as would be expected for reasons half hinted at. Two years average for corn for November plowing, Missouri climate, gave for fall plowing 8,220 lbs. and for spring plowing 7,910, total crop. For carrots, fall plowing 15,166 lbs. and for spring plowing 14,910 lbs. Other trials that have come under my eye have favored fall plowing, and yet not all of them. Varying conditions and crops demand varying methods of treatment. It is the glory of farming that it is not a mathematical study that may be managed on formulas. It demands brains, observing powers of rare ability and keen faculties such as no other occupation demands. The favorable climate, time, opportunity, and the necessity of our brief seasons demand all of the fall plowing possible. In the uncertainty that hangs over this question of time, I seize upon every available opportunity to plow and advance the work. If at seemingly unseasonable time, then harrowing will conserve the moisture and destroy weeds. For coming dry seasons the chances favor rather strongly fall plowing.

PLOWING IN REFERENCE TO PHYSICAL CONDITION OF SOILS.

Sandy soils whose particles are somewhat uniform in size and too open may be plowed when somewhat moist as they tend under this condition to hang together and remain closer than when dry plowed. Such soils should be plowed just before use and be compacted, reducing the loss consequent upon too long exposure to air circulation with unrestricted freedom, to the loss of organic matter.

A distinctive quality of clays is their kaolin content, glutinous when wet and as adhesive as hard glue when dry. This material in this condition binds our heavy soils into clods hard to fine.

Plowing clay loams and heavy loams when wet under the friction of the mould-board glazes the furrow and open to drying is succeeded by cracking and lumping. Such soils never fine well however much tilled. Plow them only when the particles will not retain the pressure of the fingers in fixed mechanical condition and when the particles will roll on each other freely. Loams and sandy loams are less sensitive to the time of plowing but either extremes noted should be avoided.

WHY PLOW AT ALL.

We plow to secure the supremacy of the one desired plant; to secure the aid of decomposing agencies of air and earth and incidentally to retain soil moisture for the crop desired.

Without understanding the why, the ancients and farmers of all periods have known that tillage is manuring and that the primary implement of tillage is the plow.

Columella's sententious exaltation of plowing above manuring, Hesiod's, Virgil's, and Pliny's workings among the ancients, later Tull's and among moderns, Mechi's, Roberts' and others' eulogiums on good plowing show the deep appreciation of the importance of "speeding the plow." New England plows but 10 to 15 per cent. of its area while the west turns 85 to 90 per cent. of its arable area. Various European countries stir from 50 per cent. to the main body of the available tillage land. Grass with its thick spires forms dead air spaces that reduce to the minimum the circulation of air through the soil. Once broken there comes a revolution in this respect as has been abundantly verified.

The moving air brings with it the carbon dioxide, oxygen and other agents that bring about directly soil decomposition or indirectly set in play bacterial growths and decompositions that add immensely to the amount of available plant food supplied by the soil as compared with sod covered land.

Sturtevant took from his lysimeters under sod land drainage water to the amount of 40.38 tons per acre; under bare soil 999.59 tons, and under stirred bare soil 1,241.54. In this drainage was found at the rate of 0.30 lbs. of nitrogen in the water from sod land per acre, 218.7 lbs. from the bare soil and 218.2 from the tilled soil. Over 600 times as much nitrogen formed in the bare soil as was formed from sod land. Increased circulating air becomes under tillage what has poetically been called the "Tooth of time" that eats away inscriptions on tombstones and resolves iron into dust.

Let us keep by more of the plow the open door to the friendly work of these agencies. I might multiply illustrations of similar character. It was these agencies that in 19 years cut out of the prairie soil of Minnesota nearly one-half of the 16,000 lbs. of nitrogen that in its virgin state it contained and did it by the process of annual tillage. Plowing is manuring and plowing is one of the cheapest sources of fertilization. Oversped in the west it has become a foe to the conservation of fertility. It must be guided by trained intellects. These alternate tillage with cover crops.

PORK PRODUCTION.

By Calvin J. Huson, Penn Yan, N. Y.

I fear that the subject on which I am to speak for a little time may not prove of interest to all of this audience.

For some reason, not easily explained perhaps, swine seem always to have occupied the very lowest place in the affections of mankind of all our domestic animals; and the occupation of the swineherd has during all the years of the past and in every land been regarded as one of the lowliest of employments.

As long ago as when the prodigal son, who took his patrimony and started out to see the world so full of hope, had squandered all he possessed, to illustrate the dire distress and abject poverty of the situation to which he had brought himself, it is recorded that he hired himself out to tend a herd of swine.

It is recorded in Holy Writ that when the great Teacher was upon the earth, and cast out the devils from the suffering man, they took possession of a herd of swine feeding in a field afar off. And even to this day some of us may at times feel that we have reason to believe that we may have in our herds some lineal descendants of that famous devil-possessed herd; but such can hardly be the case, as we read a little further on in the same high authority that after the devils possessed them, they rushed violently down a steep hill into the sea, and all were drowned, so left no descendants to trouble us.

The swine of to-day, however, bear but a slight resemblance to those of that remote period. By a process of evolution and elimination, by the application of the principal of the survival of the fittest, in the hands of the careful and painstaking breeder, they have attained as high a degree of perfection as any of our domestic animals, and are doing their full share towards promoting the prosperity of the agricultural interests of this country.

And yet, in spite of this fact, there are many of us, particularly here in the East, who still regard swine as a sort of necessary evil on our farms, kept for the purpose of replenishing the family pork barrel once a year and consuming such farm products as have no commercial value and might otherwise be wholly wasted.

It is rare indeed to find a farmer who gives to his pigs the same intelligent care and attention he gives to his horses, or his cows or his sheep, yet there is no animal that responds so quickly to good treatment and generous feeding as the lowly and despised pig, or that will degenerate as rapidly if neglected or poorly fed.

Those of us who have not kept in close touch with the subject have but a very general idea of the magnitude of the swine industry in this country.

We all know in a general way, of course, that there are several million more pigs in America than sheep, and when we stop to consider that a pig multiplies at least ten times as rapidly as a sheep, we begin to get some definite idea of the vast multitude born into the world every year.

There are slaughtered for commercial pork purposes alone in this country on an average more than one hundred thousand pigs every working day, and there is being paid to the farmers for this vast product at least one and one-half million dollars every day in the year. And this does not include the unnumbered thousands killed on the farm for the home consumption or the local market.

The swine industry has developed into one of the largest and most profitable branches of animal husbandry.

The great bulk of our pork and lard and other pork products comes from the middle West; that favored section of our country known as the "Corn Belt," where land values have been steadily advancing year after year while ours here in the east, excepting in some favored spot, have been standing still or going backward; that section where the farmers are generally as prosperous as in any portion of our entire country. The farmers of the Corn Belt do not, however, owe their prosperity solely to the fact that they are able to produce such tremendous crops of corn, but the prosperity of that section is due, in some measure at least, to the fact that year after year a considerable portion of their corn crop is incarcerated in the form of pork and lard as the finished product.

I am not here to argue that we should undertake the production of pork on anything like the scale or in the manner practiced in the section to which I have referred, for I do not think that it would be practical or generally successful. Nor am I here to say that we should keep less cows and sheep and more hogs, for I believe in cows and sheep and think we should have more of them on our farms.

I am here rather to suggest to you, and to give the reasons for the suggestion so far as I may be able, that there is scarcely a farmer in all this eastern country so situated but that he can add materially to his income, without greatly increasing his cares or labors, by the intelligent production of pork, in a moderate way and as a side line on his farm.

The farmers of this State produce but a small percentage of the pork and lard consumed by the people of the State. And this is true not only of the great State of Maine, but of all of the eastern and middle states as well, including the State of New York.

In view of the largely increasing demand from year to year for all kinds of pork products; in view of the continued high prices paid for such products, is it not the part of wisdom and good business judgment for the farmers here in the east to greatly increase their production of pork and be able at least to supply the local demand right here at home?

There is a very noticeable tendency on the part of the farmers in nearly every section of the country to become specialists, that is, to devote their time and energies to the development of some single crop, the crop that experience has shown is best adapted to the soil, the climate and conditions of that particular locality.

And the products of our farms have been and are being very largely increased by this process, but there is in some sections a tendency, perhaps, to carry this idea to a dangerous extreme. When a man ascertains after years of experiment and trial, the crop that will yield the largest amount and give him the best returns in dollars and cents, it is the part of good business judgment to make the production of that crop the leading feature of his farming operations, yet it may well be doubted whether it is the part of prudence to carry that principle to the extreme of risking our entire farming operations on the hazard of a single crop.

Would it not provide an element of safety and stability if we grouped about our principal money crop those things that could be produced on our farms to advantage, not to such an extent or in such quantities as would at all interfere with the production of our principal crop, as a dependence and production in case disaster should ever come to the crop upon which we principally rely?

It is the history of every agricultural country, that animal husbandry must enter into the farming operations of the people if the fertility of the soil is to be preserved and handed down to the succeeding generations with its productiveness unimpaired.

Swine husbandry presents some advantages over other branches of animal husbandry, not only as a means of quickly increasing the revenue from the farm, but also as a means of conserving soil fertility and building up and restoring depleted soils.

Pork production appeals strongly to the man of limited means, whose situation is such that he can invest but a small amount in breeding stock and desires quick return.

A man may invest from twenty-five to fifty dollars in a single brood sow and in eight or nine months thereafter put on the market a ton of pork worth at the present prices two hundred and fifty dollars.

Right here in the east we have the best market for our pork products to be found anywhere in this whole country. Our great cities and manufacturing towns, now drawing their supply almost entirely from the West, will ever provide a splendid local market for all we can produce at satisfactory prices.

Pork in some of its various forms will always remain the chief meat diet of those who work with their hands, for it has been demonstrated by our scientific men that there is more muscle-making energy in a pound of well made pork than in a pound of either beef or mutton.

The attractive manner in which pork and pork products are put on the market by the great packing houses of the country has done much to popularize it among all classes and greatly increase the consumption. So it will be seen that the swine industry stands on a very firm foundation and is doing its full share towards increasing the wealth and promoting the general prosperity of the country.

To succeed in swine raising one must give attention to those little matters of detail, so necessary to success in any branch of animal husbandry, and so easily overlooked or neglected because they seem so small and trivial.

If the farmers of the eastern states should give their swine the same intelligent care and attention they give their horses, their cows and their sheep, first in their selection, second in their breeding and third in their feeding, the lowly and despised pig would do the rest, and he would soon occupy his proper place on our farms, and the swine industry would receive a great impetus.

To succeed with swine, as with other animals, we must start with good stock; not that they need be high priced fancy stock, for these are ofttimes sadly disappointing; but they should be bred on such lines as to be able to reproduce themselves with fidelity. A man may exercise intelligent care in the selection of his dairy cows and in his breeding ewes and be quite indifferent in the selection of his swine. In these days when every man is striving for the best, there is no place anywhere for the scrubs or mongrels of any breed of animals. They are being weeded out of our dairy herds, our flocks of sheep and to some extent, but much more slowly from our swine.

One of the requisites of success in swine breeding is that our brood sows should be tame and docile. A sow that will show signs of fear or hostility at the approach of man is generally an unprofitable animal in any herd. She is naturally a most timid and sensitive animal. If you have her confidence she will follow you anywhere without fear or hesitation, as no other domestic animal, save the dog, can be taught to do. If she regards you with suspicion and you attempt to drive her, she quickly exhibits those traits of stubborness and obstinacy characteristic of her race. So we must have her confidence; and she must be treated kindly and made tame and docile, if we are to have the full measure of success. A daily visit to her quarters for a time preceeding the advent of the expected litter and a few moments spent scratching her back or stroking her ears, until she will welcome your approach with a grunt of satisfaction, is time well employed. And when the little ones arrive these visits should be continued and when the timid little pigs see you are welcome and their mother gives no sign of fear or hostility, they will soon gather about you and nibble at your shoes and clothing and you can handle them without their exhibiting the least sign of fear; and they will ever afterward look upon you as their friend unless you commit some overt act to forfeit their friendship. A pig started in life in this manner has a great advantage over one that regards man as its natural enemy.

A pig that can be grown to marketable weight in the quickest time on the least food is the most profitable pig. And so we must start them on their way to their final doom as rapidly as possible. They must be taught to eat and the careful painstaking man may provide a small trough, so situated that the mother can not have access to it, and provide them with milk in small quantities. But unless the trough be thoroughly cleaned out with hot water every time it is used, this had better be omitted until they are older and better able to withstand the perils that lurk in the unclean trough; and instead of the milk they may be given a small quantity of dry middlings which they will soon learn to eat.

To have pigs for the September or October market they must be born early in March, when the weather is cold, and they must be closely housed. The little fellows have nothing to do but to nurse and sleep, get but little exercise, and all of us have seen our fattest and most promising pigs die with what we call the "Thumps." A little care on the part of the owner will dispel entirely all danger from this source. A slatted partition across the pen so arranged that it will slide up and down, and the little ones placed on one side, where they will run up and down in an effort to get to their mother, will give them needed exercise and cause them to grow and lengthen out as they will in no other way. The partition is slid up at noon to enable them to nurse, and they are then again separated but permitted to remain together over night.

Then the prudent man gives the teeth of the little ones careful attention. Frequently it will be observed that one or more pigs in a litter do not grow and thrive as their mates. The hair appears dull, they do not grow or take on flesh and occasionally one may be seen with its tongue protruding from the side of its mouth. These little fellows are being reared under entirely unnatural surroundings and an examination will quite likely disclose that the teeth of those that do not thrive are exceedingly sharp, so that the gums and tongue are cut and lacerated, and therefore they do not take the food they should. It is the work of but a few moments, with a pair of small pinchers, to cut off the sharp point of these troublesome teeth, and then smooth them off with a very small flat file, thus affording almost instant relief. And it is surprising to observe how quickly they commence to grow and thrive, soon catching up with the rest of the litter.

Weaning time is the most critical time in the life of a small pig. How frequently do enterprising breeders offer for sale young pigs, six weeks and sometimes five and even four weeks of age. And how many promising pigs have been retarded in their growth and permanently stunted by being deprived of their natural sustenance at this early age.

Pigs should never be separated from their dam until seven weeks of age; and it is much better both for the pigs and for the dam that they be permitted together until they are eight weeks old; and still better if they are not weaned until they are ten weeks old. In weaning it is the too general practice to take the little fellows away from the dam and shut them up in a small pen; deprived of their mother and their accustomed surroundings at the same time, they fret and mourn and frequently refuse to eat until half starved. Their growth and development is greatly retarded or wholly stopped for days or weeks, and a single day lost in the growth and development of the young pigs can never be regained. When pigs are weaned they should never be taken from their familiar surroundings. On the contrary the sow should be removed to a place out of sight and hearing of the little ones and fed in such a manner as to stop the milk flow. The pigs should be kept in the same place and fed from the same trough as when with the dam. Under such circumstances they will scarcely miss her and their growth and development will go on unchecked. Pigs weaned in this manner have a great advantage over those taken from the dam and shut up in a strange place.

In raising swine or in the production of pork no one should rely upon concentrated or grain foods alone. Forage crops of different kinds can be easily and cheaply grown that will provide abundant pasturage from early spring until late in the fall. A paddock or small patch of rye, sown in August or early September will be the first available green thing in the spring, and pigs thrive and grow wonderfully on it. Before it is eaten too closely a paddock of clover becomes available, followed in quick succession by a patch of rape and then of oats and peas. By this time the rye if not eaten too close in the early spring, will have matured a fair crop of grain into which they may be turned without danger of a single kernel being wasted.

When pigs are on pasturage they can be fed grain more economically and with greater profit than at any other time and the summer season is the time to produce pork most cheaply and economically. Early spring pigs raised in this manner should be ready for market in September or early October, ordinarily the best market of the whole year, and should weigh from one hundred and seventy-five pounds to two hundred and fifty pounds at the age of six months.

Fall pigs are less profitable as a general proposition, but if the same general plan be followed a substantial profit will result. Alfafa, clover and sorghum in the order named are among the best coarse foods obtainable and it is surprising how large a quantity a growing pig or brood sow will consume. Quite recently molasses has been added to the grain ration by many breeders and with very gratifying results. Refuse beans are also good, where they can be obtained at a low price, and while they are not naturally relished by swine, if in cooking there be added a quantity of molasses or a few potatoes or cabbage or onions, they will be eaten greedily and give splendid results. If these or other similar foods be provided during the winter months in liberal quantities there can be a great saving of the grain ration and as rapid gains made as though fed wholly on high priced grains.

With pigs that are to go to the butcher at six or eight months of age, we need give but little attention to the growth of bone or development of muscle. But for pigs intended for years of usefulness in the breeding herd, this is of the highest consideration. They should be grown more leisurely and not allowed to take on much fat at an early age. With sufficient range to insure vigorous exercise and abundant pasturage supplemented by a grain ration that will make bone and muscle rather than flesh, they are brought to maturity full of life, health and vigor and will render profitable service for six, eight and frequently ten years in the breeding herd.

One of the reasons why some people do not meet with greater success with swine is that they constantly use young and immature breeding stock. In some localities it is quite customary to raise but one litter from a sow and then fatten her with her brood and retain the most promising sow pig in the litter for the brood sow for the following year. This course cannot give best results. A brood sow does not reach full maturity and usefulness until two and a half or three years of age and should be kept in the breeding herd as long as she will produce two fair sized litters a year.

A word in regard to breeds. That is usually a somewhat delicate question to discuss, but my notions concerning it are so different from those of most men engaged in breeding pure bred animals that I think I may safely refer to it.

There is not the wide difference in breeds or types there formerly was, and that difference is growing less and less every year. The butcher, in a large measure, dictates the type of pig we shall grow, of whatever breed it may be. While this is true to a certain extent with beef cattle and mutton sheep, it is more forcefully illustrated in the case of the pig. With even beef cattle the milk is quite a consideration as well as the meat and they are raised with both objects in view. And with sheep, even of the mutton breeds, the wool is quite an item to consider. But with the pig it is different. There is no milk or wool to take into account. He is valuable for his meat alone. The pig that will attain the largest size in the shortest time on the least grain and command the highest price in the market is the type of pig we must raise, and whether we do it with a Chester White or Berkshire, a Duroc Jersey or Poland China or any other breed is not a matter of very great consequence. The market requirements are resulting in bringing the various breeds more nearly to a common type. Whatever breed we may be interested in, we must so mould or fashion it as to most nearly meet the market requirements. Some may succeed best with one breed and some with another, but any breed is better than no breed. There does not seem to be the wide difference in breeds that formerly existed. There is a more general coming together towards a more uniform type. And this is also true in regard to mutton sheep. There used to be a large difference between the compact little Southdown and the Shropshire; and a still wider gulf between the Shropshire and the Hampshire, but it seems to be growing less. The little Southdown seems to be growing larger, and the big stately Hampshire has become more compact and with less daylight under him than formerly. And this general tendency is observed to a greater or less extent in all our domestic animals, whose chief function is the production of meat.

But it is of the utmost importance that the different breeds should be kept pure and the characteristics of each breed preserved. It would be a sad blow to the animal husbandry of this country, if the various breeds of swine, or of sheep or cattle should become so commingled that any one separate and distinct breed should lose its identity or its peculiar characteristics, or even its color or markings. And so men are engaged in the breeding of pure bred animals and record associations for every breed exist for the purpose of keeping and preserving accurate records of the ancestry of such animals.

How often have we all heard some one say that if he found the boar, or the ram or the bull that suited him in type and form and individuality, he didn't care for the pedigree. And the too frequent putting into practice of that idea has done more to retard the general development of our domestic animals than any other cause. No one can afford to breed a scrub of any breed. If he was the sort of man who would be moderately successful by doing so, he would be the man who would have marked success with better animals.

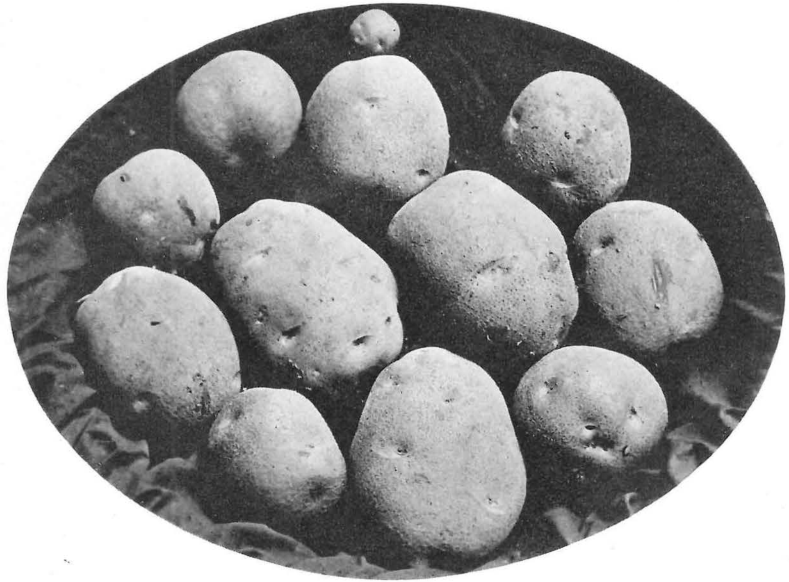
I know a man who once thought he knew more than all the men who had been working for half a century or more in breeding all the various breeds of swine to their present state of perfection; and he mated a pure bred Chester White sow with a high class imported Berkshire boar. Nothing very wrong in that, if he made pork of all the pigs resulting. He had a beautiful litter of pigs, all white of course. Their breeding was very fine, he argued, for in their veins was as good Chester White and Berkshire blood as could be found. And this man selected the best boar pig in the litter and grew him to maturity. And he certainly was a beautiful pig. He had the erect ears, short dished face, arched back and aristocratic bearing of his sire and the length and color of his dam. And this boar was used in that community to the neglect of all pure bred sires of every breed. And with what result? The crop of pigs was a large one, but no two were alike. They were of every conceivable shape and color. They were ringed, streaked and speckled; a miserable mongrel set and were raised at a loss to their owners. The failure of this pig as a sire was because he was not entitled by inheritance to the qualities he possessed. He was the chance product of a violent cross. Two distinct and widely separated blood lines were in his veins. He could not reproduce himself. All the defects of his ancestors for generations back came to the surface in his offspring. And a pure bred animal may sometimes be bred on such lines as to furnish no assurance whatever that he will be able to reproduce himself with any degree of fidelity. So we must have first the animal of the type and form we desire to reproduce and perpetuate in our flocks and herds, and second we must have his pedigree as a guarantee that such animal is not a chance product but is entitled by birth and inheritance to the qualities he possesses.

And of almost equal importance, perhaps, to the breeder, is the man behind the animal and the pedigree. He must be a man of intelligence. He must be a man of perseverance and courage. He must be familiar with the intricacies of the numerous families or strains of the breed in which he is interested. He must possess the skill and discernment to know when and how to carry two or more blood lines along in parallel columns, drawing them closer together here and there in order to more firmly fix some desirable trait or characteristic, and to be able to perceive the necessity as it arises of infusing a dash of fresh blood to insure stamina, size and vigor. And when he has given his best care, his best thoughts, the best years of his life to the wonderful problems of breeding, he finds that many of them still remain unsolved and unfathomed.

THE FARMERS' GARDEN.

By John Jeannin, Jr., West Sand Lake, N. Y.

The American Farmer of to-day is seeking for new methods, that will enable him to increase his farm crops or lessen the cost of production. But he generally ignores the fact that it is not always an increase of income that brings to himself and family added comforts. The one thing most neglected about the farm and, possibly, the one thing that is the greatest source of pleasure, as well as profit, is the garden.



One hill of potatoes, grown by Geo. E. and Lester B. Howard, Monson, Me.

It is a deplorable fact that the average farmer does not furnish his table with as good a variety of food as the laborer or mechanic. Is it to be wondered at that the boys and girls are better satisfied with city life and its bountiful table and endless variety?

A very common excuse is that a farmer can buy his vegetables much cheaper than he can grow them, and the result of such an excuse is that his family does without, or a meager supply is purchased at the grocery in the form of canned goods. The humblest peasant of Europe considers the garden as his greatest source of income. It enables him to support his family on the low wages usually paid to farm laborers, and, judging from the healthy appearance of the thousands of immigrants that come to our country, their health is not impaired by their vegetable diet.

The abominable enclosure so frequently found on our American farm is a disgrace to the profession, and to the foreign visitor denotes a lack of thrift and right living. There is no reason why the American farmer should not be the best fed man on the globe. With the literature and cultural directions found in the leading seedsmen's catalogues one can hardly offer the excuse of not knowing how.

There is scarcely a farmer but has some ideal plot of ground for a good garden. Any soil that will grow a good crop of corn can be enclosed and fitted for vegetable growing, with a hot bed and cold frames. The season can be advanced so that many sorts of tropical plants can be grown even in a cold climate.

Hot-bed sashes for a farmer's garden can be purchased from seedsmen, and are usually 3 x 6 feet, two sashes being enough. For heating material, fermenting horse manure with a liberal quantity of straw should be frequently forked over until the whole pile is warm, when a pile should be made in a sunny location well protected from north and west winds. The pile should be eight feet square and two feet thick. Then place a frame of boards on the pile, which should fit the sash closely, twenty inches high in the back and ten inches on the lower side. Should the manure be slow to heat a sprinkling of hot water will start fermentation. The sash should be raised to allow the excess moisture to pass off. When the temperature begins to recede, four inches of rich, fine soil should be placed inside the frame.

In a few days, if given proper ventilation, the surface of the soil will be dry enough to sow the seed. The seed should be sown about eight weeks before the usual time for planting in the open ground.

After sowing the seed care should be taken to give plenty of ventilation, especially on bright days. Mats should be provided for cold nights. The following is the lists of seeds that can be sown in rows four inches apart: Tomato, pepper, eggplant, lettuce, early cabbage, melons and cucumbers. Lettuce and cabbage should be sown in alternate rows between the tomatoes, pepper, and eggplant, and removed to cold frames as soon as large enough to transplant.

A frame similar to that used for the hot-bed should be provided and covered with sash or oil muslin. No manure is used for heating materials, the frame being placed on a bed of well enriched soil. For two days after transplanting, the plants in cold frames should be shaded with bran sacks, and plenty of air should be given as the hardening process can only be done by exposure to the open air.

Lettuce and cabbage should be transplanted three inches apart both ways and if properly cared for will be large enough to set in the garden as soon as the soil can be plowed in good condition, when the cold frames can be set with tomato and eggplants four inches apart each way and shaded as for former crops. After the tomato plants are removed the hot-bed will have exhausted its heat, when it will be in good condition for sowing celery to be transplanted as the former crops when the tomatoes are removed from the cold frames. Cucumbers and melons can be sown in strawberry boxes filled with rich fibrous soil and placed in the hot-bed after the lettuce and cabbage plants have been removed to the cold frame. When all danger from frost has passed, the boxes containing the melon and cucumber plants should be moved to the garden, and transplanted in well prepared hills six feet apart, and the sides of the boxes cut so as to permit the removal of the soil without disturbing the plants. Thus the season may be advanced two or three weeks.

The ideal garden is one that is large enough to be worked with a horse, longer one way, instead of square. A soil that is nearest to sandy loam, with a southern exposure, is to be preferred. The rows should be such a distance apart as will enable frequent cultivation and plenty of sunshine for the plants therein growing. With some forethought as to the season of maturity of the different varieties of vegetables, a second and sometimes a third crop can be grown on the same ground.

In the selection of seeds one must be guided by the wants and tastes of the family, but the following list may be of service:

Peas, Thos. Laxton, Dwarf Champion, Champion of England.
Beans, Bush, Wardwell's Kidney Wax, Refugee.
Beans, Pole, Kentucky Wonder, Golden Cluster Wax.
Corn, Mammoth White Cory, Shaker's Early, Stowell's Evergreen.
Beets, Eclipse, Long Blood.
Squash, Yellow Crookneck, Boston Marrow, Hubbard.
Spinach, Thick Leaf.
Cucumber, Early Cluster, White Spine, Long Green.
Onions, Sets, Yellow Globe Danvers.
Celery, Golden Self Blanching, Crawford's Half Dwarf.
Lettuce, Big Boston, Henderson's New York.
Tomato, Sparks Earliana, New Corliss.
Pepper, Sweet Mountain.
Cabbage, Early Jersey Wakefield, Succession, Danish Ball Head.
Radish, Vick's Scarlet Globe, White Strasburg, China Winter Rose.
Muskmelon, Paul Rose, Netted Gem, Surprise.
Watermelon, Hungarian Honey, Seminole.
Parsnip, Guernsey.
Carrot, Danver's Stump Rooted.
Cauliflower, Snowball.
Asparagus Plants.
Rhubarb Roots.

No fertilizer has yet taken the place of well rotted stable manure for the garden, which should be plowed under in the fall. An application of a good grade of commercial fertilizer well harrowed in in the spring is very effective. Planning the garden will be found very interesting work for the long winter evenings. It should be planned with a view of supplying the family with canned vegetables in winter as well as fresh ones for the table in their season.

From an economical standpoint a good garden is a good investment. Some years ago the writer was curious to know the costs to the mechanic with a family of five persons for the supply of vegetables during the summer season, and I was surprised to know the amount was $48.00. The head of the family was, therefore, obliged to labor for twenty-four days at $2.00 per day to pay for the vegetable bill, and yet he did not consider it was an extravagance.

It is very doubtful if the average farmer would be willing to expend a like amount for a like supply of vegetables for his family, and yet he can grow an equal amount of vegetables on less than 1-6 of an acre with much less than 24 days' labor.

There is oftentimes a spare half hour at noon or after the day's work is done that the horse and cultivator can be used in the garden to good advantage without a loss of time.

A farmer who plants the garden and depends on the women folks or the hired man to work it on rainy days is too shiftless to ever accomplish much in making the home what it should be.

It would seem superfluous at this time to give cultural directions for the growing of the various vegetables when such directions can be had in detail from the seedsmen's catalogues which may be procured for the asking.

A profitable addition to the vegetable garden would be a liberal supply of small fruits, such as strawberries and raspberries (both red and black), besides currants and gooseberries, which add so much to the variety.

It is to be hoped that in the near future the farmer's table will be abundantly supplied with all of the fruits and vegetables that are offered in such an attractive way in the stores of our cities and when the time comes the farmer's home will have become the ideal home for the boys and girls who have to spend their youth on the farm, and the good wife can point with pride to the result of her skill in the art of preserving and canning. She can also have the satisfaction of knowing that her daughters are better equipped to make their homes what they should be,—the best in the world.

TWELVE LEAKS ON THE FARM.

By EDWARD P. MAYO, Waterville, Maine.

I am aware that it is not a pleasant task to tell one of his faults, but we never should get above mediocrity if we listened only to the voice of flattery, and if we have faults and failings the quicker our attention is called to them the quicker we shall be in condition to right about face and commence the work ot reforming our methods. This procedure is especially desirable and in fact very necessary on the farm. While of course I have not time today to detail to you all of the errors into which the average farmer has fallen, neither have you the time or patience to listen to the recital, I purpose at this time to enumerate to you a dozen of the prominent leaks that can easily be found on far too many of our Maine farms, any one of them sufficient to turn what would otherwise be success into almost if not quite a failure.

1. The first leak to which I would call your attention is the failure to appreciate the dignity of the work in which we are engaged. We have all been taught from our mother's knee to deprecate the business of farming, and our boys have been adjured to avoid agriculture and adopt it only as the last resort. Our girls have been encouraged to look with favor upon almost any one as a future companion as long as he did not contemplate a lifetime spent on a farm. Our children have been taught to think of the manufacturer or business man as a very important personage in the community, but let us look at the real condition of affairs just for a moment. A man comes to town, and hires our largest building. He brings a carload of leather and hires a crew of men, women and children to manufacture a shoe. Each one has his or her allotted part or portion in the work of making this simple shoe; just precisely the same work is done year in and year out. The manufacturer buys a little more leather and ships a few more shoes, and yet he is looked up to by all the community as a great business man, a man of great capacity. He does things, and is thus respected by the community. On the other hand, a farmer takes a piece of land, and studies the component parts that go to make up that soil.

He decides just what it needs to fertilize and invigorate it. He supplies those wants and then cultivates thoroughly and well. Then looking over the markets carefully he estimates what will be the best crop to grow, not what crop will be the best to sell today or tomorrow, but what crop that soil is capable of producing that will bring the high dollar in the open market six months hence. Then he plants the crop which in his judgment is best adapted for his purpose, all these things considered, gathers the harvest and sells it to the highest bidder. Which, I ask, requires the greater business capacity, the man who day after day and month after month produces exactly the same products, or the one who has to first study the future markets, and study the capabilities of his soil and plant or sow accordingly?

2. The next leak which I wish to consider with you is our failure to understand that farming is a business which must be conducted on business principles in order to obtain the results that are its due. The time was when farming was considered simply a means to help eke out a sustenance to keep the wolf from the door, but that time has happily passed and gone, and today we recognize farming as a legitimate business, that if conducted upon business principles will give a good return for the labor involved and for the money invested. It will give the farmer a pleasant happy home, educate his children, and give him a competence for the twilight of life, but to receive these returns the farmer must see to it that he buys for cash, and gets all the discounts that the sagacious business man receives. He must also sell for cash, getting the high dollar each and every time, and to do this he must of necessity produce the high dollar goods. Also, the goods must ever and always be true to the label, and a sale once made must make a customer forever.

3. Our next leak is our failure to appreciate the value of an education, for there is no class of business men to whom an education means as much as to the twentieth century Maine farmer. Now please do not misunderstand me. I have not said that it is necessary for a man to have graduated from Harvard, Bowdoin or Colby in order to make a successful farmer, but I have attempted to convey the idea that this is an age of specialists, and the farmer who makes the most of his opportunities must be educated along the line of his future efforts. And this remark applies to every line of agricultural operation.

I have in mind a visit made recently to a farmer who had grown gray in the service. He showed me his beautiful level fields, and told me that he had cleared them and leveled them by his own hand, but he remarked that when he had done that, that was as far as he could go, for, he added, "I had no education, but I did know enough to send my son to Orono to take the dairying course, and when he returned he convinced me very quickly that our cows must be fed a balanced ration. Just what a balanced ration was or where it could be had, or how it was to be fed was entirely foreign to me, but I believed the boy was right and I was determined to see him through, so I told him to go down to the village and buy a whole lot of 'balanced rations.' As a matter of fact I had not the least idea what they were like or for what purpose they were to be used. When he returned with a whole load of bags and packages, on top of which was perched a pair of scales, I jokingly asked him how often he would have to give the cows a set of those scales in order to make them give five per cent. milk? But my jollying didn't disturb him any, and he commenced to mix up their 'rations.' He dipped out a little of this and spooned out a little of that and began to feed it to the cows. This was all nonsense to me, but it was only a few days before I noticed that we were getting more milk than we had ever had before, and before thirty days had passed the increase in the volume of milk was very marked indeed. To be sure, George called one of the cows a boarder, and we beefed her, but we got a good deal more milk from those remaining than we had ever had before. And then I began to see the value of an education, even in a cow stable." This simple illustration will explain to all the value of an education to a young man who is about to enter upon any one of the many branches of agricultural development.

4. The next leak to which I will call your attention is our failure to appreciate the value of the soil. While the most of us have an idea that we know something of the composition of our farms, as a matter of fact the wisest of us know but very little of the art of maintaining fertility, or renewing fertility when once it has been lost or wasted. In England the farmer who does not leave his soil in better condition at the end of the year than he found it at the beginning is counted a poor farmer. This of course cannot be done unless we are familiar with and

have a thorough understanding of the capabilities of the soil, from which we are getting our profit. There is probably not a farm in the State which today is yielding 50 per cent. of what it would if properly nourished, thoroughly cultivated, and handled as a business man would handle his business. We crop too many acres, and gather all too little for our pains. We are admonished to sow less and cultivate more, which is another way of saying that cultivation is fertility.

5. One of the most grevious leaks on Maine farms is the outrageous manner in which barn dressing is wasted, and commercial fertilizers are employed. We know a host of farmers who never think of cleaning up their barnyards as long as they can get trusted for commercial fertilizer, and if the barnyard is cleaned up as a forceput, the dressing has been allowed to remain there so long that it has lost a very large per cent. of its manurial value. We should study from experts. When the greenhouse man wants to get the most nitrogen, the best growing qualities into his soil, he takes the drenching from freshly made cow manure. We let that same cow manure drench and drain off into a weed nursery, and go to the fertilizer man and buy a high sounding mixture at a high cost. There is only one ending for such a practice. Our animals furnish us absolutely the very best plant food that can possibly be produced. We almost criminally allow it to go to waste, disfiguring the looks of our farm buildings as well, and then ask credit for poorer goods. This certainly is one of the great big leaks that if not stopped speedily will drain any farm of its assets.

6. Another leak which is the cause of the undoing of many a man with high aspirations, is the failure to care for domestic animals. A very large part of this leak comes from ignorance, for strange as it may seem, many a man who has been brought up on the farm and mingled with animals all his life, has no kind of conception as to what care they must have in order to give the best returns. We rode with a veterinary surgeon the other day, who told us that seven-eighths of his business at least, came to him from farmers who by simple neglect were compelled to forego the use of their horses and cattle when if the least forethought or timely care had been accorded them the trouble could practically all have been avoid-

ed. The superintendent of a large breeding establishment told me recently that in all the years he had been at the head of the farm he never yet had had a veterinarian called professionally. I asked him to explain the secret of it. He said it was simple enough. He always managed to "get there" just the night before they were taken sick. With nearly fifty head of stock under his immediate care he was so familiar with the individuality of each animal that he could tell from the slightest symptoms when there was any trouble brewing. It was his practice nightly just before retiring to go to the tie-up and listen to the breathing. If there was any one of them that did not "ring true," he was able to detect it in a moment and apply the remedy promptly, and as a result when morning broke all was calm and serene. Too many of our farmers have no definite knowledge as to the capacity of their animals, as to what they ought to do, as a good day's work, for instance, and what they ought to receive in the way of feed and handling, not only to prepare them for the task but to renew and freshen them at its completion. The loss of domestic animals from neglect and abuse largely through ignorance, is one of the most glaring defects in Maine agriculture today.

7. One of the largest bills the Maine farmers have to meet today is for farm implements, and where one man takes anything like adequate care of his implements, one hundred take no care at all. I was called to a large well-known farm recently, by a farmer who has struggled long and hard against many adverse circumstances, and asked to tell him if I could, why he was slowly but surely going to the bad from a financial point of view. He had a large farm, and harvested immense crops, using the latest implements to conduct his business most economically. He had no bad habits to which you could attribute his ill fortune, and yet he was slowly but surely going astern each year. When I reached the farm he was milking, and he told me that he would be with me in a few moments. I occupied the interval by taking a stroll around the premises. When I had completed the circuit of the buildings I made a list of the farm implements that I had found housed under the high firmament of heaven. I found a $22 plow standing right in the furrow, where he had left it the fall before. There it stood all ready to be hooked on to. I found a hay loader down in the

field, where it had refused to "work." I found a hay tedder behind the barn, where it had been stored, lo! these many years. I added up the list of farm machinery thus scattered about (not so much as a plow or a harrow was to be found in the buildings) and I found that this good man had paid in the last twenty years four times the value of his farm for high-priced gaily-painted farm implements, and never had taken the trouble to house a single one of them. Further comment would seem to be unnecessary on this branch of our discussion.

8. We next come to the importance of our markets. It matters not how much we may plant and reap, unless we are diligent in procuring a good market it is all wasted. We see farmers every day who work hard and long to produce large crops. They spend long days and many of them seeing to it that the crop is secured in the best possible condition, but if you ask one of them to spend even half a day in looking up a suitable market for the crop that has been produced as the result of his own brain and brawn, he will tell you that he has not the time, that he is too busy, and the first one who comes along and makes him anywhere near a reasonable offer and absolves him from any further responsibility in the matter, nine times out of ten will get the crop. Did you ever think how absurd it is to allow the man who buys your crop to make the price that he will pay you for it? When you step into a store to buy the household necessities the man there makes the price, too, and you permit it so to be, just exactly as you allowed the man who bought the product of your farm to make the price. In other words you let the other man name prices to you, whether you sell or buy. Did it ever occur to you that this was a one sided way of doing business, and far removed from doing it on a business basis? Why, I have neighbors who sell wood, but they never have a stick to sell when there is any to be had elsewhere in the market. In case of a regular wood famine they can always be depended on to produce "just one load more," provided, of course, you want to pay double price for it. When the famine is over and the market begins to be well supplied their wood is snugly piled in the shed, but as long as the high price is maintained and you have the price, you can always depend upon getting a single load. Their neighbors always begin to haul their wood

when the market is glutted, and they have to coax some one to pay them almost any price to get rid of it. We notice the same condition of affairs every Thanksgiving. The luckless farmer who is always chasing the market takes a lot of turkeys to the dealer. They are only about half dressed, they have been crowded into a box, they look anything but inviting, and the poor poultryman is naturally at the mercy of the dealer, who is not slow to take advantage of the situation. It matters not what price the dealer pays, the birds are dear, and he is obliged to flee to the man with the one cord of wood, to help him out, as his best trade will not put up with any poorly dressed, slack looking poultry for Thanksgiving, and naturally the wood man makes his own price on his turkeys as he did on his wood. Here we see the two classes of farmers,—the one who chases the market with an inferior product that nobody wants at any price, and the one who dictates a price to the market and compels the market to come to his terms. There is a great big profit between chasing the market and having the market chase you. If you would have the market chase you, your goods must always be not only presentable, but really tempting, and true to the label.

9. In order to produce paying crops the farmer must be master of the situation and be able to produce them at the lowest possible price, and under the very best and most advantageous conditions. Here we come to the terrible leak of buying concentrated feed in great quantities, feed that was produced in the middle west, on land worth several hundred dollars per acre, and railroaded across the continent, to be sold to consumers and fed on land worth in many instances not over ten dollars an acre. Here it will be seen, is a terrible discrepancy. No true business man would consider such a proposition for a moment, and yet thousands of farmers throughout our State who like to be called good farmers, are at the mercy of the grain store from one year's end to the other. This leak has been particularly grevious the past year or two, when we have seen dairy products constantly rising, but the farmer handicapped from reaping the benefit, because of the great amount of concentrated feeds that he is obliged to purchase at the fast increasing prices. Just think for a moment what would be the change of condition if the farmer was allowed to take advantage of the high price

of his products without paying such high tribute to King Corn of the West. But this is not all. The farmer is not only wasting his substance on what he could or should raise, but he is losing the benefit that the cultivation of such a crop would bring to his soil. So the leak assumes awful proportions, virtually cutting the life from the would-be prosperous farmer. Here we see the beauty and the importance of the admonition of the Patrons of Husbandry: "Produce more, and buy less, that the farm may become more nearly self supporting." In a great majority of cases which have come under our observation we find our farmers reversing this solemn admonition, for each year they are producing less and buying more, and the soil is becoming less and less fertile, as the years go by. Here is another yawning leak that needs the prompt and intelligent attention of those who would prosper on the soil.

10. While Maine is wonderfully well suited to the raising of horses and mules, we find the farmers on what might be considered our best farms, depending almost wholly upon the western horse market to supply them with their farm teams. It has been estimated that Aroostook county alone sent more than $50,000 last year into the West, with which to purchase farm teams to cultivate that rich clover-growing soil—the best soil that could be imagined on which to grow strong boned, heavy limbed and muscled work horses. If Aroostook county alone was guilty we would say nothing, but practically every part of our State is doing precisely this thing. In France where these heavy horses are produced in great numbers, where the stock comes from that breeds our Maine supply, the conditions are in no wise as favorable as we have them here in Maine. A horse is raised there on a small poorly cultivated farm. When four months old his breeder will sell him at auction for anywhere from $12 to $20. The colt is purchased, shipped across the water, fed the cheap grown corn of the middle west, and at two years of age shipped east, where foolish farmers almost tumble over themselves to get possession of this wonderful bunch of fat at a price beyond all sense or reason. Think of one of these ordinarily bred horses from the district of La Perch, where they are raised, and sold at four months old, for $12, selling here eighteen months later, at a price anywhere from $3,000 to $4,000, and sold to farmers, too, who ought to be in the business

Harvesting Wheat in field of O. B. Griffin, Caribou.

of raising their own farm teams, even if they do not care to go into the business on a larger scale. Maine farmers have no right to expect any great mead of success as long as they continue to send their money west, for horses and mules that could and should be produced on their own farms. One of the great surprises to me as I travel over our State, is to find not a single establishment now in existence that could be termed a breeding establishment for heavy farm horses. And yet the demand is not only constantly increasing, but the price is equally as great. While the horses throughout the United States have in the last ten years increased in numbers 50 per cent., and in price 400 per cent., we here in Maine have only about held our own, either in price or numbers. How best to stop this great big leak is certainly worthy of your most deliberate and profound consideration.

11. But if we stop all these leaks, wholly or in part, and allow our boys to leave the farm, we have not made any material progress in the general prosperity of our State from an agricultural standpoint. Look at it as you may, the fact remains that we must keep the boys on the Maine farms, or we cannot keep the farms. We have gone the limit with hired foreign labor, and are all too well aware that it is a failure. We must have the boys or we cannot have the farms. In the past we have as a rule tried two methods. One was to keep the boys so completely impoverished that they had not the wherewithal to leave the farm. The other was to threaten them that if they dared to make the attempt and we captured them they would a least wish they hadn't. Both of these attempts have failed most pitifully, and now we face the situation anew, and what shall we do and how shall we do it? I believe the only true solution of the question is to take the boys into partnership with us. I made calls on eighteen farm homes in one town recently, where I found that the son was a partner in the business of conducting the farm, and one father told me that he never had had any kind of a transaction, large or small, important or trivial, in which he had not consulted his son, since the lad was fourteen years of age. Like all boys he thought he wanted to go out into the world. He thought he wanted to go to Lewiston and work on the electric cars. The father had about reached his limit for hard labor, and still he wanted to retain

the farm. It had been in the family for years and the heir was the only key to the situation if the farm was to be retained. He didn't tell Charley that all the boys who went to Lewiston and entered the employ of the street railroad became drunkards and vagabonds and died in the gutter, neither did he tell him that if he would remain on the farm he would give him a thousand dollars at the end of every year, over and above what the farm had netted; no, he didn't talk about any of those things, but one day he bought Charley a pair of Percheron colts. They were good ones, Maine bred, and handsomely matched. He told Charley they were to be his and he was to have the entire management of them. Incidentally he suggested to him how he would educate them, not break them, if they belonged to him. Charley thought well of the suggestion, and began to get the colts accustomed to his ways. One day the father and son went to Lewiston and bought a pair of farm harnesses for them. Seeing a set of harnesses just going out to another customer bedecked with colored rings, the father asked Charley if he didn't think such adornments were an addition to a good harness. Charley rather thought they were and the father told him to pick out as many as he could use to good advantage and they should go with the harness. Before returning home they purchased a modern farm wagon, and for several days Charley was more busy than ever before in his life connecting up the colts with the harness and the wagon. When they were all together they made a fine equipment. No finer, in fact, could be found in the whole county. That was ten years ago, but Charley is still on the farm, and those simple, inexpensive colored rings to bedeck the farm harness have proven rings of steel to bind Charley to the farm, and to the development of the farm, which today is under a very high state of cultivation, in fact one of the finest in that section. Does any of my readers imagine for a moment that there was any danger of Charley's throwing that harness on to the floor or failing to properly care for that team at the end of a hard day's work? In my judgment we might have the State all dotted over with Charleys if there were more good, faithful, earnest fathers, that had the good judgment to treat their sons in the same manner that Charley was treated. Does anybody think for a moment that there is any danger of Charley's leaving the farm for life in the city, or that there has been danger for the last ten years? In my judgment this good man has solved the problem of how to keep the boys on the farm, and stopped one of the greatest leaks that is draining the life out of our Maine farms, and Maine farmers.

12. But now we come to what in my judgment is the greatest of all our many, many leaks on our Maine farms, and that is our failure to appreciate the value of our social, fraternal and domestic blessings. We here in New England have become so accustomed to these blessings that we cannot remember that they were not always ours. I have traveled over practically all of these United States, and I am familiar with conditions in every section of this country, and I am here to tell you that we have no true appreciation of what we are favored with in the way of fraternal, social and domestic blessings. The fraternal spirit in New England generally, and the State of Maine especially, is higher, purer, and much more in evidence than in any other part of the land that I have ever visited. Socially, our blessings are so much above and beyond those in other sections of our country, that it is difficult to make a comparison, and yet we take them with the same indifference as the air we breath. We think of them as a part of our birthright.

And the same might be said of our domestic enjoyments. As has been said before, we are so accustomed to our delightful rural farm homes that it never occurs to most of us that there are those, many in fact, who know nothing about true domestic enjoyment in rural life. There is a sweetness and a purity in the life and living of the average of our people in this State, that is delightfully refreshing, and it seems a great pity that it should be so little appreciated by so many people. We are told that the true farm home should be the most delightful and sweetest place on earth, and we believe that the truth of this statement is being daily illustrated all over our State.

Thus I have gone hastily over what to me has seemed to be the most glaring of our so termed farm leaks. I am happy to know that much that has been said does not apply to hundreds of our farmers in this good State of ours, but there is no question but that we have far too many errors to make our farms as profitable and as enjoyable as they might be if we were awake to the golden opportunities that surround us on every hand.

TWO INSTITUTE WORKERS AND THEIR FARM HOMES.

By D. H. Knowlton, Farmington, Maine.

In the summer of 1909 I had the pleasure of a short but exceedingly interesting trip in the West. At the Farmers' Institutes in Franklin County I had previously met Andrew Elliott and Forest Henry, two of Commissioner Gilman's most popular institute speakers. Both these gentlemen were advised of my intention to take a trip west, and both extended cordial invitations to spend a few days with them. My wife and I were both glad of this opportunity of visiting two farmers as part of the tour. So much had I read of western farming and so much had I learned of it from these gentlemen that I was glad I could see with my own eyes just what it all meant. Commissioner Gilman was informed of my intention to visit the homes of these gentlemen and he wished me to convey to them his best compliments and regrets that he could not visit them at the same time.

These gentlemen had been employed on the Farmers' Institute force in this state several times, and had made a very favorable impression among the farmers of their skill in operating their farms. Commissioner Gilman, on my return, requested me to report the results of my observations in the form of an institute lecture, that the people of Maine might have this additional evidence of the character of the men and quality of the work they are doing on their own farms—a work, let me say here, which has given them more than local fame. I feel it an honor as well as a privilege to have such a duty entrusted to me, and I take special pleasure to preparing this paper from the observations I made in this delightful visit to the homes of these eminently successful farmers. My wife and I were most cordially welcomed and all possible courtesies were extended to us.

ANDREW ELLIOTT, GALT, ONTARIO.

Andrew Elliott is of Scotch descent, from good Presbyterian ancestors. Just how or when the family settled in Galt I did not learn, but here on a farm of 300 acres, about five miles from a city of 9,000 population, Mr. Elliott lived for many years, until a son was able to operate the farm, when he bought a house and moved into town, where he now lives. Galt is about halfway between Toronto and Hamilton, on the Canadian Pacific railroad.

Mr. Elliott married an estimable woman and here on this farm they brought up a family of five daughters and a son. One of the girls, it would seem the loveliest of them all, died just as she was entering the age of womanhood. The daughters are well educated and cultured women. The son, after graduating from the Agricultural College, has settled upon the farm, where he bids fair to excel his father as a farmer and lecturer. The son has one child, a boy of ten years perhaps, who brought out the specimens of plants and insects he had been gathering. A letter from this boy came to me in the fall in which he said: "We held a school exhibition for our townships. I got first prize for weeds, weed seeds and insects. It was the first one held in the district, and it was a great success."

This reminds me that on my visit to the University at Toronto I found a summer school in session with seventy-five teachers who came there to learn how to teach agriculture. The spirit of progress is everywhere in the Province. Perhaps the educators in the States might learn something here to aid them in teaching agriculture in the public schools.

Mr. Elliott is known in Galt as an "agricultural man," and well he may be, for far and near he is consulted upon farm topics. As an agricultural lecturer he is in great demand and since he was in Maine most of his time has been spent in institute work. More than all this he is active in his interest in the social and political affairs of Ontario.

FOREST HENRY, DOVER, MINN.

Forest Henry's parents came from New York State, though his mother was a Vermont woman. He was born in Dodge

County, Wisconsin, in 1856. The family settled in Minnesota Territory in 1857, on a farm a few miles from Dover Village, where he now lives. He grew up on this farm, making the most of the country schools, and a high school in a neighboring town. At the age of fifteen he began teaching school, and later took part of a two years' course in Carleton College. Duty to his aged parents called him home, where he remained until he was twenty-six years of age, farming during the summer and teaching winters.

At that time growing wheat had become uncertain and unprofitable in Minnesota, and he took up the study of agriculture "to find out what we could grow to make a living." He has continued this study since, and along with the study he has made practical and profitable application of the knowledge thus gained. The attention of the authorities was called to his successful farm operations and he was invited to take part in the institute work in the state. The fact that he has been kept in this work since goes to show how highly the authorities value his services.

In 1882 he married a popular school teacher who has proved an efficient helpmate all the way along. They settled down on a small farm where they remained for six years, then sold out and bought a larger farm in Elmira, and for fifteen years he applied himself and all his resources to raising pork. This long and successful experience gave him the practical knowledge on which he based his lecture on pork raising. Six years ago they sold the Elmira farm and settled in the village of Dover, a small hamlet in southeastern Minnesota, on the line of one of the great western railways, about seventeen miles west of the Mississippi. The farm consists of about 200 acres of rolling prairie, sloping down to the village home. The house, built by a Maine man, is supplied with water by a wind mill, is heated by furnace, piped for hot and cold water and lighted with acetylene gas.

There are two sons in the family, earnest students of farm problems and industrious workers. One has already graduated from a short agricultural course and the other is taking the three years' course. The older one is running the farm now, and it is interesting to note that on the letter heads of the "Clover Crest Stock and Dairy Farm" the proprietors are announced as "Forest Henry and Sons." This home is so pleasantly situated and the home life is so beautiful, it is not strange that the sons are ready to take up the work for which father and mother have so carefully trained them.

Mr. Elliot's Farm and Farming.

Mr. Elliott's farm, the surroundings, and the farm itself are much like many New England farms, and I could not see that conditions were any more favorable. The farm contains about 300 acres, divided into tillage, pasturage and woodland. The locality is a favorable one, for all around the farmers seemed to be a thrifty class. Many, I may say most, barns have cellars or a stone basement where the stock is kept. They must be very warm, but it seemed to me the air must be very close; however, they assured me their stock was healthy and took on flesh readily.

Not far away from the house was a "bunch" of steers, nearly or quite ready for the market. Some of them were bought in the winter and fed till spring, when all were turned out to fatten on the abundant feed of the pasture. They were all dehorned, as was most of the stock I saw here and in the West. They looked odd, but they seemed more docile in consequence.

It was just after the Fourth of July, when most Maine farmers were beginning to cut their hay. Mr. Elliott's men were cutting the last piece of clover. It was a heavy crop, fully two tons to the acre, and Mr. Elliott said he expected a good second crop of clover from the same land. He grows only clover for hay, for he finds this the most profitable to feed to his stock.

The crops of the farm are roughly estimated as follows:

Clover hay	100 tons
Wheat	750 bu.
Oats	960 bu.
Oats, barley & peas, mixed	500 bu.
Ensilage	250 tons
Peas	200 bu.
Turnips	5000 bu.

In addition to the above there was a good supply of vegetables and fruits for the family. The farm was carrying 10 horses, 9 cows, 62 steers, 24 sheep and 25 hogs. More or less stock is bought and fed a few months and then sold at a good profit.

The cash receipts from the farm for the year are approximately:

Steers sold	$1200
Sheep sold	900
Hogs sold	200
Wheat sold	500
Odds and ends	200
Total	$3000
Labor cost	600
	$2400

These figures are based on the Ontario prices, which are somewhat less than the prices in the States.

I was curious to know something about the implements used in operating this farm, and Mr. Elliott's first mention was his gasoline engine, grinder and straw cutter which he estimated at $400. In the hay field the men were using a large mower, side delivering hay rake and hay loader, all valued at $170. The other implements brought the total amount up to a little over $1200. The team and its outfit made about $1000 more.

Mr. Elliott, like our Maine farmers, believes in feeding out the straw. During my trip I saw the remains of hundreds of straw stacks, left to decay on the ground where it was stacked. Mr. Elliott chops his straw and mixes it with his ensilage, of which he feeds about 40 lbs. per day to his cows, and in similar proportion to other animals. When the ensilage is mixed with straw the stock will eat both up clean, and with all the clover hay they will eat, and a liberal ration of turnips, the animals thrive while laying on the flesh. He believes in lots of turnips, and this year "lifted," as they style the harvesting, about 5000 bushels from the turnip patch.

Mr. Elliott practices a short rotation of crops, planting largely corn, oats or barley and seeding to clover. The tilling of the soil is constant and thorough from first to last. Weeds have no chance to grow on this Ontario farm, and it was a matter of interest to me to notice here and on other farms that there were no weeds and foul stuff growing on the cultivated lands. There were acres and acres of grain nearly ready to harvest without a trace of mustard, and thousands of acres of clover without white weed, wild carrots or other noxious weeds in sight. It all shows that the system of rotation and cultivation in vogue is bringing the farmer liberal returns for his toil. If the farmers of Maine could see the fields I saw on my trip, there would certainly be more frequent rotation and better tillage ever after on their farms.

Forest Henry's Farming.

The farm of Forest Henry is one of the most productive I saw. He has lived on this farm six years, and within that time has increased its production 300%. Of the value of this 200 acre Minnesota farm I did not learn, but Mr. Henry wrote me that he had bought another farm nearby containing 160 acres, with fairly good buildings, for $11,000. He considered it a good trade, and I mention it here to give Maine people some idea of the value of farms in Minnesota.

The special work upon Mr. Henry's farm is dairying and in October the boys were milking 29 cows and 7 more came in soon after. At that time he had just bought fifteen tons of bran at $20 per ton and ten tons of oil meal at $31.25 per ton. The wheat, oats and barley grown on the farm are sold and other feeds are bought and fed with the clover, silage and corn grown on the farm.

The buildings are especially attractive. A new barn erected by Mr. Henry is 36 x 100 feet, all built above ground. The entire lower part is devoted to his dairy stock, arranged to give abundance of light, fresh air and ample space. The floors are of concrete, graded to conserve all the manures, while the tie-ups are so arranged that a team can be driven between them, the droppings shoveled into a spreader and drawn out and spread upon the land when weather conditions will permit.

It will be remembered by those who heard Mr. Henry's lectures in Maine that he advocated spreading the manure on the land as soon as possible after it was made. This is certainly much more economical than the methods in the east, and he maintained that when it was spread on the ground nothing was lost of its manurial value.

A small room is built out from the center of the barn where the milk is run through the separator and the cream prepared for the creamery. A small gasoline engine furnishes the power.

Near the center of the building two ventilator shafts are placed to carry off the foul air, and fresh air from outside is introduced to keep up the circulation.

The second floor is utilized for the storage of hay and straw. The clover hay goes in at one end by means of a horse-fork and the straw is blown in at the other when the grain is threshed out.

At the southeast corner just outside the barn is a large silo made of brick and concrete, 16 x 42 feet, which holds 200 tons of silage when filled, grown for the purpose on 12 to 15 acres. A quick job is made of the filling, which is usually done in a day and a half. The fodder is cut just outside, and a blower sends it into the top of the silo. Cutting the fodder and drawing it to the cutter in that time illustrates the hustle these western farmers put into their work.

Every foot of ground in Mr. Henry's farm is tillable. The crops this year consisted of 50 acres of barley, 40 acres of oats, 20 acres of timothy, 30 acres of clover, 40 acres of corn for grain and ensilage. The balance of the farm, besides a potato plot and a large garden, is devoted to pasturage. The products from the land Mr. Henry estimated in dollars, as follows: Barley, \$600; timothy seed, \$200; oats, \$300; making \$1100 besides the hay and other crops that were to be fed out.

The following, Mr. Henry considered a fair statement of the receipts of the farm for the year:

Hogs	\$300
Barley, oats and timothy seed	1100
Cream	1750
Profit on cows sold	400
Horses sold	400
	\$3950
Feed bought (estimated)	600
	\$3350
Less labor bills	1000
Net proceeds	\$2350

Orchard of Volney Gray, Dover, Me.

THE SECRET OF IT ALL.

Rotation of Crops. As already stated every acre of this farm is tillable land. Mr. Henry believes in a short rotation of crops —not more than three or four years, and one of these crops is always clover, from which he gets a yield of 2½ to 4 tons to the acre in his two cuttings. Corn likes nothing better than to follow clover, and Mr. Henry says his average yield is fully seventy-five bushels, 50% more than his neighbors are getting.

Culture. The ground is thoroughly plowed, harrowed and cultivated. On July 20th, when the corn was too tall to work a double cultivator the boys were cultivating with a single cultivator. This tillage had been so well done that no hoeing was needed, for the weeds had no chance to grow.

Fertilizers. Mr. Henry has never bought a pound of commercial fertilizers, but he uses with much care all that are made on the farm. He utilizes all his straw for bedding his stock. He says it is a good absorbent and is worth more for this purpose than to feed out, when clover hay is so abundant.

Many manure and straw heaps were noticed near the farm buildings as we rode through the country. They were unsightly to behold and suggestive of the extravagant wastes of many western farms. But it should be borne in mind that there is greater progress in western than in eastern farming, and with all the educational work that is going on we may expect even greater results in the near future. The state of Minnesota spent over $23,000 in 1909 in the work carried on through its farmers' institutes.

Clover and cultivation are the chief fertilizers on this farm, because its owner knows how to make use of the vast resources the all-wise Creator has placed within the reach of every farmer. The system makes the soil fertilize itself.

Freedom from weeds. There were no weeds except by the roadsides. The grain fields were clean; hardly a weed of any kind could be seen. The pastures from which clover was cut last year were equally clean, and there must have been fully a ton and a half to the acre. It is no wonder the cows give milk freely and the steers grow fat on such forage. Frequent rotation and cultivation give the weeds no chance to mature. This freedom from the pests of our Maine farms was the most assuring evidence of successful farming.

CAN THE MAINE ORCHARDISTS COMPETE WITH THOSE ON THE PACIFIC COAST IN THE PROFITABLE GROWING OF APPLES?

By LOWELL ROUDEBUSH, New Richmond, Ohio.

To the above interrogatory we would answer yes, with emphasis. All New England, particularly Maine, by virtue of its soil and climate is pre-eminently the best apple orcharding section of the United States. If that be true, why is it that Pacific Coast apples command the highest prices in our market, and are eagerly sought for by the fancy trade in this and other countries? This is why,—conditions have changed and we have not. When our ancestors had destroyed the Indian, wild beast and forest in part, and founded homes, they began setting apple trees which in due time gave bountiful crops of perfect apples in size and color, free from fungous disease and insect injury. This condition obtained for a long time. Occasionally there would be a killing late frost or severe winter, when the fruit buds would be killed or the trees destroyed. By and by it was noted that many varieties were not so prolific; fruit was not so large nor high in color; often, many were wormy and illshapen. Again it was noted that the foliage was not healthy; the leaves of many varieties dropped prematurely, while others had patches of brown on them. There was a reason for all this. The apple orchards, for long years, were set on a virgin soil. This is desirable, as no plant or animal has the ability to make something out of nothing.

The codling moth and many other insect pests had not come to us from foreign lands; in fact, the native pests, the curculios and apple maggot,—the so-called "Railroad worm"—were satisfied with the native wild fruits, hence did no real injury. Neither were the many fungous diseases such as the rots, canker and scab in evidence. The soil of the region is not as fertile as it once was. The native pests have left their wild haunts and now prey upon our orchard fruits, and the imported ones, like the codling moth, flourish in the land of their adoption better than in the land of their nativity, because they left their enemies behind. In short, conditions have radically changed.

Let me ask how much change in care and general management or treatment has there been on the part of the apple-growers of Maine in the past half century? When were a large majority of the trees pruned, fertilized and tilled in part, much less in the full sense of the terms? If the orchard was in timothy (and it generally was) this was cut for hay and the last stalk was exacted. Is it reasonable to suppose that a soil of low fertility will produce two bountiful crops at the same time? "A house divided against itself cannot stand." It is not less hay and more fruit, or more hay and less fruit, but less of each and but little in the aggregate. Have you cultivated your apple trees? No soil gives greater returns for tillage than does the granite of Maine.

Have you applied the farm manures or chemicals as you have on your site for oats, timothy, corn and potatoes? Have you sprayed to destroy insect pests, and to prevent fungous diseases? Yes, possibly two per cent. of the apple orchardists of Maine have. What about the ninety-eight? They have simply done nothing. If Maine orchardists have lost the fancy trade of the United States and other countries (and they admit it), is it not their fault? Indifference, neglect and don't care in the management, is seen everywhere. Is it because they are lazy? No! it is bcause they have not changed their orchard methods to meet changed conditions; because they have not appreciated the fact that there are great possibilities; because their industry, so far as it relates to the apple orchard, is not well directed; because they are growing apples their grandfathers grew. This obtains from Maine to the Mississippi River to a less or greater degree among orchardists, less where there are fruit organizations, more where none exist.

Is it possible for the Maine apple orchardist to regain that which he has lost? Yes! Yes!! Yes!!! Did not the Wise Men come from the East? The possibility of apple orcharding in Maine is only bounded by the ability of the orchardist in seeing and doing things at the right time and in the best way; putting honest goods in an honest package. How did the Pacific Coast orchardists capture our best trade at home and abroad? Will you tell us? We answer, by doing as well as they knew how, and this not only meant best varieties, best setting, best tillage, best pruning, best spraying, best picking and packing, but the best in organizing and marketing. More than this, the state came to their assistance in the enactment of wise laws in regard to spraying, grading, marketing and naming the variety and number of the fruits contained in the package.

What has the State done specifically? It has said what size the package shall be; the character of its contents according to the grade. Idaho, for example, has only one grade, and the marketing of wormy fruit or its giving away, subjects the owner to a fine or imprisonment, or both.

It has appointed horticultural inspectors, who can appoint assistants, whose duty it is to inspect nurseries and orchards to see if they are infected or infested, to give instruction to orchardists in the selection of varieties best adapted to soil, climate and market, to tell how to set, prune, cultivate, fertilize, pick and pack the fruit, and last but not least, how to spray their trees and with what, and the number of times necessary for best results. The state has also said that the name of the owner in full with his postoffice address, also that of the packer, shall be enclosed in each closed package. On the outside, the name of the owner or organization, with place of business, grade, variety, and in one state number of apples, shall be given. Thus it is seen that the state helps the grower, and in return, the grower, by his skill, has added to the wealth of the state as well as to his own.

To prove to you that the individual does something in California, Oregon, Washington, Idaho, Montana, Nevada, Utah and Colorado, five acres are all one man can care for and this means in addition one or two horses. The trees are carefully pruned one or more times each year, cultivated from five to twenty-five times, sprayed from four to seven times, the fruit thinned and carefully picked, hauled to nearest shipping point, graded and packed. And because of the doing of these things, he has taken your best trade from you. But you say, has not the Pacific Coast orchardist great advantages in soil? As to soil, the so-called volcanic ash is ideal as to physical condition, but is out of balance—deficient in nitrogen and humus, and both must be supplied for best results. As to climate, he has just as many ups and downs as the Maine orchardist, but he has overcome some of them by the use of various mechanical devices from old-fashioned smudges to the latest crude petroleum heat-er. Again, when a freeze is apparent, schools are dismissed, business houses and factories closed until the danger has been prevented or passed and all join in helping save the orchard. As to insect pests and funguous diseases, he has all you have save the Gypsy and Brown-tail moths, with the San Jose scale thrown in, as it first appeared on the Pacific coast. As to spraying, he found years ago that it was fundamental. The leaves of the tree are both its lungs and stomach. That the synthetical or vital processes may go on undisturbed, it is essential that the leaves be healthy. If they in part or whole are destroyed, then the plant cannot get that 98% of its food out of the atmosphere, out of the carbonic acid gas in the atmosphere—that poisonous excreta of the lungs of man and the inferior animals. Again you must remember that the food which goes to make the leaf and fruit buds, the blossom and pollen, and to grow the apple to one-third its normal size, must be stored in the tree the previous year, hence spraying means much—is the essential, all else being equal. If the Maine orchardist will do these things as well as the one on the Pacific Coast, he will soon regain his lost market, because he has many advantages. What advantages has he, you ask? We will first give those of the Pacific Coast.

First. Better mechanical condition of the soil.

Second. Trees come into bearing two or three years earlier.

Third. Spraying is not delayed or made worthless by wet spells.

Fourth. Trees live much longer.

What are those of Maine?

First. A cheap site.

Second. Low rate of taxation.

Third. A balanced soil, hence better quality, better keepers.

Fourth. Better climate—as much sunshine too, and no more insect pests or fungous diseases.

Fifth. The best home market in the world and possibilities of foreign markets.

Sixth. Cheap, rapid and safe transportation.

Seventh. The Man! The Man!

Maine has the man, who, when awakened, will do things. A market is fundamental. Who has the market that all New England orchardists have? Twenty millions of people within a radius of 200 miles of them; the millionaires are not a few and high-priced artisans many. The latter furnish the best customers—they have both the appetite and money. Cheap transportation is necessary. It costs the Pacific Coast orchardist $3.75 per barrel or its equivalent, to lay his apples down at New York or Boston. Would not that be a reasonable price for yours, f. o. b.? One thing more, last but not least, we must consider cost of site and taxes. If there is an acre of orchard land to be found on the Pacific Coast that you would accept for a gift that can be purchased for less than $100, I failed to see it. An average would be nearer $750. It costs from $40 to $150 per acre to fit it, and $20 to $40 for water. In many towns taxes range from 5 to 7 per cent. Do you want to leave Maine to grow apples? Can you afford to pay $250 to $2000 per acre for land no better than you have at home, that can be purchased for $25 to $50? Can you throw away the best home and foreign market for one on paper in part? Stay in Maine, my brother orchardist, there are diamonds here. The Pine Tree State has possibilities in orcharding never dreamed of, much less realized. If you will keep step to the music of progress, imitate your far western brethren, in tillage, manuring, pruning, packing and marketing, you will have found veritable diamonds in the granite hills of your native state. You have led all the states east of the Mississippi in legislating for better packing, grading and marketing. Obey this law to the letter—it will pay you a big investment in that it will help you once again to have your market and lead your sister states in orcharding. Maine can and must lead.

PROCEEDINGS OF THE

State Dairy Conference

AND MEETING OF THE

MAINE DAIRYMEN'S ASSOCIATION

Guernsey Cow, Osceola. Produced 9,188 pounds of milk in 12 months. Property of J. Henry Rines, Portland.

REPORT OF PROCEEDINGS

OF THE

State Dairy Conference

AND

TWELFTH ANNUAL MEETING

OF THE

Maine Dairymen's Association,

NOVEMBER 30 AND DECEMBER 1, 2, 3, 1909.

The annual State Dairy Conference for 1909 was held at the Opera House, Skowhegan, on Tuesday, Wednesday, Thursday and Friday, November 30 and December 1, 2 and 3. This was a meeting of great interest and value to the dairymen of the State.

TUESDAY EVENING, NOVEMBER 30.

Meeting opened at 7.30 by F. S. Adams, president Maine Dairymen's Association. Invocation by Dr. F. A. Leitch, Skowhegan.

ADDRESS OF WELCOME FROM BOARD OF TRADE AND CITIZENS OF SKOWHEGAN.

By Prof. Roy L. Marston.

Gentlemen of the Maine Dairymen's Association:

I am here to extend to you the welcome of the Board of trade and citizens of Skowhegan. We are glad to greet you as citizens of sister cities and towns and as representatives and exponents of the dairy industry which means so much to many of our citizens here in Skowhegan. The Skowhegan Jersey Creamery is one of the most prosperous and successful institutions that we have in the town. It was established by farmers for the benefit of farmers and has been maintained through the efforts and executive ability of farmers through a great many years, and we as citizens of Skowhegan are proud of the size and quality of its business. We are also proud to hold this Skowhegan Jersey Creamery up as an example of what co-operation will do in the management and handling of farm products. I can but feel that this question of co-operation is one of the greatest problems which confronts the agricultural interests of this country today. It is a matter of interest that the answer in the majority of cases to the question sent out by Mr. Roosevelt's Country Life Commission, asking what the trouble was with the farmers and the farms, was, "There is no trouble about raising crops, but we want to know how to get rid of them."

The fact that co-operation is the greatest problem that confronts the farmer today is very evident when we consider the overpowering magnitude of the value of farm crops compared with the value of other products in the United States; when we realize that the value of our poultry and eggs is considerably more than the total value of all the silver and gold mined in the United States, without Alaska, and the value of our wheat and corn is a great deal more than the total value of all the other minerals combined. We hear almost every year of $1.50 wheat and $2.00 wheat, but I do not think many of us ever heard of a farmer getting this for his wheat. It is such organizations as the Maine Dairymen's Association that will bring this matter of co-operation to a head, because they will bring together farmers who are interested in the same things, and they are going to realize that it is not a question of producing the product so much as a question of disposing of it.

Gentlemen, as a representative of the town, I want you to feel perfectly at home while you are here. We want you to like us, we want you to have a good time and we want you to come again. I want to assure you that a great many people of Skowhegan are glad to see you that are not here tonight; and in behalf of *all* the people of Skowhegan I want to offer you the courtesies of the town.

ADDRESS OF WELCOME FROM SKOWHEGAN GRANGE AND THE AGRICULTURAL INTERESTS OF SKOWHEGAN.

By Frank P. Pennell.

Members of the Maine Dairymen's Association; Ladies and Gentlemen:

I knew that the gentleman who spoke before me would say all that was necessary to be said in order to make you feel at home and entirely welcome. I think we can well congratulate ourselves that we have with us this evening and for the next few days the Maine State Dairymen's Association, representing some of the master minds in the dairy industry; those who have made the dairy industry their chief study for many years, those from whom we shall expect and undoubtedly shall receive many good and useful ideas. From these men we can obtain a good deal of help in relation to the best methods of producing the most and the best at the least expense, thereby leaving a fair margin for the producer. We can be much benefited by absorbing from them the knowledge and the valuable information that they have gathered. It gives me great pleasure at this time in behalf of the agricultural interest of this section in general and the grange in particular, to extend to the Association, its officers and members, a hearty welcome. Let us drink from your fountains of knowledge that we may improve in every way until we have become perfected in the industry. Again I say, Welcome.

RESPONSE.

By W. G. Hunton, Vice-President Maine Dairymen's Association.

Ladies and Gentlemen:

We have been taught from infancy that "It is more blessed to give than to receive," but I think the Maine Dairymen's Association are well satisfied, tonight, to be the recipients of your cordial welcome. I can but recall, here tonight, the last meeting of this character which I attended in your town. It was in the year 1896, and if my memory serves me right a prophecy was made that night by a friend of agriculture in Somerset County, which I can think of tonight as being full of meaning and of more importance than at that time was recognized. This was made by George Flint, a friend of many of you, and a member of the Board of Agriculture from Somerset County. In a discussion at that meeting he said, "The time has been when a cow, a tin pan and a dash churn were the equipment for the Maine dairyman, but I believe that conditions will demand a different kind of dairying in the near future." The truth of that prophecy can only be understood when we think of the growth in that line of business in the State of Maine today. At that time there were a dozen or more creamery associations that were doing business in the State,—today we have sixty-five. In that year the gross business of the largest association was $370,000; the same association last year did one and one-half million dollars worth of business. Truly the Maine dairyman of today has to be better equipped than he was in 1896, to meet the requirements of the market and the demand for his products. This great increase in the demand for Maine products in the dairy line made it possible for this association to ask the taxpayers of Maine to furnish men whose sole business should be to encourage this industry and improve the conditions under which the product was made, and also to protect the consumer in the buying of those products, to see that he is not deceived.

I want to say right here that I think much has been done by the creamerymen of the State. To them we owe largely our success, as they first pointed out to the producer the necessity for a purer and better product. It was the creamerymen who saw that if they had the product in a better condition they could pay the producer a better price, and we have seen the price constantly advancing through all these thirteen years until today, a producer myself, I am receiving nearly double for my product what I was at that time. This has made it possible to overcome the antagonism between the producer and the creameryman which existed at one time and threatened the whole industry. The producer realizes today that the best friend he has is the man who is constantly finding fault with his product because it is not good enough for the market. This fault-finding has led to such vast improvements in conditions that today we are proud of Maine dairy products. Nature has been very kind to the State of Maine in the quality of all the agricultural products that are indigenous to this climate. They rank in the markets among the best. But it is not a business proposition for the farmers of Maine to neglect to put those products upon the market in the best possible condition. The men of Maine today, the young men of Maine, are beginning to realize that there are facilities for their brains and muscle in this State which are not exceeded by those of the West. They are beginning to see that there is an opportunity for a young man in Maine today not only to succeed but to mark his success and crown his efforts with something honorable.

In a publication of one of the largest agricultural organizations of the State we find this axiom: "New ideas are the material from which progress is made." I trust and I believe that this association, after the cordial welcome which it has received in the good town of Skowhegan, will produce new ideas which in the congenial soil of Somerset County will take root and bear fruit throughout our whole glorious State of Maine. I thank you again in behalf of our association for all which your welcome means.

AGRICULTURE OF MAINE AND ITS POSSIBILITIES.

By Dr. GEO. E. FELLOWS, President University of Maine, Orono.

If I could succeed in inspiring you with the same enthusiasm which I myself feel for the possibilities of Maine agriculture, it would be well worth ten times the effort that I shall be obliged to put forth this evening. If it be possible that I can make you feel as I feel, it will be my greatest regret not only that every seat in this hall is not filled, but that the hall is not ten times its present size. This subject was assigned to me, but no subject could have been assigned which would have pleased me better.

The possibilities of Maine agriculture! After a little thought it seems that they are almost limitless. The very first glance fills you with interest, a little more thought with animation, and the more you study into the subject, the more are you inspired with the possibility of satisfying the highest ambition of any and every citizen of Maine. And it is more than Maine agriculture that can be developed. Maine has many other interests,—industrial, maritime, lumbering, manufacturing—and yet the possibilities of Maine agriculture alone are so vast that if we fairly contemplate them we shall ourselves be amazed.

Now what are the possibilities of Maine agriculture, in brief? We mean every product that can be developed upon the Maine farm home, and there are a great many thousand farms in Maine; I think we have something like 54,000 farm homes. The possibilities of Maine agriculture, then, mean all that is possible on the farm, but only a few of those things may be named, such as the farm crops, hay, grain, corn, potatoes, etc., the live stock and the dairy interests, the poultry, and the fruit. It may mean, also, and it does mean, the development of forestry, practically on the farmer's wood lot; and last but by no means least, it means the development of the country roads by which these crops may be taken to market. All of these are contained in the possibilities of Maine agriculture.

I shall say what I have to say this evening under three divisions: First, a general view of the topic; second, What can we do; third, How shall we do it?

James J. Hill is the agent through whom so much has been done for the great Northwest, not only by the building of railroads but by the inspiring of the new inhabitants to develop their land, that at the opening of the great Seattle Exposition of this past summer, a colossal statue of this man was unveiled on the Exposition grounds. It was my good fortune to take a trip there last summer, and I do not wonder at the feeling of admiration, almost of reverence, which those people have for James J. Hill. He has, in addition to having built the great railroads, so stirred the people with ambition to develop the soil and the natural resources of their country, that every one of the people living on the Pacific Coast along the great lines of his railroads, from St. Paul westward, is an apostle of progress, a most strenuous agent for the uplifting and upbuilding of the country. Some of them are people who have gone from Maine. There is no reason why any one should not be ambitious to put forward the claims of the country where he lives. James J. Hill will now devote the remainder of his life to inspiring the people of the United States to give more attention to agriculture. He has found that the great railway lines that he has built cannot be supported successfully unless the people cultivate the soil.

You will notice in the November number of "The World's Work" a splendid article by that gentleman on the agricultural resources and development of the country. He does not simply mention the resources, but he goes on to show the necessity of a greater development in the country. In the course of his remarks we find this sentence: "Land without people is a wilderness; people without land are a mob." There is a great deal in that sentence; think it over. It does not matter how magnificent the timber standing on the ground may be, how wonderfully rich the soil may be, how broad and deep and clear the rivers, how rich the mines, if there are no people the whole of the land is a wilderness. On the other hand, great aggregations of people crowded together in the cities, in the slums, or even, if you please, in uncultivated territory,—masses of people by themselves without a proper relation to the land, are a mob. Civilization, then, results only from a proper adjustment between the land and the people, it does not matter whether it is in ancient times or in the present. The proper adjustment of the land to the people means progress, and nothing less than this will ensure it. The depopulating of the country and the filling up of the cities has been the great tendency in the past twenty-five or fifty years in the United States, and it has grown to be a great danger. The most difficult problems for solution by politicians, by thinkers, by sociologists, are those problems which come from the massing of the people in the cities, away from the land; and those who are the most far-seeing are making plans as to how these people who are a surplus in the cities may be taken back to the soil and not only made self-supporting, but a help in building up the country. Therefore, the great problem before this nation, the problem before all others, is the proper adjustment of the population to the land.

The great trouble with the American people has always been that they want to get too much for too little. We all have been inclined this way, especially our ancestors. They have plowed the soil and gotten what crops they could, and when there began to be a shortage, instead of putting in the proper work to rejuvenate the soil, they have moved westward, and the general progress of the country has been westward. It was only about 100 years ago that the people of New England began to push on into New York; and about fifty or seventy-five years ago that they began to push on from New York into Ohio, Indiana, Michigan and Wisconsin; only about twenty-five or thirty years ago that they began to push on from Wisconsin into Iowa and Nebraska, and it is within the remembrance of the youngest people here when they pushed on to occupy what was known as the Great American Desert. Now almost all the available land between the Atlantic and the Pacific Coasts has been pre-empted, homesteaded, or obtained in some way. The race is over. We do not take up any more free land. The problem is, How shall we develop the land which we have taken up, to get the best results?

The older ones here know that for twenty-five or thirty years wheat was raised successfully in Central New York; but the land gave out and the wheat raisers went to Illinois. That land gave out in twenty-five or thirty years more, and they moved on to Iowa, and the same thing is happening there. They have not used intensive cultivation, they have been robbing the soil, they have been using up our resources, and now the great cry is not for land alone but for the conservation of our natural resources. It is a very significant fact that the man who is at the head of the oldest and most noted of all our educational institutions, since he has laid down his educational robes has been called upon to take up the chairmanship of the Association for the Preservation of our Natural Resources; but perhaps I am going a little too far afield.

I was to talk about Maine possibilities. We want to see what portion of the soil which is available for agriculture is occupied, and how it is cultivated. In looking over the map of the United States we find that the one state in the Union which occupies and cultivates the largest proportion of its available farm land is the state of Illinois. In that state 86.4 per cent of the good farm land is occupied and cultivated. You would almost suppose that with such excellent soil they would occupy and cultivate the whole of it, but even with that rich soil only 86.4 per cent is cultivated. Although we think that proportion is not what it ought to be, let us see what we are doing ourselves. Maine has 6,300,000 acres of land which is suitable for farming, and only 2,400,000 acres of that land are cultivated in any form whatsoever. That is to say, a little less than 38 per cent of the available good farm land of Maine is now cultivated, whereas Illinois cultivates 2¼ times as great a proportion. We hear great stories about the wealth of the soil and the richness of the farms in Iowa. Only two weeks ago I was in conference with a gentleman straight from the richest portion of the state of Iowa. I might incidentally mention that he was the gentleman whom I have just engaged to become Professor of Agronomy of the University of Maine. He is coming from that rich state into Maine, and why? Partially because he knows that the possibilities for development in the State of Maine for the next ten or twenty years are going to be greater than in that wonderfully rich State where farm lands are sold for $200 an acre. The land is too high. He told me that one might think because the farms are so rich and the land so high that everybody was prosperous, but they are obliged to have enormous crops to sell at the prices which they can obtain, in order to have such a margin of profit as the farmers in the East can procure from a much smaller piece of land which is not so rich, but is nearer the markets. Just stop and think a moment. On land that is worth $100 to $200 an acre, the farmer is obliged to raise a very large crop in order to secure enough above the cost of labor, the expense of tillage, etc., to pay merely the interest on the amount invested. It is almost more than the farmer can make, at the prices he can obtain. There is altogether too much invested, in such rich land. The result is that the people are selling their land at large prices and moving away, and thousands have gone up into the Canadian Northwest; but I want to show you that there is no reason why any one of us should go up there. If we could get at some of those people who are selling their farms I believe we could induce them to come here, much to their own profit. We hardly appreciate the advantages which we have. In the first place, we are thousands of miles nearer the market for all agricultural products than are those farmers who occupy the so-called rich lands and who have such advantages. I know of what I am talking. I was brought up in the middle West. I was born in Wisconsin and have lived in almost all of the middle states in the Mississippi Valley for a brief time, and recently have taken a tour to the Pacific Coast. I will admit that they have a charming climate on that coast, and beautiful, big red apples. I will admit a great many of their advantages, but considering the prices and the distance of the market to which they must send practically all of their products, it does honestly seem to me that to locate on a smaller farm in New England or in the Eastern States would be a far more advisable thing for people who are moving on toward the extreme West than to make such an effort as they are making to compete with those tremendous enterprises out there.

To get the facts on our own crops I wish that we might have the figures that we shall have a year hence. The legislature has made an appropriation to gather agricultural statistics, and these will be available during the coming year. I have the value of one crop, however, and we can infer from that something as to what the others will be. The only figures I have are on potatoes. This is not the only crop grown in Maine, we all know. This is a Dairymen's Association, and while we are here, at least, we feel that the dairy products of Maine are the chief products, and they ought to be, nothing else ought to surpass them; but I happen to have the figures on potatoes alone. In 1908, 116,000 acres in Maine were planted to potatoes. Those acres produced 26,100,000 bushels, which were sold at a value of $15,921,000. There are the acres, the bushels and the dollars. We know that potato growing in Maine on such a scale is a comparatively new enterprise. It is so new that all of us know the beginnings of it. I understood from Prof. Woods a short time ago that it was only seven or eight years since when but 500 pounds of copper sulphate was sold in Aroostook County. But within the past two or three years six train loads were sold, for the spraying of potatoes. That shows the rapid progress in one county alone. We also know that Aroostook County is not the only county in Maine where potatoes can be successfully grown, but the chief acreage at present is in that county and we are talking about one county alone in mentioning these figures. Here are some facts which we should consider: One hundred and sixteen thousand acres is only one-twentieth of the amount of land which is cultivated in this State and only one-sixtieth of the suitable farm land which ought to be cultivated; and yet the product from one crop raised from only five per cent of the present occupied land is fifteen millions of dollars. Just suppose that the same proportion were carried out, not over all the land but over only that portion of the land which might be cultivated and planted to that crop successfully, the number of millions of dollars that could be obtained from a single crop are so stupendous that we can hardly realize them. Three hundred millions of dollars in a year! The crop of potatoes raised in Maine in 1908 exceeds the total crop in any other state in the Union except New York, in bushels, and New York had almost four times the acreage that was planted in Maine. The value of the potato crop in Maine exceeds the value of the same crop in every other state except Pennsylvania and New York, and in Pennsylvania 2½ times as large an acreage was planted. And, by the way, they sold their crop at an average of 84 cents, and their total value only exceeded that of Maine by about $30,000.

Here is another fact that is worth knowing. Wisconsin, Pennsylvania, Ohio, Michigan, New York, Iowa and Illinois each exceeded in acreage the potatoes in Maine, but only one of them exceeded Maine in bushels produced. Can we contemplate that—and that is only one of our possible crops—and not feel that the soil of our State is more valuable to us than gold mines or silver mines or iron mines or mines of any kind? The best mine anywhere will be exhausted sooner or later. Indeed, if it is properly worked, it will be exhausted in a few years and when the mineral is gone from a mine there is nothing but an empty hole; there is no possibility of reproducing the former contents, while the soil may be cultivated for 1,000 years and at the end of that period be richer than in the beginning, for we can point to such cases in Europe. In that country there are instances in which land has been cultivated for more than one thousand years and is richer today than when the cultivation commenced. The soil of Maine for any crop is far more valuable than mines of gold would be on the same land.

What can we do to realize the highest possibilities of Maine agriculture? There is not one of us here, or anywhere else in Maine for that matter, who would admit that we cannot do as much as other people who have no better soil, no better markets and no greater intelligence. Of course we might admit for the sake of argument that there are people located on soil richer than that of Maine, and for the sake of argument we might admit that there are people who have better markets and opportunities, but I do not see any one here who will admit that there are people who have any greater intelligence than the average American Yankee. Now, then, with the soil, markets and intelligence, we claim that we can equal any other person anywhere in the world. If that is the case, we must see what they are doing in other countries. We cannot go back on the original statement,—I am sure you will stay with me on that. It can be demonstrated without any effort that the land in Maine which we now have available for cultivation, not forest land, if it is cultivated only in the same manner as others are cultivating, could maintain at least a populaton of five times the present number, with no difficulty whatever; because certain small countries in Europe, less than one-half the size of the State of Maine, are maintaining on their soil in a condition of prosperity more than five times the population that we have. They have none of them any better opportunities for marketing their products.

I am going to compare our prospects with those of the country of Denmark, and Denmark is fully as far from good markets, the markets to which she sends her dairy products, as any point in the State of Maine. They care for their own people, four or five times as large a population as we have, and export almost a fabulous amount of goods. Now Denmark has actually an area of considerably less than one-half the area of the State of Maine. In 1900 the population was 2,600,000. Besides taking care of that population, which is 3½ times as large as that in the State of Maine, Denmark exported last year $48,000,000 worth of butter, $21,000,000 worth of bacon, and $18,000,000 of other provisions, to Great Britain, and the people did not live like slaves, either. They lived so well that they did not wish to go anywhere else. That means $40 of exports for every man, woman and child in the country of Denmark. What would that mean in Maine? Besides supplying its own population, if this State could export $40 worth for every man, woman and child, it would mean $28,000,000 in addition to what we now do.

We are talking about possibilities, and that is only a part of them. Holland, with a very much smaller area than Denmark, with much smaller farms and more intensive cultivation, maintains a population of five millions; and Belgium, with a smaller area than Denmark, maintains a population of seven millions. These countries, however, have other industries aside from agriculture.

For a moment we will drop those foreign countries and talk about some state nearby. We certainly can do what is done in Wisconsin, which is a state almost exactly like ours in many respects. Along its border is a great lake which serves as the Atlantic Ocean. In the northern part of that state there are great lumber interests as there are in the northern part of the State of Maine, and in the southern part there is land suitable for agriculture. I happen to know just about how agriculture has progressed in Wisconsin, because I grew up there from childhood, and it is not over twenty years ago that the impetus towards the co-operative creamery and cheese factory began. I meant to have brought with me a map which they gave me at the Agricultural College in Wisconsin, showing the State of Wisconsin as it now is. It is a white map with red spots all over it; it looks as if it had the small pox. Every one of those red spots shows the location of a creamery or cheese factory. Fifteen or twenty years ago the whole northern half of that state was a solid, unbroken forest, and yet you can hardly distinguish the difference between the northern and the southern part of the state in the number of red spots which are the co-operative creameries and butter factories, and their northern limit is farther north than ours, and the climate is essentially the same as ours. That is what has been done in the last twenty years merely by co-operation in that one line of creameries and cheese factories. We can certainly do the same kind of things that are done in Wisconsin. We can do what other states are doing to attract attention to our advantages. We are not doing what many other states are doing to give publicity to our own progress and our own possibilities. Those are some of the things that we may do.

What I have said before in the form of acres, I will now put in the form of square miles. We have ten thousand square miles out of thirty-four thousand, suitable for farm land, and only thirty-eight hundred are used, and none of us claim that these are used as they might be. If the ten thousand square miles were used by the methods we are now using, our productions would be 2¼ times as large as they are. If they were used as we might use them, if they were to be developed as is the land in Denmark and Holland, our imaginations are almost stupefied by the colossal figures that could be shown.

How can we do these things? There is no need of drawing on the imagination. We will simply discuss how other people have done them. Is there any one here who says that a Dane is smarter than a Maine man or that a Dutchman knows more than a Yankee? You remember when Darius Green proposed to build his flying machine he said, "You need not tell me that a little sassy bird no bigger than my thumb is smarter than we be!" You need not tell me that a Frenchman or a Dutchman knows more, or has greater ability to know, than any of us. The older ones of you here, those that are middle-aged, know very well that a good many Danes used to come to this country. There were a good many of them in Wisconsin, around the middle of the state, the best potato growing part. In Waupaca, where we were living at one time, all of the foreign laborers were Danes, and they were splendid laborers. We had Danes in our household and all the farm work was done by them. In Minnesota the farm help is mostly Swede and Norwegian, in southern Wisconsin mostly German. In some parts of our country, in the early history of it, the French came to our shores and a great many English and Irish; but I will confine myself to the French, Dutch, Danes and Germans. If you will take note of the foreign immigrants that are coming now, you will find that there are almost no Danes or French or German or Dutch, and there have not been for a great many years. For 20 to 25 years there have been but very few Germans and almost no Danes, and the Dutch have ceased entirely to come, and the French stopped long ago. I can give you the direct cause of the ceasing of the Germans to come to our country. It was because at the Exposition in this country in 1876 they discovered that our industries were not comparable to theirs, and they established a system of schools that developed German industries in such a way that it is more profitable for them to stay at home than to come to this country, or to any other. At just about the same time the Danes, who were about the lowest, agriculturally, of all the nations in Europe, began a system of agricultural education and informed the people that by intense cultivation of their own farms they might be more successful and thus remain at home, and the Danish emigration has stopped and the Danish people are rich, as illustrated by the amount of dairy products alone which they shipped last year. What have they done? We will look at the education alone for a moment. Denmark is about one-half the size of the State of Maine, no larger than Maine would be if a line were drawn from Bridgton through Bangor to Eastport, and yet in that territory they have an Agricultural College and twenty allied agricultural schools. In addition to this there are 78 high schools in which agriculture is taught. In the college and allied schools there are 4,000 students, and in the high schools 6,000 students; ten thousand people in a territory less than one-half the size of the State of Maine who are definitely studying agriculture in the schools. In addition to that, there are co-operative societies for the purchasing and the testing of seeds, and there are co-operative organizations for the marketing of products. The Government assists these organizations by experimental breeding, and in other ways. All of these are the kind of things that our best men here are advocating. They have been advocated tonight, they will be advocated tomorrow and so on in the future, and those are the causes for that tremendous change in Denmark during the past twenty years. From the lowest nation agriculturally, they have risen to the highest in all Europe. I will not stop to refer to France and Holland in the same way. In my visit to Seattle last summer I was impressed more by the exhibits of the counties of the State of Washington than by all the other exhibits from all parts of the world, and it was because of the organization. I went through those exhibits and I found that every county had a room by itself, and not only had they displayed their products to the best advantage but they had literature which explained in the minutest way and of course in the most interesting manner the facilities for the growth of these products in their particular county. That is to say, each one of those exhibits became an advertisement for the county it represented, and I made a collection of their literature, not because I wanted the people of Maine to go out there or that I wanted to go myself, but because I wanted to make a study of how the people by county organization put before the public their tremendous success. We ought to have county organizations, publicity organizations, for each county of the State, to show the possibilities and resources and encourage people to come and settle here and take advantage of the opportunities which have been offered. We have some associations, as the cow test associations which are being formed in our State, which are exactly the solution of our difficulties and will bring about the greatest development. In Wisconsin the first association of the kind that I knew anything about was a corn experiment association, called "The Agricultural Experiment Association," and it was all in the interest of dent corn, and in that state, through that association made up of the farmers all over the state, they have succeeded in growing successfully dent corn in a profitable way as far north as Lake Superior, farther north than we are. That is only one crop. These experiment associations would assist in developing every crop that we can grow successfully. We might develop a larger canning industry. At present the only product we are canning is corn, with the exception of sardines on the coast and possibly a few blueberries. A greater canning industry could be developed through the co-operation of the farmers in these different agricultural lines. There could be a farm school in each county, and the elements of agriculture taught in every country school and every high school in the State. I am thankful that provisions are now being made to get agri-

Prize Winners at State Fair, Lewiston, dragging 7350 lbs. 143 feet. Owned by C. F. Clement, Hiram, Me.

culture into the country school. That is a thing that must come. We must have the facilities that other countries have, in these lines. We have heard many complimentary remarks concerning what the Agricultural College is doing, and certainly I speak for it when I say that we want to do ten times as much as we are doing. But you cannot afford to wait for what the College can do. You must have instruction brought closer to your own homes and more frequently. In Ohio I think that forty or fifty thousand dollars are used for this purpose. They have a peripatetic agricultural school which goes around and holds its sessions in every community. There ought to be a little agricultural school which could come into a community and run a week at a time, all over this State. And this can be done. We cannot and must not wait for the slow process of the machinery we now have in operation. We must have instruction in the vicinity of all the people. Taking out all of our forest and lake area we have suitable for farm land as much as the nation of Denmark, and we can without any exaggeration and without any remarkable change make a good successful living for 3,000,000 people on this land; and by doing that we are not crowding it. We are making every individual living here more prosperous, as he is working on a smaller area and getting a larger product.

To sum up in a word, What have we here in the resources of our State? I need not repeat them in detail. We have the land, we have a climate suitable to certain crops which can make us independently wealthy. We can do exactly the same things that other states in the Union can do and have done. We certainly ought to be able to do what other nations no larger than our own State have done. How are we to do it? In just three words,—organize, co-operate, educate.

WEDNESDAY, DECEMBER 1.

CO-OPERATIVE BREEDERS' ASSOCIATIONS.

By LEON S. MERRILL.

You will not expect me under this subject to discuss in any way the science or practice of breeding, but rather to present a practical plan whereby our farmers may become more interested in the improvement of our live stock.

The purpose of the co-operative breeders' association is to promote the breeding and improvement of high grade and pure bred cattle, to establish and maintain cordial relations between its members, and by co-operation to improve the general dairy interests of the particular community in which the association is located.

When we consider the general admixture of blood lines in our live stock, it must be apparent that work of this character is necessary, and that we should stimulate among farmers a greater interest in the raising of live stock; that there should be established in their minds definite ideals as to the characters the particular breed of live stock they are interested in should possess.

In considering the breeders' association work it is well to do so under several different headings.

1. Plan of Organization. A breeders' association should undoubtedly be elastic in its organization. It must have comprehensive by-laws for directing its work, which shall also provide for necessary officers, membership limitations and fees. In order that the plan adopted thus far in Maine may be well understood the constitution and by-laws of the first association to be organized in the State is made a part of this paper and is as follows:

CONSTITUTION AND BY-LAWS OF THE SEBASTICOOK VALLEY HOLSTEIN BREEDERS' ASSOCIATION.

Article 1. Name. The name of this Association shall be Sebasticook Valley Holstein Breeders' Association.

Article 2. Object. The object of this Association shall be to promote the breeding and improvement of high grade and pure bred Holstein cattle in the towns of Corinna, Dexter, Exeter, Newport, Plymouth, Stetson, Ripley, St. Albans and Palmyra, and to aid its members in buying, using and selling first-class animals.

Article 3. Membership. This Association shall be composed of dairymen who will use a pure bred Holstein sire exclusively in their herds, or have a Holstein herd under their immediate management.

Article 4. Organization. The officers shall be a President, a Vice President for each town represented, a Secretary and a Treasurer. An honorary President may be chosen to preside at any meeting.

There shall be an Executive Committee of five members, which shall have charge of the affairs of the Association when it is not in session, and during its meetings shall be at the command of the Association. This committee shall consist of the President, Secretary, Treasurer and two members elected by the Association at its annual meeting.

Article 5. Meetings. There shall be a regular annual meeting of the Association and at least three special meetings at such times and places as may be determined by the Executive Committee. The annual meeting shall be held in Corinna at 10 o'clock in the forenoon on the first Tuesday in January in each year.

Article 6. Election. The election of officers shall be held at the regular annual meeting and such election shall be by ballot.

Article 7. Amendments. Amendments to this constitution may be made by a two-thirds vote of the active members present at any meeting, providing a notice of the proposed change has been given in the call for the meeting.

BY-LAWS.

Section 1. New Members. Any person upon recommendation of a member and accepted by the Executive Committee shall become an annual member upon paying the Secretary the annual fee.

Section 2. Duties and Privileges of Members. It shall be the duty of every member to improve his herd of cattle by mating his cows exclusively with pure bred Holstein bulls and doing as much as he can to care for his herd in an up-to-date manner.

It shall also be the duties of members to coöperate so far as possible with their fellow members in the use of pure bred bulls and in buying and selling animals; also to get new members and encourage them in the practice of better methods in caring for their herds.

All members in good standing shall be entitled to vote in the business meetings of the Association.

Section 3. Dues. The membership dues shall be one dollar, payable annually to the Secretary of the Association.

Section 4. Arrears. A member in arrears over one year, shall cease to be a member but may be restored by paying all arrears.

Section 5. Officers. The officers shall be elected to serve one year and shall perform such services as are ordinarily required by their positions and shall serve until election of their successors.

Section 6. President. The President shall serve for one year and shall preside over the meetings of the Association and shall give the annual address.

Section 7. Vice President. It shall be the duty of the several Vice Presidents to look after the interests of the Association in the various towns and do all in their power to promote the general interests of the Association.

Section 8. Treasurer. The treasurer shall receive and hold all moneys coming to the Association, and shall disburse or invest such money as directed by the Executive Committee and shall keep an accurate and detailed account of all receipts and disbursements and make a report of the same to the Executive Committee and to the Association at each annual meeting. The records and accounts of the Treasurer shall be open to the inspection of the members.

Section 9. Secretary. The Secretary shall keep a record of all proceedings of the Association and of the Executive Committee, all membership dues and miscellaneous receipts, and pay all moneys received by the Association promptly to the Treasurer. He shall send and receive all notices and record and hold in trust such property of the Association, other than money, in the hands of the Treasurer. He shall also act as correspondent for the Association in such matters as pertain to the business of the Association and do all in his power to promote the interests of the Association.

Section 10. Executive Committee. The President shall act as Chairman of the Executive Committee and the meetings shall be called through the Secretary. Three of the five members shall constitute a quorum. It shall be the duty of this committee to determine upon the place and time of the annual and special meetings and give due notice of them through the Secretary. They shall elect members of the Association and shall have power to expel any member whenever in their judgment it is for the best interests of the Association to do so. They shall carry out the resolutions voted by the Association, appoint such special committees as necessary and make an annual report to the Association upon the standing and progress of the Association.

Section 11. Auditing Committee. At each annual meeting there shall be appointed an auditing committee consisting of three members, whose duty it shall be to examine and report all books and accounts of the officers for the fiscal year.

Section 12. Order of Business.

1. Reading of minutes of previous meeting.
2. Report of the Treasurer.
3. Report of the Committees.
4. Unfinished Business.
5. New Business.
6. Election of Officers.

So far as the size of an association or the territory included within its limits is concerned, we feel they should not be of such extent as will prevent any of its members from attending its meetings. It must be evident that the more concentrated the membership of an association can be, the more easily they can assemble for meetings and with very much less expense. Thus far most of the associations have placed county lines as the limitations of their work.

Whatever the plan on which the association may be organized, co-operation should be the fundamental basis upon which it rests. This principle can be utilized not only in the purchasing and selling of animals, but better perhaps than either of these, the use and exchange of pure bred males. One of the greatest works the breeders' association has before it, is to preserve within the limitations of the particular community in which it is located, the services of such pure bred males as have demonstrated their worth. In the opinion of the writer the indiscriminate slaughter of worthy males constitutes *one* of the greatest if not the *very greatest* hindrance to live stock improvement today.

2. Plan of Educational Work. In carrying on their educational work our associations depend upon the regular meetings held each three months more than upon any other feature. Programs for these meetings are carefully prepared, providing for discussion of important subjects by the members, a lecture by a representative of the Department of Agriculture and stock judging. Every feature of the program at these meetings is planned with the idea of developing and bringing out the individual member of the association. The demonstration in stock judging has exercised great influence upon the members and no one thing has occurred in which they are more interested.

An attempt is now being made to form a class in stock judging in each one of the associations, conducted along lines similar to the work being done at the Agricultural College.

The meetings are held during the summer months at the home of some member, where his animals, his methods and his successes or failures may be compared with our own work.

The records of the animals owned by members, when filed with the secretary will also be a means of education to the members. The association encourages its members to secure instructive literature along breeding lines.

3. How to Secure a Reputation. If a breeders' association is to establish the community in which it is organized as a center for the distribution of the particular breed it represents, then it must first establish a favorable reputation for animals that are uniform in size, conformation and quality. It must also have a large number from which the prospective purchaser may select. It is the hope of the association that through frequent meetings and the stock judging, such ideals will be established in the minds of the members as will cause them to think and act more nearly alike.

If this is accomplished then they will breed alike and the animals owned by the members will more closely resemble each other in the qualities mentioned. With these things accomplished, we believe that together with the saving in traveling and shipping expense, they will prove a great attraction to buyers.

4. Economy in Association Work. There are several different ways in which the members may effect economy in carrying on their work with the aid of the breeders' association. The co-operative purchasing and selling of animals, wherever tried has proved satisfactory. The using and exchanging of males is an economical practice, as is also the advertising in agricultural and breeders' papers.

The secretary should be kept informed by the members as to the exact number of animals of different ages and sexes owned by them. He should also be furnished with a list of animals for sale, together with their qualities, pedigree and price, so that upon receipt of inquiries from prospective purchasers this information can be furnished them. It can be readily seen that the secretary of a breeders' association is its most important official so far as concerns the success or failure of the association work. It is his duty to keep in touch with the breeding work of the members so that he may furnish satisfactory information to inquiries addressed to him. In order to facilitate his work as well as to secure copies of the reports for departmental use, the Department of Agriculture has prepared certain blanks, which are herewith made a part of this paper, calling for reports from the members to the secretary at frequent intervals.

MAINE DEPARTMENT OF AGRICULTURE.

.... *Breeders' Association*

CENSUS OF LIVE STOCK.

Member ....*Date*................19

Residence ....*Address*..........................

	Number Calves	Number 1 year old	No. 2 years old & over	Total No.
Males pure bred registered............	....	....	....	....
Males pure bred not registered..........	....	....	....	....
Females pure bred registered...........	....	....	....	....
Females pure bred not registered.......	....	....	....	....
Females high grade.....................	....	....	....	....
Females grade	....	....	....	....
Totals	....	....	....	....

MAINE DEPARTMENT OF AGRICULTURE

.... *Breeders' Association*

REPORT TO SECRETARY.

Animals for Sale..........................*Date*................19

Member ....*Address*...........................

Sex of Animal........... Age...........(When Fresh................)Price $...........

Reg. No..................Name...

....

Performance..

....

....

Description..

....

....

....

MAINE DEPARTMENT OF AGRICULTURE

.... *Breeders' Association*

ANIMALS TRANSFERRED.

Member ....*Date*................19

Sold to..................................Address...

Sex of Animal.......................Age...................Price $.......................

Reg. Number...........................Name..

....

Bought of.............................. Address..

Sex of Animal.......................Age...................Price $.......................

Reg. Number...........................Name..

....

....

....

Provision is made for recording the pedigree of the animal for sale or transferred, on the back of each report card.

5. Assistance Rendered by the Department of Agriculture. After a very careful investigation into the work of breeders' associations in the state of Wisconsin, and believing that if the same plan of work was to be adopted in this State equally good results would obtain, the Department of Agriculture has offered to assist the farmers of the State in the organization of such associations and to assist them in so far as may appear practical or desirable in their direction. It has offered to supply all of the necessary record blanks, with the distinct understanding that a copy of such blanks as the Department may desire shall be furnished to it. It has also offered to send a representative to each one of the meetings held by the associations to deliver an address on such subject as the association may have selected. The Commissioner of Agriculture has also kindly offered to publish the yearly report of the associations in the annual report of the Department of Agriculture.

Thus far five associations have been organized in Maine: 1, Sebasticook Valley Holstein Breeders' Association, at Corinna, which includes in its territory the western part of Penobscot and the eastern part of Somerset Counties. 2, Oxford County Holstein Breeders' Association, including Oxford County. 3, Androscoggin Valley Breeders' Association, including the towns in the valley of the Androscoggin River. 4, Oxford and Cumberland Counties Jersey Breeders' Association, including Oxford and Cumberland Counties. 5, Androscoggin County Holstein Breeders' Association, including the towns in Androscoggin County.

Among the members in these different associations will be found the leading farmers and breeders of their respective counties. The interest thus far has constantly increased, and it seems that before very long breeders' associations of other kinds of domestic animals will be called for. At the present time there is interest in a sheep breeders' association in Somerset County and a draft horse breeders' association in Aroostook County. The Dairy Division of the Department of Agriculture feels that its efforts should not be limited to encouraging the organization of associations for the improvement of dairy stock alone, but that its work should be extended to the breeders of all kinds of domestic animals. When the Department took up this work it was not with the idea of giving material assistance to the breeders of pure bred cattle, but rather that general improvement might come among the grade cattle of the State. It can, however, be readily seen that such an improvement among the grade cattle could not obtain except there also came increased interest among the breeders of pure bred stock.

The writer of this paper had the opportunity, two years ago, to visit some sections of the State of Wisconsin in which co-operative breeders' associations had been in successful operation several years. And wherever such associations have been organized in that state there has come an increased interest in the industry and an improvement in the quality of animals, and a greater recompense for carrying on the work. The results obtained there are sufficient warrant for undertaking the work in this State, and when we consider the character of the men who have identified themselves with the work, the statement of principles and purpose under which they are working, and the plan of work they have adopted, I feel sure that we can confidently expect the same measure of success that has attended the work in the State of Wisconsin.

C. E. TRIPP—In relation to our association, the Sebasticook Valley Breeders' Association, I will say that when Brother Merrill first published his notice in the paper advocating these associations, I was very much interested in it. I wrote Brother Merrill in relation to the matter, and asked him to send me a copy of the by-laws for such associations and some of the recommendations which he would make, for a community to follow up. Brother Jones did the same. Some of us breeders in that vicinity talked the matter over, and as a result Brother Jones issued a call for the breeders of Holstein stock in our section of the State to meet at Corinna on the 22nd day of March and talk the matter over and see what we would do in regard to forming an association. Brother Merrill was there and we formed an association of which Brother Jones is president and I was chosen one of the vice presidents. We have at the present time a membership of twenty-three. We have had two very interesting and profitable meetings during the year. The first one was held at the farm of Brother Jones and the second one at the farm of another member living a short distance from Mr. Jones' place. Brother Merrill outlined this morning what the object of these associations was to be. I will simply say that in our section there is a great demand at the present time for high grade, pure bred Holstein stock. There is not enough of that kind of stock there to supply the demand. I myself have sold animals that I did not wish to sell from my herd recently because I put prices on them and they were quickly taken. Only the night before I left for this place I had a telephone message from a party asking if I knew of any one who could furnish him with eight or ten good Holstein cows, and I was obliged to tell him that I did not know where he could find them. By organizing the breeders in any one section of the State and getting them to work together, along the lines in which they are interested, you can increase your herds and you can improve your herds by the exchange of sires and in other ways. I hope that other associations of this kind will be formed in the State, not only of breeders of Holsteins but of other breeds as well, so that every breeder of cattle will have an opportunity to join some one of these associations.

L. E. McINTIRE, Waterford—In relation to the breeders' associations, I will say that my son is secretary of the Oxford County Holstein Breeders' Association and before that fairly got organized he began to have letters from different individuals, some nearby and some in other parts of the State, asking about the animals for sale in this association. Co-operation in selling is one of the points that Dr. Merrill just brought out, and I can say personally that I have sold all the Holstein animals I cared to sell, and more too. The association has stimulated a greater desire for Holsteins in that section, and I want to take this time and place to thank Dr. Merrill, in behalf of our section of Oxford County, for his assistance to the dairymen in that county.

LOWELL ROUDEBUSH, New Richmond, Ohio—I am glad that you good people here are imitating some of my Dutch cousins over in Holland. You heard last night what they have been able to do in that country, particularly along the line of dairying. This is the age of co-operation and organization. In a multitude of counsel there is safety. You people in Maine have a dairy state, if there is one in the United States. You are on the right road. Just keep on traveling in the same direction; do not stop or turn back, because you may have the same fate that Lot's wife did. You need salt in your butter but you do not want to get it that way. We have no organizations in our state like unto these breeders' associations, but we are going to have, because the Ohio man has never been found in the rear. I want to congratulate you on the good work that you are doing along this line of co-operation in breeding and in your cow test associations.

E. N. MERRILL, Skowhegan—Farming, to my mind, is one of the grandest and noblest occupations that a man can be engaged in. It brings him in direct contact with nature. But farming must be entered into as a business and much thought and study should be applied to it, equally as much as to law or medicine or any other profession. A technical knowledge, a scientific knowledge, is as useful and as necessary—yes, even more so—in agriculture as in the practice of a profession, in order to attain success. Farming, or the pursuit of agriculture, dates back beyond any history that we have. Thousands of years ago farming was the chief and practically the only occupation by which men received any particular benefit, and the history of agriculture is a long one. We find that there was a very advanced stage of agricultural progress among the Egyptians upon the Nile thousands of years ago. Even antedating the Christian era there is sufficient proof of an advanced state of agricultural progress. Dairying, crop raising, rotation of crops are mentioned even in those very ancient times. Subsequently the art was practically lost, and for the past two thousand years the great advance in agricultural pursuits has been made within the last century. There is no question that during the nineteenth century agriculture, as well as many other departments of work, made greater progress than it had made in the preceding nineteen centuries. And how has this been brought about? By the application of chemistry, geology, zoology and other sciences to the working of the soil. By chemistry we find out what the soil is, what it contains; its elements are known, and the application of crops to that particular soil is ascertained. It is through that means that great impetus has been given to agricultural pursuits during the last century, and especially the latter part of it. When we stop for a moment and think that within the last century practically all of the farming implements and machinery have been invented and put to use, the labor previous to that time having been entirely done by hand with very rude implements, we realize something of the progress that has been made. The first iron plow that was ever put into the soil was made within the last century. The first reaper was made within the last part of the nineteenth century. So we see that science, increased knowledge and the application of that knowledge to the handling of the soil has enabled the people of this country, and in fact the people of the world, to handle much more land, produce much greater crops and do it at a much less expense. The cheapness of our agricultural products has been made possible by the introduction of science and the use of improved implements of husbandry.

When the farmer first commenced to till the soil on the western continent, he found a virgin soil. It was rich and it was cropped by the farmers of that age, 100 years ago, year after year, and no fertility returned, until it was practically exhausted. Then they would move on to another piece, and let nature rejuvenate that soil, as they said. But nature will not do it; it has to be handled properly. As Dr. Fellows said last night, by a scientific handling of the soil, by ascertaining what the soil is fit to produce and using it scientifically, with a rotation of crops, it can be made to be more productive year after year instead of becoming worn out and useless as was the case by the kind of farming that was practiced in the past. We often hear it said in a rather slurring manner that when you find a scientific farmer you find a man who is throwing his money away, and trying to do something that he knows nothing about. The same remarks are often made in regard to the breeding of stock. It is all wrong; as the people become more enlightened and see more and more the results of scientific farming they will begin to realize more and more the necessity of a scientific knowledge of the art of agriculture. I fully believe that the great opportunity for the bright, intelligent, industrious, ambitious young men of today, the great field for success, for happiness and for prosperity, lies in the pursuit of agriculture. A great deal is now being done not only by our own state but by nearly every state in the Union and by nearly every intelligent nation of the earth,—much money and much effort is being put forth, to advance the interest of agriculture. With our telephone, our telegraph, our rural delivery and our electric cars, the time has come when the country is a desirable place in which to make the habitation of man. There is nothing that will do so much to develop the human family, to raise them from a lower to a higher level, as close contact with the soil. Now in cultivating the soil, a high degree of cultivation is absolutely necessary to get the best results. In looking around among our acquaintances and neighbors we see one man who is cultivating his acres with a great deal of care. Every stone that can be found is removed; the weeds are kept down. Perhaps not so much of an area is cultivated but when it comes to the gathering of the crops in autumn you will find that the man who has devoted the most time to his acre of land as a rule harvests very much the larger crop. The difference between the cost and the profit of an acre of land, when it produces, for instance, 200 bushels of potatoes or 400 bushels of potatoes, is quite an item, and it does not take very much more time to do the work. When you take the cost of the material, the labor and the interest on the capital invested, if this amounts to seventy-five or eighty dollars on an acre of potatoes and you raise 200 bushels, they will cost you 37½ or 40 cents a bushel; if you raise 400 bushels it will cost you only 17½ or 20 cents for each bushel, and you will get a good profit. The same thing is true of other crops, and the same principle applies in the raising of stock.

BUSINESS MEETING.

The annual business meeting of the Maine Dairymen's Association was now called, for the purpose of receiving the reports of the officers. The report of the secretary was given as follows:

To the Officers and Members of the Maine Dairymen's Association:—

In submitting my annual report I will call attention to the different matters which may be of interest to the association under their respective headings.

FINANCIAL.

During the year I have received moneys as follows:—

59 membership fees	$59 00
Sale of prize corn	3 00
Total amount received	$62 00
CR.	
By amount paid Treasurer	62 00

In compliance with the direction of the association a letter was addressed to the different members, calling their attention to the fact that the annual membership fee of one dollar was due from them. Thus far only two of the members so notified have responded.

LEGISLATIVE MATTERS.

At the annual meeting held last year several resolutions were adopted outlining the policy of the association, and the officers were directed in so far as they were able, to execute them.

These resolutions instructed them to present to the legislature certain matters of importance to the dairy interests and to use every honorable means to secure the adoption of such legislation as would assist those interests. In pursuance of these instructions your executive officers, acting as a legislative committee, caused measures to be introduced in the legislature, which later received favorable passage, providing for increased appropriations for promoting the dairy interests, for the investigation of dairy products and enforcement of dairy laws, for the gathering of agricultural statistics and for seed improvement work. They were also able to secure an increased appropriation for the Maine Dairymen's Association of $200.00, making the total fund available for the purposes of this meeting $700. While this amount was secured, it was done at the expense of the Farmer's Institute fund. This particular matter will be touched upon later in the report under the heading of Recommendations.

Special Committees.

Several special committees were appointed at the last annual meeting,—the legislative committee, above referred to, the corn committe consisting of Leon S. Merrill, Prof. W. D. Hurd and Hon. Z. A. Gilbert, and a delegate, Hon. F. S. Adams, to the meeting held in Boston under the auspices of the Country Life Commission. These several committees will undoubtedly render a written report to the association covering the work performed by them.

Corresponding Secretaries.

During the year the corresponding secretaries were communicated with and their advice asked as to methods to be used in interesting the dairymen of the state in this meeting. Several of them promptly responded to my inquiry and have been of great assistance to me in their respective counties.

Special Meeting of Executive Committee.

During the year only one meeting of the executive committee has been held. At that meeting the usual arrangements for the Dairy Conference were made.

Early in the year a communication was received from Hon. A. P. Leighton, Mayor of the City of Portland, inviting the Dairymen's Association to hold its annual meeting in that city. An investigation of the accommodations to be offered by the city was made, which revealed the fact that on account of there being no building owned by the city that would offer suitable rooms for holding their meetings, it would be necessary to hire the Auditorium at an expense of one hundred dollars for the session.

This expense was prohibitive so far as the Dairymen's Association was concerned and the Mayor was so notified.

Later a very cordial invitation was received from the Board of Trade and the local grange of Skowhegan, offering the use of the new municipal building for the purposes of the meeting if the association should decide to accept. This invitation was promptly accepted and your secretary desires to state that the above organizations through a joint committee appointed for that purpose have rendered to the officers of this association every possible assistance.

On account of the extra work undertaken by the association, it was felt that the time allotted to it in the past was not sufficient, hence an extra day has been added to the time usually occupied. At this meeting it was voted to invite the Maine Creamerymen's Association to occupy a place in the program as usual and the desire indicated for them to furnish the program for one entire half day, if they cared to do so. This invitation was accepted and that part of the program occupied by Prof. James O. Jordan of Boston and Mr. E. L. Bradford of Auburn, is to be credited to the Creamerymen's Association.

Recommendations.

As a result of the experience of the past year I would make the following recommendations:—

1st. That a committee be again appointed this year to nominate a corresponding secretary for each county in the state. The splendid assistance received from some of the secretaries leads me to believe that with men equally interested acting in that position in each of the counties, a very largely increased interest could be stimulated in the work.

2nd. That the association take such action as may be necessary to secure at the next session of the legislature an appropriation of $1,000 annually for the support of the Maine Dairymen's Association, and that this amount of money shall be exclusive of the amount received by the Department of Agriculture for the purpose of Farmers' Institute Work.

3rd. I would recommend that the association consider the advisability of adopting some plan for providing for a permanent membership.

Respectfully submitted,

LEON S. MERRILL,
Secretary.

This report was approved, and it was voted that the recommendations contained in it be referred to a committee on resolutions to be appointed by the chair. This committee was appointed as follows: Dr. Chas. D. Woods, Orono; A. F. Tilton, Auburn; L. E. McIntire, Waterford. The report of the committee on arrangements for corn contest was read and accepted. Adjourned until Friday morning at 10.30.

MILK FROM A CITY VIEW POINT.

By Prof. JAMES O. JORDAN, Milk Inspector, Boston, Mass.

I have been requested to say something of the regulations of the Boston Board of Health concerning the sale and handling of milk; consequently this subject will be one of the features of my paper. Probably the most noteworthy portions of these regulations are those prohibiting the keeping of milk at a temperature of over 50° Fahrenheit, and the requirement limiting the number of bacteria to 500,000 per cubic centimeter. There has been much criticism of this latter standard, and the assertion has been made that it legalized traffic in dirty milk. While in one sense the standard is a high one, its adoption, considering the sources of supply of a large city, was founded in good judgment; furthermore it has been legalized by a large proportion of the cities having bacteriological oversight of milk supplies. Critics of this regulation fail to comprehend its meaning, or realize what actually occurs in localities where it is actively employed as a basis for improvement. Its operation results in supplies which for the most part are well within this abused requirement, i. e., paradoxical as it may seem, it is practically impossible for a dealer to change his methods sufficiently to have his product meet this standard, without the milk which he sells being well inside the limit. With this condition attained, authorities may feel that a fair measure of success is resulting, despite adverse comments.

This regulation places responsibility upon the dealer, and also to a degree upon the producer. For this and other reasons the large dealers have inaugurated a policy of oversight at dairies, which will result in better conditions and practices, the ultimate end being milk of increased quality.

Impetus towards commendable conditions is being given in another manner. In 1905 only one of the large dealers employed a bacteriologist, but beginning with that date, the bacteriological regulation of the Board of Health was made a prominent feature of the work for improvement in Boston, and one result of this has been that seven other contracting firms are now employing bacteriologists, and that this is of material assistance cannot be gainsaid. In the prosecution of their work in 1908, the bacteriologists employed by these firms examined over 40,000 samples of milk, an expenditure of time and money which, it is believed, brought good results.

In other ways this standard, coupled with the temperature requirement, has had an important influence, for their essence is clean, cold milk, which not only means at the dairy, clean cows, barns, attendants and utensils, and prompt and efficient cooling with ice, but also proper handling of milk by the dealer on its way from the farm to the consumer.

There are many other requirements in these regulations, some of which may be of interest. It is within the power of the Department to require, through its licensees, detailed information as to the conditions under which each cow is kept, whose milk is brought to the city for purposes of sale. Milk drawn from cows fifteen days before or five days after calving is deemed undesirable, as is the product from diseased animals. The straining, handling, or storing of milk in any room occupied by cows, horses, or other animals is recognized as not being an accompaniment of good milk supplies. This means the provision of a separate room for the straining, handling, and cooling of milk, a feature which should form a part of the equipment of all dairies. The walls and floors of these rooms ought to be of such construction as to permit easy and thorough cleaning. It is further required that provision be made for the cleansing and sterilizing of all utensils used by dairymen and milkmen, and for this purpose boiling water or a steam supply is recommended. An important clause in these regulations is that treating of infectious diseases. Producers or dealers suffering from such diseases, or associated with those thus diseased, should suspend all connection with milk traffic, until authorized to resume the business by competent authority. This is a condition which from the health standpoint should be honestly met by every fair-minded man. Furthermore, such precaution is for the interest of producers and dealers, and without thus safeguarding supplies, consumers will be subject to the terrible milk-borne epidemics, which in the past have created such havoc.

Many of the progressive contracting firms, recognizing this fact, have stipulated in their contracts with producers that, where contagious diseases exist on farms, the milk would be paid for, as under usual conditions, but that the milk should be destroyed, and not be taken from the farm.

In this attempt to prevent the carrying by means of milk of the germs of dangerous diseases, the Board of Health has regulated the manner in which milk is to be tested by tasting by milk handlers. This testing is to ascertain whether or not the milk from the standpoint of sweetness and flavor is salable. Formerly this was ascertained either by applying the tongue to the milk end of the can stopper, and then returning the stopper to the can, or by conveying some of the milk to the mouth by means of a spoon, the spoon being employed repeatedly without cleansing. Regardless of danger, such testings were extremely filthy, and under the provision now governing this subject a spoon, piece of wood, cardboard or other article once used for this purpose cannot be again so employed, or brought into contact with milk, until after being thoroughly washed and sterilized.

A word concerning can washing history may not be out of place. The former practice was to send all cans in either the embryotic or advanced stage of filth and decomposition, to the farmer to cleanse. Not infrequently the cans were employed as containers for substances other than milk. This work was a great hardship to the producer, and his facilities were in most instances inadequate for the proper performance of this task. Under present arrangements all cans are washed and steamed before being sent from Boston, and in most instances an earnest attempt is made to have them thoroughly cleaned. It must be borne in mind, however, that this involves the washing of many thousands of cans daily, and it is possible that some cans may be sent out unfit to hold milk. By reason of the magnitude of this problem, it is believed that responsibility for the condition of cans should not devolve wholly upon one set of individuals, i. e., these cans should be examined at the farm before being filled, and if any are found not properly cleansed, they should be put in condition before being used. Under an existing regulation all milk vessels must be cleansed as soon as emptied, and this requires at least a preliminary rinsing with water by consumer or shopkeeper.

The sale of milk in shops is a vital matter by reason of the fact that the poorest quality of milk in large cities is that retailed in stores. Believing that the sale of bottled milk only in these places would remedy at least a part of the evil, it has been decided to prohibit the sale of "loose" milk after May 1, 1910.

Another subject which should appeal to producers is that of the dilution of unsweetened evaporated and condensed milk with water, and the subsequent offering of this diluted product for sale, without furnishing consumers information as to its origin. So far as I am informed, none of these condensaries make any claim as to the inspection of farms from which their product is obtained. For this reason, in addition to the fraudulent watering, the dilutions of these products, with intent to sell, has been prohibited by regulation.

The desire is to approach this subject of milk production in a spirit of co-operation. Only in this manner can the best results be attained. The assistance of dairymen is invited, and where possible, health boards are anxious to aid the producer. There is no wish on the part of the authorities to antagonize farmers, but where antagonism is invited, it will not be shirked.

CREAM PRODUCTION.

There is an increasing demand for this product, although the milk, from which the cream is obtained, is procured at farms over which the dealers have practically no oversight, and another objectionable feature is the age of the article. Fully 95 per cent. of the cream sold in Boston is subject to one or both of these objections. In summer some of the cream is from 36 to 72 hours old, and the larger part of it from 84 to 108 hours old, when delivered to customers. In winter it is from 120 to 144 hours old. But little attention is given to farm inspection, when the milk is converted into cream. From the facts obtainable, it is evident that many of the places where milk is raised for cream, have never been visited by representatives of the firms buying the milk. Concerns engaged in the sale of cream make no claims regarding its freshness or cleanliness, and the reason for this is obvious.

At times when there is a scarcity, cream is procured from creameries even farther distant, which decreases the likelihood of knowledge of conditions at the farms. Some of the middlemen have no information whatever about the creameries from which they obtain supplies, either regular or temporary, consequently the clean milk question has but little hold in the cream business.

To save expense, the collections of milk and cream from farmers are infrequent, especially in winter, and the shipments of the finished product to trade centers are irregular. These are serious drawbacks to the supplying of fresh cream, and it is only made possible because the cream is heated at all of the creameries before being sent to market. Thus the easy method of heating is the substitute for proper methods of farm inspection, quick transportation and delivery. If it were not for this, the cream business would necessarily be conducted on a very different basis.

Notwithstanding all these conditions affecting production and handling, the demand for cream is constantly increasing, as previously stated, and this substance is now looked upon as almost a necessity. But the question which it will be well for those interested in catering to the public to consider is, Will this demand continue, unless there are great improvements in the methods used at the farm and the creamery, and in transportation and delivery?

In 1908, Boston consumed about 770,000 gallons of "light cream," containing from 15 to 20 per cent. of fat, and 490,500 gallons of "heavy cream," with a fat content of from 35 to 44 per cent. Beside this, probably about 750,000 gallons of cream were shipped from the city to trade elsewhere. As heavy cream is less bulky than the light variety, in order to save transportation charges, much of the thin cream is prepared by diluting heavy cream with milk or skimmed milk, after arrival in the city.

As the sale of cream is constantly increasing, the quantity of milk used for its production is fast becoming a prominent factor in the problem of procuring a supply of milk which will be adequate for future needs. The daily consumption of cream in Boston averages about 2,110 gallons of "light cream," and 1,344 gallons of "heavy cream." If the light cream contains about 17 per cent. of fat, and the heavy cream about 40 per cent. of fat, approximately the following amounts of milk would be required for its production: light cream, 10,022 gallons; heavy cream, 13,104 gallons; or a total of 92,504 quarts of milk. This amount of milk equals 39 per cent. of the quantity of milk consumed daily in Boston. These figures serve to show the importance of the cream industry, and its bearing upon the milk supply.

The prediction is made that in the near future, unless milk production undergoes a complete revolution in New England, the bulk of the supply now being utilized for cream will be drawn upon and used as milk in the cities of this section. The increase in population in the large centers will render this necessary, even if the per capita demand for milk continues to decrease. When this problem confronts the trade, milk to be utilized as cream will have to be obtained from territory even more remote than that of the present.

ICE AN ESSENTIAL.

In order to have good milk, we must have cleanliness, but another equally important factor, and a requirement which can be met by every producer in this section of the United States, is quick and thorough refrigeration. Dairymen should recognize this necessity, and not only cool the milk quickly, but keep it at a low temperature until delivered. The old, antiquated devices still in use on many farms should not be permitted. Every dairy should store an ample ice supply each year, which will prove sufficient for years of extreme high temperature, or when the heated season is long continued. Having the necessary ice, it must be used freely, and whenever the temperature requires it. Many dairymen are now using ice liberally, but perfection in this direction is far from being reached at the present time.

Another important matter is the method followed by some dairymen in handling milk in very cold weather. To prevent its freezing, they often take the milk into the kitchen and place it behind the stove. In this way it may remain at a high temperature for some time, and thus cause bacteria to develop and multiply. Producers should properly protect supplies in winter as well as in summer.

PUS ORGANISMS IN MILK.

An increased interest is being shown in the health of stock, and in future this inquiry on the part of consumers will doubtless become more persistent. There can be no question as to there being ample reason for public concern in the health of cows used for the production of milk, and it is surprising that it has been so long delayed. There can be no doubt that there is gross carelessness on the part of many milk producers regarding the physical condition of their stock. Milk from unhealthy animals is often sent to market, and consumed by the public, without their realizing its true condition, as ordinary observation seldom discloses the facts, which would only be detected by laboratory examination.

The majority of dairymen apparently give no consideration to the undesirability of sending milk from diseased cows to market. In order to protect the public in this respect, it is often necessary to use compulsory measures. The owners of stock are frequently unwilling to lose the small profit on this kind of milk, even though the lives and health of human beings may be endangered by its use. It is time that this state of affairs was corrected. Much progress has already been made by a policy of exclusion, but greater efforts are needed to free supplies from the product of suspicious animals.

Consumers have a right to expect that their health will be guarded at all times, and this certainly should include not sending to market milk from diseased cows. Dairymen have it in their power to materially reduce the amount of milk infected with pus organisms. That this is not always done shows disregard of the interest of purchasers, and the necessity for their using greater discrimination in the selection of those from whom they buy milk.

BOVINE TUBERCULOSIS AND CONTROL OF PRODUCTION.

The subject of the tuberculous cow is arousing public attention, and this will increase as time goes on. Many progressive dairymen are discussing this question, or have had their herds freed from diseased animals, and this matter also appeals strongly to consumers. Boards of health have already taken action concerning it, as shown by the example of Montclair, New Jersey, Chicago, New Orleans, and at least nine cities in Wisconsin. At present, according to Russell and Hoffman,*

* Bulletin No. 175. Russell & Hoffman. A three-year campaign against tuberculosis, p. 15.

"over 25 per cent. of the population of the state" of Wisconsin will be protected by ordinances of this character, if properly enforced. During the last three years in Wisconsin, the Agricultural Experiment Station, the State Live Stock Sanitary Board, and the State Veterinarians have co-operated and engaged in a spirited campaign against tuberculous animals, and with such success as to demonstrate that much progress has been made in eliminating tuberculous animals from many of the herds of that state.

Why should not the health authorities and dairymen of the New England States consider this subject with greater seriousness, and strive to emulate the activity exhibited in Wisconsin? Is each state doing all it should in the matter of tuberculous animals, and can there not be co-operation of officials in every state, also between the several states in dealing with this great problem, thus obtaining a degree of uniformity which alone can bring the best results? If we cannot have uniform laws, we can at least adopt a work-together policy.

This issue is a live one, and is daily becoming more active; it affects all communities alike, and no section can afford to ignore it. The value of the tuberculin test, as compared to physical examination, the question of indemnity by the state to farmers for loss of stock, or whether the latter should stand the loss for condemned animals, are questions well worth considering, but the main issue is progress and suitable protection to consumers everywhere. No farming community can longer afford to neglect the question of healthy cattle as a source of dairy products, and those who pay no heed will finally meet with financial disaster. "In this connection a statement made by a practical dairyman may be of interest. The man in question owned what he sincerely believed to be a herd of healthy cattle; the application of the tuberculin test, however, revealed the fact that a fairly large percentage of his cows were affected with tuberculosis. He immediately disposed of the tuberculous cows, adopted proper measures for the protection of those that were left over, replaced those he lost by others proved to be free from tuberculosis by the tuberculin test, and continued his dairy business. After about five years he asserted that his healthy herd, which he knew to be free from tuberculosis by the periodic application of the tuberculin test, was so much more profitable than the seemingly healthy, tuberculous herd had been, that he had absolutely no reason to regret the expense he had incurred." *

Reproach falling upon a producer in any place is shared more or less by his neighbors, and suspicion is felt toward all engaged in similar business. The health of animals in dairies and the cleanliness of their surroundings are important to farmers and consumers alike, and have an important bearing upon the welfare of the community in which the milk is raised. The proper solution of the problem is that each state should have an active oversight of all milk produced there, no matter where it is used, or the form of dairy product it is to take. This is a matter of importance to the Boston supply, where a large part of the milk must be obtained outside the state. At present, demands for improvement are often met with the statement that nothing can be done, as the authorities of the state from which the milk came take no action in such matters. Where this assertion has foundation, the people in the city are more or less helpless. Neither the authorities nor the contractors can deal with this condition without the aid of the authorities outside the state, as there are many creameries in three of the states from which most of this milk is obtained, and where demands from Boston are objectionable to dairymen, they send their supply to a creamery, or to a nearby city. Such conditions can only be successfully controlled by the authorities of each state, or by Federal power. No milk should be produced for any use which will not withstand the closest scrutiny.

Is not the remedy then for each state to give its board of health, or other authority, power and funds to prohibit the production of milk, regardless of the form, or where it is to be sold, when the stock and farm surroundings are such as to preclude the raising of a wholesome product? This suggestion cannot fail to appeal to clean dairymen who under the present plan are having unfair competition from careless and indifferent neighbors. Do dairymen desire that when Boston, Portland, Bangor, or any city excludes for cause the product of any farm, the prohibited milk should be allowed to be sold in another city or to a creamery? Yet this state of affairs confronts us now, and. this juggling for a market for dirty milk is a fre-

* Yearbook of the U. S. Dept. of Agriculture, 1908, p. 225.

quent occurrence. How long can progressive dairymen stand this competition, and how long will the public permit the harmful traffic?

An instance of progress in legislation is that adopted in the State of Wisconsin in 1909, where "milk" was defined as the product of "one or more healthy cows, properly fed and kept." Unsanitary milk was declared to be "milk which shall be drawn from cows that are kept in barns or stables which are not reasonbly well lighted and ventilated, or are kept in barns or stables that are filthy from an accumulation of animal feces and excreta or from any other cause; or milk which shall be drawn from cows which are themselves in a filthy condition; or milk kept or transported in dirty, rusty, or open seamed cans or other utensils; or milk that is stale, putrescent, or putrid; or milk to which has been added any unclean or unwholesome foreign substance; or milk which has been kept exposed to foul or noxious air or gases in barns occupied by animals, or kept exposed in dirty, foul, or unclean places or conditions." Cream from any such unsanitary milk is declared to be "unsanitary cream." The sale of unsanitary milk and cream is prohibited, as is also their manufacture into any article of food for man.

It would be well if other states would adopt such progressive legislation as that of the State of Wisconsin.

Dairymen have made the mistake of assuming that the conditions of a milk supply were important only to the section in which the milk was consumed. That this is an error is shown by the decrease in milk consumption, and the increasing demand for clean milk from healthy animals.

Some farming journals and dairymen are beginning to realize that the former attitude of milk producers was a serious error. Others not equally advanced are making the mistake of urging that there is too much agitation about milk. If there is any fault, it is that there has not been enough discussion. Let the talk go on vigorously until the covering-up policy is abandoned. Cowards and drones have no place in the suppression of the tuberculous cow, or the use of correct dairy mehtods.

Public confidence will only be restored, and the consumption of milk increased, when producers show willingness to furnish clean milk, properly cooled, and not procured from diseased animals.

E. L. BRADFORD—One thought that was presented in the paper just read has impressed me and I think it will impress all the other creamerymen, and that is, that we must not be too slow in accomplishing some of these results that the consumers are demanding. We must not simply say, Yes, that is a good thing, and do nothing towards accomplishing it. Prof. Jordan has set forth somewhat briefly in his paper our greatest obstacle, and that is,—if we go to the producer and tell him that the cream or milk must be produced and handled in such a manner in order to meet the requirements, we have the feeling all the time that we must be very careful how we say this or the cream or milk will go to some place where it does not make so much difference whether sanitary regulations are complied with or not; and naturally we all want to retain the measure of our business. The remedy set forth in the paper is that the State Board of Health or some State authority should take that matter in hand and say to the producer that he must comply with these regulations. I do not want it to be thought that I am bearing down on the producer. We creamerymen have our defects in great abundance. We have creamerymen's meetings and talk things over and are actually trying in our feeble way to make progress in the bettering of conditions and the production of better dairy products. I want to call attention again to the speaker's suggestion that the State take hold of this and say to the producer, if you are producing milk and cream for other people to consume, no matter to whom you sell it, it must be reasonably pure and produced under sanitary conditions. These two things particularly struck me,—that we must do something to make our products better and purer, not merely look on without action, and that our State authorities really should take hold and help us out in the work. I hope we shall not lose sight of these.

W. K. HAMLIN—I fully appreciate what Mr. Bradford has just said, that it is quite an obstacle to the creameryman to demand any particular improvement among his patrons. It seems to me that if there could be some government regulation that would take this out of the hands of the creamerymen so that it would not interfere with their business, and require conditions to be sanitary, etc., it would be very desirable for all of the creameries as well as the consumer; and I am also quite sure that the creamerymen would concur as far as they possibly could, with any such movement.

C. M. GALLUP—I have heard that the Turner Center Creamery discriminated in favor of cream from tuberculin tested herds. I would like to ask what has been their experience.

MR. BRADFORD—It is true that the Turner Center Creamery has done that, and we keep a very complete record of these cows. We require a certificate to be furnished, signed by some person who has done the tuberculin testing, some person who is in standing with the Cattle Commissioners, and from now on no certificate will be received and filed by us and the extra price paid unless a certain form is complied with. The man who wants his herd tested must make application to the Cattle Commissioners and they will designate who shall make the test of his herd, and when this has been done and the certificate is received, we send a card to the man, acknowledging the certificate and telling him that from that time forward, for one year, we will pay him an extra price. Our system is not just perfect for the reason that we put it on this basis, regardless of whether the farmer makes any changes in his herd or not. We have not gone into the matter very finely as yet. When the year comes around we send a notice that if he wishes to continue to receive the extra price, he must send us a new certificate. We have been practicing this only three years. A few of the herds have been tested the second time and a very few the third time. If we should find any cases of tuberculosis in such retested herds, we should investigate very carefully as to those cases. Thus far there have been no such developments. All the retested herds have come out all right. The gain in the number who are having their herds tested is not so rapid as we would like, but this number is constantly increasing. I think about 300 herds have been tested, perhaps ten per cent. of the number sending their products to us. Some farmers who do not know anything about it think there is great danger in testing cattle with tuberculin, just as a certain class of people are afraid to be vaccinated; but I do not recall a case where a man has had his herd tested and experienced any bad results. I have become a thorough convert to the tuberculin test. I did not become so in a minute,—I looked upon it as a somewhat serious matter, but the evidence in favor of it accumulated so fast and so strongly that I now thoroughly believe in it.

Ques. Would it not be possible to carry out your policy on other lines?

Ans. We say in our offer that we will pay this extra price provided the conditions at the tie-up are reported fairly good. The veterinarian who does the testing has to certify as to the conditions at the tie-up. If these were bad we certainly should not pay the man merely for having his cows tested.

Ques. If you could adopt a score card so that the inspector could report the condition of the dairy, would it not be possible to make a variation of prices?

Ans. I feel at this moment to answer that question in this way: We simply haven't quite got to that stage. I look with favor upon your suggestion, but I also think now that the suggestion of the speaker in regard to the State authorities taking some interest in this is a matter of importance, and it is more important, perhaps, to the consumer, than it is to us. This is a matter of public health. If one is not successful in his business it is just a personal matter that does not affect the rest of the community materially, but the conditions under which dairy products are handled affect the consumer, and therefore I think this is a matter of general public interest, and the public should be willing to pay something to support the work.

Prof. Jordan—I would like to say a word regarding the controversy between gentlemen who are producing dairy products and some who are in the creamery business. It seems to me, from my standpoint, that the question is a large one. The producer may feel that the individual creamery owner or agent ought to be willing to pay a little more for clean milk, and I will agree that he may have a right to feel so, but the question is a larger one than that. It strikes me it is one that affects the whole State or the whole section. For instance, if the State Board of Health or some other competent authority could put its seal on the statement that every drop of milk that goes out from any farm is from non-tuberculous cows, kept in clean stables and the milk handled in a clean and proper condition, it would be worth many dollars to the producers of this or any other state and to the creamerymen and those who are handling these products.

MR. GALLUP—I feel that after the creamerymen and the dealers have gone as far as they can, the State should take hold of this matter.

L. S. MERRILL—Last year at the Dairy Conference held in Dexter this association adopted a resolution asking the State to do this very work. At the last session of the legislature an act was passed arranging for the machinery for carrying on this work, and when the time comes that the dairymen of the State as well as the consumers of dairy products believe that it is for their interest, all they have to do is to make financial arrangements. I think the Commissioner of Agriculture at the present time has ample authority to do all that would be required of him. I think it is a good omen that the Dairymen's Association should ask that the State take hold of this matter of the inspection of dairies. I do not believe that a similar instance has ever occurred in this country before,—where the farmers themselves have asked for this. Our dairymen are in a splendid condition for progress. I have never been in a state where the people were just right for progress as they are in this state. They are beginning to realize the importance of just such work. I am not sure that the time is ripe for the state to take up this work. I am not sure that the people would realize that it was of enough importance to warrant the expense. Money has been spent for everything else except for agricultural purposes, but you would be surprised to see how little has been spent for agriculture, through governmental and educational means. We talk about asking for an appropriation of one or two thousand dollars, for a business that amounts to fifty or sixty millions of dollars a year, and say that it will interfere with something else. We want to wake up to the importance of this business and the importance of what it needs to carry it on, and we want to ask for what we need.

J. M. DEERING—I was very much interested in Prof. Jordan's paper, and especially in the part of it which referred to tuberculosis. I noticed that in speaking of the conditions he grouped all of the New England States together, in regard to the milk supply. Now I do not want the Professor to go back to Boston until he finds out what Maine is doing. Maine today is spending some eight or ten thousand dollars a month to improve its milk supply. The people of Maine, both producers and consumers, are all interested and are all co-operating in the work. This work is all done in Maine by the free will of the cattle owners, and requests are coming faster than we can get money to pay the bills. If the work goes on as it has during the past year, within two years we shall have tested 50,000 cattle. The State is liberal with the people, and that is the way to get rid of tuberculosis. In those states where they are slow in appropriating money to pay for cattle they do not get ahead, but in those states where they are liberal with the farmers they are cleaning out tuberculosis. If the present policy of this State continues it will not be long before we can give to Boston a guaranty with the State seal on it that the milk comes from tuberculin tested cows. Maine is doing a great deal in this line.

LOOKING AHEAD.

By E. L. BRADFORD, Auburn.

Bacon said, "A wise man will make more opportunities than he finds." I say the opportunities for dairying in Maine already exist in full measure and thrust themselves upon us. We do not have to be wise men.

Wheat may come from the great West and Northwest. Even butter and cheese, condensed milk and powdered milk may find their way into our markets from distant parts; but the ever increasing population of New England must look to Maine in its growing requirements for fresh milk and cream.

We are fairly near to the great markets of New England and our own local consumption in the summer months is rapidly becoming a factor to be reckoned with.

I wish to note here that our Maine creameries are sure to encounter a shortage of milk and cream in July and August. People consume more milk in hot, sultry weather and there are more people in our midst at that time. Less milk is produced and more spoils. I should like to hear a discussion upon the most feasible plan for keeping the supply at the maximum in those two months.

During the past two summers, which have been unfavorable for production, the supply of milk and cream has been exceedingly inadequate. Higher prices paid by the consumer have naturally resulted. While the prices paid to the producer have been high, they have not been so high as he may have expected under the circumstances. But if the producer could stand in the creameryman's place for one hot week in summer, when there is not half milk and cream enough available to supply the clamorous demands of customers, he would realize that it is very strenuous and expensive to conduct business under such conditions.

It would be less work and less expensive to fill orders entirely than to split them up and make changes at the last moment before train time and write or wire explanations to customers. Then, too, all fixed charges are the same whether a plant is doing a full business or a diminished business.

Thus with a short local production of milk and cream the producer may not expect to get the full benefit of increased prices.

In this, the dairy business differs from fruit growing. In the latter case the producer gets practically the full benefit of higher prices resulting from short supply.

I estimate that over 200 tons of butter have been brought into Maine the past season from the West and from Canada, exclusive of a large amount of butter substitutes that have been used in the cities.

What is to be said of the Maine dairyman's opportunity when we find on his table choice butter from beyond the Mississippi or imported from a foreign country with six cents a pound duty—all because he cannot afford to eat his own butter? Yet it is a fact that a considerable amount of this foreign-made butter has been sent for miles into the country to supply the tables of patrons of Maine creameries. Their own product was more valuable for market cream and milk.

Dairy butter has sold in the country at phenomenal prices. The conditions are not likely to change greatly in one or two years to come.

With seasons more favorable to production and the incentive of higher prices it may be expected that the production will increase; but likewise there will be a growing demand and it is reasonable to expect good returns for market milk and cream in New England for the next few years, at least.

But dealers and producers must bear in mind that volume of business and present profits are not the only things to think about. The question of producing pure, sanitary products is one that must ever be uppermost in our minds. We should be actuated to this end for the very sake of doing things right—as they should be done. It is also fortunate that a reputation for best products is the most profitable part of any business.

Getting ourselves interested in the bettering of conditions is good for us in a general way. The more one learns, the more he is capable of learning and the more readily he learns. Every step in the direction of improvement broadens one's view and tends to make him more interested in the good work.

When a creameryman tidies up his factory, or when a farmer cleans up and whitewashes his tie-up, either one may feel a just pride in the result and it will make a better man of him. It is not a long look from a whitewashed tie-up to a family bathroom.

When the proposition is put forth, that we must take more pains with our dairy products, deliver our milk and cream fresher and as cold as possible at all seasons without their being frozen, and above all else, *clean,* shall we be heard to say that we are doing all we can afford to do now at the price we get? No. This is too shortsighted a view to be taken by the bright dairymen of Maine. We must look ahead to that most valuable asset—a good reputation, well earned and well grounded. We want it to become a well established and recognized fact that Maine dairy products are excelled by no others. There is only one obstacle in the way of this and that obstacle should gradually become less and less—I refer to the smallness of our herds and their distance apart. I would not have it understood that I think we are behind other states in our methods.

We simply want to see Maine milk forge ahead to the front rank in excellence.

That is why your creamerymen, headed by the State Dairy Instructor, have drummed up such a magnificent array of samples as is seen displayed here today. The samples are here not for the small premiums they may win. The premiums are only tokens of something far more valuable—skill in production of milk.

We have much excellent milk, some that is inferior and some that is bad. The creamerymen have for a few years made an imperfect sort of discrimination, but that matter must be gone into more thoroughly. Our products are being watched by expert guardians of the public health. The bacteriological laboratory is the little bird that tells the expert whether proper sanitary regulations have been complied with in the production and marketing of the milk under his observation.

Dealers sometimes get a card from the Bureau of Milk Inspection, saying, "You are hereby notified that the milk obtained from you on such a date was examined at the Bacteriological Laboratory and was found to contain bacteria far in excess of the limit established by the Board of Health, etc." On the other side of the card is printed the regulations of the Board of Health: "No person, by himself or by his servant or agent, or as the servant or agent of any other person, firm or corporation, shall in the city, etc., sell, exchange or deliver or have in his custody or possession with intent to sell, exchange or deliver, any milk, skimmed milk, or cream which contains more than 500,000 bacteria per cubic centimeter, or which has a temperature higher than fifty degrees Fahrenheit."

Then follows this note: "To insure that your milk or cream shall conform to the above requirements, both *cleanliness* and *cold* are absolutely necessary at every stage of its handling. With clean cows, clean hands, clean pails, cans, ladles, strainers, etc., absence of dust in the air to which milk is exposed, rapid cooling and continuous maintenance thereafter of the temperature at or below fifty degrees Fahrenheit, you need have no failures in meeting the demands of the above regulations."

This is what the dealers are up against. But after all it is nothing but what any decent, well-bred person should want to comply with.

The principles of good milk production are few and have been repeated over and over again. The details are numerous and new phases are ever coming to light. These ever varying conditions can only be met and dealt with properly by constant vigilance and intelligence.

Around the creamery the same vigilance is needed that the creameryman asks of his patrons. I surmise that we creamerymen are very far from knowing it all.

Clean cans should not be piled one top of another with open ends up. It is a better way to pile them on the side with open ends turned to the wall to keep out dust and flies. I have seen a workman use a clean open can for a stepladder—with no thought of washing it afterwards. It was convenient but not a nice thing to do.

It is useless to try to enumerate all of the things which should not be done. The faithfulness with which one applies the simple principles will mark his fitness for the work.

Among the advantages which we have might be mentioned the ice crop which never goes back on us, though we may sometimes go back on the ice crop and fail to avail ourselves of this natural resource.

The present healthful condition of our herds is another great lead we have over other dairy states. Our laws are so good and our officials are so efficient in the matter of tuberculous cattle that we may fairly hope to be practically rid of the diseased animals before many years. To my thinking this would give Maine dairy products a great prestige among consumers. Aside from such preference on the part of consumers, there is no doubt that herds of cows in health are more productive than herds preyed upon by disease.

Although I do not consider my opinion of very great value in this matter, nevertheless I will say that I did not espouse the cause of the tuberculin test as a fad, but rather from conviction as to its merits, after giving the matter the careful study that on account of its importance it deserves.

It is well known that our company—the Turner Center Dairying Association—pays an extra price for milk or cream from tested herds. Not all such milk and cream is kept separate from the general product, but a portion of it is kept separate for certain markets and the increased price derived from the sale of such special product fully justifies the extra price paid to the farmer. I look for still further sale of this special milk and cream from tested herds as soon as we get enough to justify advertising it in new markets.

Whatever the facts may be as to transmissibility of bovine tuberculosis to the human family, it is certain that almost any person will relish better, milk known to come from healthy cows.

Another thing that is bound to be a great help to Maine dairying is the awakening interest in raising corn on the dairy farms. This subject is of fundamental importance and deserves the full measure of attention that it is receiving at our dairy meetings.

Still another good boost to our dairy interests will come from the Cow Test and Breeders' Associations. These organizations do not attempt results by absent treatment. They get right hold of the patient's pulse. They diagnose present troubles and point out the unprofitable animals in the herd. They confidently aspire to future benefits from careful, intelligent breeding.

And still again the awakened interest in protecting consumers against the abuse of adulterated dairy products is a direct benefit to the honest dairyman.

These are some of the advantages that attend the dairy interests. I believe that today dairying is an inviting business for any one who is willing to put study and work into it. I have placed the words study and work in just the order of their importance.

What about these State of Maine farms? Don't you know they are going to be worth more than they are now by the time the young man of today is a middle-aged man?

Any young man possessed of fair business ability and blessed with a taste for farm life need not hesitate to devote himself to dairying in Maine. One may begin in a small way if he has to, but do not stop there. Build up; grow; let every year find you with an increase in your herd. Do not be afraid to abstain a little—to sacrifice a little to your business for a few years. There is a sort of joy and zest in accomplishing something, in building up a business. "There is a tide in the affairs of men, which taken at the flood, leads on to fortune." If this august oracle may be applied to such an unpretending business as dairying, it is timely now. The business will not be overdone.

As I said before, our dairy region is too sparsely populated with cows. It is one of our greatest drawbacks. The smallness and infrequency of the deliveries of cream and milk are a great setback to successful marketing. The denser the cow population the better the business will be. It is a case of "the more the merrier."

This is an age of progress. Let us fall in and keep step.

Finally, I want to see suspicion eliminated as far as possible between producers, dealers and consumers. I want to see a measure of confidence and co-operation. At this meeting today all three parties have been represented,—the producers, the creamerymen and the milk inspector from the metropolis of New England.

I trust that this dairy conference and the results coming from it will justify the statement that "There is a dairy revival on in Maine."

J. D. McEdwards—I think we should have more money for the inspection of dairies. There ought to be more inspectors to go around among the dairies, so that they would be governed by the State instead of by creameries. We all know very well that if we go into a man's barn and find fault with the conditions there, he will say, "Well, if you do not like my cream I will send it somewhere else." But if an instructor appointed by the State and paid by the State goes around, they know he has no issue at stake, he is working for the upbuilding of the dairy products of the State. I think it is better to have the inspectors come from the State than from individuals. I have been interested in the creamery business all my life and I know something about the conditions. If we find a little fault, no matter how nicely we present it, we shall hurt the man's feelings. And another thing, he will tell you his milk is just as good as his neighbor's, and perhaps that may be true.

I am very much interested in this meeting. I think there is a future in the dairy business of this State. I never knew prices to be so high for a pound of butter fat as at the present time. Last month I understand most of the creameries paid

36 cents, and I should not be surprised if it were higher. It looks very encouraging for farmers to go into the dairy business and raise their own feed. They should raise more corn, and thus save paying out all their cream checks for grain.

MR. BRADFORD—Prof. Jordan in replying to a statement by some one that perhaps we were not quite ready for some of these progressive movements, said that they were ready for them in Boston; and this thought goes along with it,—whereas the supply is very short in the great markets and perhaps almost anything could be put in now that is in decent condition, still I think a record of the milk from different sections is being kept, and if the time should come when they could choose a little, where should we want to be, among the chosen ones or the ones thrown out?

L. S. MERRILL—I think Prof. Jordan misunderstood the remark I made this morning as to whether we were ready for these things. I think the action of this association is sufficient answer as to whether we are ready for such work or not. What I intended to say was that I did not know whether we were ready to raise the funds or not. Our farmers are very conservative. They have not been in the habit of asking for very much. I have heard many farmers say, "All we ask is just a fair show; we do not want any special assistance in the way of carrying on extension work." I believe they are wrong. The question now before us is whether we are ready to ask for what we need to carry on this work or not. I believe in this work most thoroughly and that the State is ready for it. The only question is whether we are ready to ask for the money to carry it on.

E. E. HARRIS—It is one thing to have a good idea and another thing to have the force and courage to carry it out. I believe this is the key note of Brother Bradford's paper. He has a lot of good ideas, but the point is to carry these out. The question has been raised as to whether we are ready to raise the money to carry out these movements. Will there ever be a better time? Will there ever be any more demand for good, pure milk than there is today? Do the prices want to be any higher? I am sure I hope the prices for butter and for grain will not go any higher. It seems to me that when the prices are high people do not eat quite as much of good butter; they take something that is not as good. We have seen that demonstrated in the amount of Western butter that has been shipped into this State and the amount of renovated butter, butterine, oleomargarine, etc.

I would like to see the people stimulated into action.

DAIRY BUTTER MAKING.

By P. A. Campbell, Orono.

Just when in the world's history butter was first discovered is not known, but we find it spoken of several times in the Old Testament. The people of the East used the skins of animals sewn together for holding milk, and as these were carried from place to place on the backs of animals the jolting motion caused butter to be churned. Whether butter was discovered in this way or not makes but little difference, but it shows that it is not a new subject we are dealing with, and I often wonder if we have made the progress we ought in this length of time.

In discussing this subject of dairy butter making it is not my endeavor to go minutely into every detail, but rather if possible to throw out some helpful hints that may be useful to our Maine dairy butter makers and that will help to raise the general standard of our product.

It would appear that the dairy butter maker has many advantages over the creamery butter maker; but dairy butter as we oftentimes find it in the market does not always seem to prove it. The dairy butter maker has everything his own way. He knows all the changes that his product passes through from the time it was in the form of feed-stuffs and fed to the cows until it is ready for the table in the form of butter. Most of these changes and conditions can in a large measure be controlled with a little forethought and trouble. The creamery man cannot control them, as his work is only the manufacturing end, and without good material to manufacture from, no really first-class article can be made; although upon the skill of the workman will depend whether the manufactured product stands high or low, considering the material from which it was made.

The dairyman's work commences with the feeding operations. Turnips, cabbage, and such feeds should not be fed just before milking, as they are likely to give a feedy flavor to the butter. Whether this taste comes with the milk from the cow or from the fact that it is in the atmosphere, and milk being very susceptible to all odors takes it up easily, makes but little difference. It is sure to get there and can be noticed in the butter. If they are fed directly after milking and after the milk has been removed from the barn, all effects of such feeding will generally have disappeared before the next milking. It is not advisable to feed hay or to sweep just before milking, as the dust in settling is bound to get into the milk pail and there is no strainer made that is fine enough to remove these dust particles.

The question of feeding often comes up in relation to the churnability of the cream. We know that butter is made up of several different fats and the relation of these separate fats to each other determines the melting point of the butter fat. The feed that the cow eats directly influences these fats, and if a cow is fed dry fodders and cottonseed meal without succulent feeds, corn meal, the gluten feeds or linseed meal, the melting point of the fat will be low, and if the dairyman tries to churn his cream at a low temperature, the butter refuses to come. The same trouble occurs with cows that are well advanced in the lactation period—the fat globules are small and hard, and fail to unite. The remedy of course is to change the feed, or raise the churning temperature, or perhaps both in some instances.

Have the cow, the milker, and the milk-pail clean, and these in a clean barn should give a clean product. It does not necessarily mean extra expense to have these conditions. I think anyone who has tried both methods will agree that the little extra time required for keeping things in shape will more than pay in the extra satisfaction that will come from it in doing the work, to say nothing of the better product.

As soon as possible after the milk is drawn it should be removed to the dairy-room, strained, and run through the separator while it is still warm. I know that every dairyman does not have a dairy-room. A part of the barn, shed, or kitchen too often serves this purpose and the extra labor and inconvenience involved in doing the work would soon pay for setting aside a part of the shed or house that is free from odors, sheathing it, and arranging it with a place for the separator, churn, butter worker, ice tank, and a place for washing the dairy utensils.

Some still are using the Cooley system for obtaining the cream. There is nothing wrong in this method except that for anyone having a good sized herd it is too expensive. Too much butter fat is left in the skim-milk. Careful as you may be, you are bound to leave an average of .2 of one per cent of fat, while a good separator will not leave over .02 of one per cent. I have tested skim-milk for those who thought that they were drawing it close when we found .40 to .50 of a per cent of fat in the skim-milk. You can easily reckon what this means in dollars and cents. With a herd of a dozen or fifteen cows the loss would nearly pay for a separator in one or two seasons. I know the reply to this is that it is not a loss, that the skim milk is fed and thus it is saved. Butter fat is worth at the present time some thirty-three or thirty-four cents a pound and it would seem to be rather an expensive food, when the same food value could be obtained for much less. But it would seem that one of the principal advantages of the separator is having the skim-milk warm and fresh to feed to the calves and pigs.

The separator can be abused, but rightfully handled it is one of the dairyman's best friends. It was not originally intended that it should be washed only once a day or in some cases even less frequently. If the best results are to be expected it should be thoroughly cleaned with each separating time. That part which is left in the separator bowl after separating, commonly called bowl slime, is made up of the impurities of the milk, such as pus, bacteria, and foreign particles that may have gotten into the milk. It is not right that it should be left to contaminate the next milk that is put through the separator. If anyone is doubtful in regard to this, save some of it after a large run and allow it to stand in a warm place for a few hours, and it will certainly convince anybody as to the necessity of regularly washing the separator. The separator should be set level and should be run at a regular speed at all times. There are usually full directions for running the machine, and these should be carefully followed.

It is folly for anyone to think that the percentage of fat in the cream will not vary from time to time. The speed of the bowl, steadiness of motion, temperature of milk, the amount skimmed per hour, and the stage of lactation all affect the efficiency of skimming and the richness of the cream. Perchance the milk has become cooled before separating. It will be better to warm it than try to skim it cold. About 85° F. is the lowest temperature at which one should try to skim milk. It is well to frequently test the skim-milk with the Babcock tester to see that the separator is doing efficient work. The cream should be tested also in order to know just what is being done and in order to be able to estimate the amount of butter. This testing can be done at the time of the monthly testing of the herd and at other times often enough to keep in close touch with the work.

As soon as the separating is finished, the cream should be thoroughly cooled and kept at a low temperature until the time of ripening comes. If possible keep it down to 55° F. or below, by setting it in ice water. It is a help to the flavor of the butter. It is the common practice with many dairy butter makers to let the ripening process take care of itself, and the result is that what otherwise might have been good butter loses several points right in this operation. There is no trouble in keeping cream sweet if it has been carefully handled. It is no secret process. Simply keep it clean and keep it cold. Do not mix the lots of cream from two separations until they are thoroughly cooled. When they are put together stir them so that they will thoroughly mix, then if any change takes place it will affect the whole lot of cream. Churning should not be delayed too long. With small herds it is impracticable to churn every day and the accumulations from several days are often churned. However, if delayed too long and if care has not been taken to keep the cream sweet and cold, a fermentation has occurred, and an undesirable flavor has been imparted to it that is easily tasted in the butter.

In common terms cream ripening means souring of the cream. The common practice of allowing the cream to self-ripen I believe is one of the chief reasons why the butter is not more uniform. Good results are sometimes obtained in this way, but the butter maker is never sure just what to expect. The lactic acid organisms play the chief part in the ripening process and while objectionable to the milk dealer are indispensable to the butter maker. They grow rapidly in number at a temperature of 90° F. and act on a part of the milk sugar, changing it into lactic acid. At a low degree of temperature they are inactive. Under cleanly conditions the lactic acid type always predominates. When, however, the other species outnumber the lactic acid bacteria, as sometimes happens, especially when the cream ripens itself, we get undesirable flavors present. It is quite possible to overcome this by the use of a starter. A starter is nothing more or less than a pure culture of the lactic acid germs. We can buy these pure cultures and that is undoubtedly the best method for the creamery butter maker. For the dairy butter maker some of the best skim milk can be selected, usually some after the separator has been run for a few minutes, and this heated to 80 or 85° F. and kept at that temperature until it has a pleasant sour taste and is about ready to coagulate. This is practically a pure culture. If, as sometimes happens, an off flavor is present, it is not a very serious loss to throw the starter away and try again, while if it had been the cream that had presented this flavor it would have had to be churned, and consequently a poor butter would have resulted.

Some use sour cream from the previous churning or buttermilk as a starter. The trouble with these is that they may gradually get an off flavor and the dairyman's sense of taste is not sharp enough to detect it and as it grows worse from time to time his sense keeps in sympathy with it and he does not notice that there is anything wrong.

The amount of starter that one should add to the cream will depend largely upon conditions. If you wish to ripen quickly more starter is added. If the cream is poor and the starter is good add more starter to overcome the trouble with the cream. To a thin cream add as little as possible and yet have it effective. Under ordinary conditions use as much starter as 10% of the bulk of the cream.

It is desirable to have the cream contain 28 to 30% of fat. A rich cream will allow you to churn at a lower temperature and it will give an exhaustive churning. A light cream churned at the same temperature is likely to give trouble.

The temperature of the cream should be such that it will ripen in about twelve hours. If the temperature is too low it is not favorable to the growth of the lactic acid germ and an unfavorable growth takes place and a bitter flavor is the result. From 60 to 70° F. seems to be a good temperature at which to ripen the cream and as the ripening nears completion the temperature should be gradually lowered to the churning temperature. The cream should be frequently agitated to insure uniform ripening. When it remains undisturbed the fat rises the same as it does in milk, although in a less marked degree. The upper layers being richer will sour less rapidly since the action of the germs is less rapid in rich than thin cream. An uneven ripening will result and a cream with a poor body. Instead of being smooth and velvety it will be curdy. The cream should be ripened until it contains about .5 per cent of lactic acid. The richer the cream the less acid will be required. Of course the amount of acid that need be developed will also depend upon the market condition, the aroma and flavor being dependent upon it.

It is not advisable to depend entirely upon the senses to determine whether the cream is right or not, but it should be tested occasionally. Farrington's Alkaline Tablet Test has the advantage of not being expensive and can be used by anyone by simply following the directions that come with the outfit.

There can be no definite rule laid down as to the temperature at which the cream should be churned, as different creams require different temperatures. The fat is in the form of microscopic globules and they must have a certain degree of softness if they are to unite. When the cream that is properly ripened and contains 26 to 30% fat enters the churn, the temperature should be such that the cream will churn in thirty to forty-five minutes. This will give an exhaustive churning and leave the butter in a condition in which it can be easily handled without injuring the texture.

Before putting the cream in the churn, the churn should be thoroughly scalded and as thoroughly chilled with cold water. The advantage of this is that it will freshen the churn and fill the pores in the wood so that the cream and butter will not stick to it. The outside temperature of the churning room should be as nearly as possible the same as the churning temperature. If it is warm, the cream will warm up rapidly and the butter will probably be soft and will require more washing to remove the buttermilk. It is useless to lower the cream rapidly to the churning point, just before churning. It should be there at least two hours before churning. The reason for this is that fat is a slow conductor of heat and although the serum has cooled and the thermometer reads the right temperature, the fat has not actually reached it and the results would be the same as if churned at an actually higher degree. As the cream is put into the churn it should be strained to break up any lumps. If color is to be used it should be added at this time. The amount to use will depend upon the strength of the coloring, the breed of cows, and the season of the year. The color should be of a vegetable origin, and care should be taken to see that it is fresh. If musty it is likely to cause an off flavor in the butter. A careful butter maker will know how many pounds of butter will result from the churning. A safe guide to follow is to take one-sixth of the number of pounds of fat and add it to this number as the estimated number of pounds of butter. For example, if you have thirty pounds of fat, one-sixth of it will be five, and the pounds of estimated butter will be thirty-five. If no mistakes have been made it should run over this rather than under. From this it is possible to experiment and add just enough coloring to keep the butter the same color at all seasons. High coloring is not advisable, but rather uniformity is what is desired most.

The speed of the churn should be such as to give the greatest amount of concussion, and can be determined by experimenting. Churning is nothing more or less than causing the fat globules to move about in such a manner that they strike each other and stick together, hence the greater the agitation the more they are driven about and the greater the possibility of their adhering to each other. During the first two or three minutes that the churn is revolving, the vent should be frequently opened to relieve the pressure which is probably due to air becoming saturated with moisture.

In from thirty to forty-five minutes the fat globules should have collected into a granular form about the size of wheat or a little larger. It is not advisable that they should be much larger because it will make it hard to remove the buttermilk.

At this time the granules should be free and have a tendency to float. If there is a sale for the buttermilk or it is to be used for cooking purposes it can now be removed, otherwise a brine, generally of the same temperature as that of churning, should be added and the churn allowed to revolve two or three times more. This will tend to free the granules from the buttermilk and cause them to float. The granules are now thoroughly drained and then the wash water is added. The only object of the wash water is to remove the buttermilk, and if too much is used it will have a tendency to take away some of the flavor also. The wash water should be pure and have the same temperature as that of churning. If, for some reason, the butter is inclined to be soft, the temperature of the wash water may be lowered a degree or two with each washing, but from the time that we commence to ripen the cream, every effort has been made to prevent any sudden change in temperature.

With the butter in a free granular form it is an easy matter to salt it in the churn. Nothing but good salt that is free from impurities should be used. Salt easily takes up odors and hence should be kept in a clean, dry place. The amount of salt that is used will, of course, depend upon the market. The aim should be to have it uniform from time to time. The amount of butter is known and if the granules are of the same size and about the same amount in the churn each time it will be uniform. Of course with a small amount in the churn, more will be lost on the sides of the churn. With an excess of water present or small granules, more will be lost and these facts must be taken into consideration.

Sift the salt evenly over the granules with a fine sieve, and cause the granules to roll about until the salt is well distributed. Then they can be brought together and the butter is ready to be worked.

The kind of worker used is immaterial so long as it does the work. In many of the creameries at the present time the combined churn and worker is used. It has some advantages in that it requires less handling of the butter and a more thorough control of the temperature. A churn of this kind would be impracticable where there was not a power to run it, but in a good sized dairy where there is a power, there is no reason why one should not be used.

With the salt well distributed the chief factor to be considered in the working is to press the granules firmly together so that there will be no holes left in the butter. Many overwork, the grain is spoiled, and the butter made salvy. The number of times that it should be run through the worker can only be determined by each butter maker. It generally requires more working in the winter than in the summer. When it is finished it should be waxy in form, free from holes, and should show no signs of stickiness when cut with a ladle. If with this treatment the salt has failed to dissolve and appears gritty, it would have been better to have worked it twice. That is, about half work it and then allow it to stand for one or two hours until the salt is dissolved and then finish the working. This method will also prevent any uneven coloring, as the salt in dissolving sometimes has a tendency to cause mottles if the buttermilk has not been thoroughly washed out. The casein that is in the buttermilk is set free by the salt and collects and hardens in the spaces between the lumps of butter, giving the mottled appearance.

The two workings will generally prevent this. Sometimes there is a mottled appearance that is caused from the fact that the cream is more or less coagulated when it goes into the churn, and the specks or casein become incorporated in the butter. This would have been prevented if the cream had been strained.

The form into which butter is to be put on the market will depend upon what the market demands. Most of the butter that goes to the local trade is put up in the form of pound cakes. The square cakes seem the most desirable, that can be cut into quarter-pound squares, each square with the maker's initials or brand. That has a double advantage from the fact that a customer once having secured good butter with a certain mark upon it is looking for the same thing again, hence it is a sort of advertisement. It also has another advantage, that the maker who has gained a certain reputation dislikes to let a poor article go on to the market, especially with his own trademark on it, consequently he will use all his skill to keep it up to his regular standard.

It should be carefully wrapped in parchment paper, the folds coming underneath the cake. Some are accustomed to wetting the paper in a brine solution. There seems to be no material advantage in this and it does not make as neat a package. Paper cartons can be used to slip the wrapped butter into, and if the owner's name, the name of his farm, or brand is stamped on the outside no more desirable package can be put up. It is attractive and it is sanitary. From the beginning to the end, the butter has not come in direct contact with the hands.

If the butter is to be kept for some time it can be put into tubs. They should be prepared by thoroughly scalding and then allowed to stand, filled with brine with the cover on, until they are thoroughly chilled. They are then lined with parchment paper or are coated with paraffine. The butter is placed in them, not too much at a time, and pressed firm enough so that there are no holes left. The top is cut off even with a fine wire and the parchment circle is placed on top and generally a handful of salt is sifted on.

It seems to me the dairy butter maker stands in a class entirely alone. He is selling the finished product. There is no trouble in selling good butter, the trouble is that the demand exceeds the supply. Nobody wants poor butter, but oftentimes we must take that or none at all. Our villages and cities will take all that they can get. Many are anxious to have a reliable source of supply, and gladly pay for a butter that suits them.

There is an individuality about butter the same as about persons and when customers become familiar with a certain make, they prefer it to other makes that are equally as good.

CHAS. D. WOODS—In the report of the cow test association work one of the things that struck me forcibly was the fact that the farmer as an agriculturist, as a tiller of the soil, was selling roughage to his own animals at an exceedingly high price, and that is a good thing. If I as a grower of hay can sell hay—not even marketable hay but rough hay that does not command a very high price in the market—at a high price to my own cows, it is a source of profit; and one of the things that I want to congratulate the cow test associations on is that in selling rough fodder to their cows at a high price they are still getting a good profit. The farmer is converting his coarse materials which have very little market value directly into a high class finished product. Another thing that we know about, but which sometimes escapes us, is that when we are selling butter fat we are only selling sunshine, we are not depleting the farm in the slightest. I shall be exceedingly sorry if Maine ever gets to sending much milk to market. I hope that she will continue to keep the solids of the milk that are not butter fat at home upon the farm. I believe that is the key to building up our lands and making them better and better year after year. We all know about nitrogen. We all know about the tons of it that are lying right about us. We also know that when we stay in a room poorly ventilated we get too much nitrogen and too little oxygen. This oxygen question is an important one for the farmer. We can get our phosphoric acid tolerably cheap, we can get potash fairly cheap, but every time we get nitrogen it costs, and it costs exceedingly, and the cost is constantly coming up. So when we are selling butter fat and holding the nitrogen or protein that is in the milk and feeding it properly upon our farms, we are getting the growth out of it and best of all we are returning the nitrogen to the land, when we are saving both the solid and the liquid excrement from our animals. That is the one reason that animal husbandry has always paid.

Ques. Would it be a good practice to apply lime to the soil in order to grow more clover?

Ans. The question of the liming of soils is a very serious one for us here in Maine. There is very little doubt in my mind that more than one-half, and perhaps seventy-five per cent of our cultivated land in Maine would be improved so far as the growth of plants is concerned by the addition of lime; but there is another side to that story. We are growing potatoes more and more. The only potato disease that no man knows how to control is scab. We know what causes scab and a great deal about it, but we do not know what scab lives on in the soil year after year, when there are no potatoes or allied crops. We are working with that and have been for several years at the Maine Station, but we do not know very much more about it than when we began. We do know this, however, that an alkaline condition is favorable to the growth of the fungus that makes potato scab, and that all conditions that tend to sweeten land, in the ordinary sense of the word—to make it non-acid—are favorable to the growth of these fungi. Hence you should go rather slowly in putting lime on your soil if you are to put potatoes into the rotation. On some land to which a large amount of ashes had been applied, where potatoes had not been grown for twelve years we planted them this year, and in order to make sure that the potatoes were free from fungous diseases of all kinds, they were thoroughly treated with formaldehyde before they were planted. You never saw such a fine crop of scab in your life. It was not caused by the ashes except indirectly. The ashes produced a favorable condition for the growth of the fungus.

Ques. If you were not intending to use potatoes in the rotation, how much lime would you recommend ordinarily?

Ans. In our experimental work we have obtained practically the same results from 500 pounds that we have from 1,000 or 2,000 pounds of lime per acre. We have gotten results that were striking on 500 pounds. The first field that we had in use on our experimental work we divided up into ribbons, with lime and no lime, and in varying amounts. The field was a little slanting, and within half a mile you could tell where the lime was and where it was not. We got a very much better crop of clover where the lime was used, but when we grew potatoes on the land the next year and the year after, the lime told very unfortunately against the potatoes.

PROF. SANBORN—I wish to confirm what Dr. Woods has said. I am using fertilizer very freely. I had sections laid out with lime and non-lime, and where the lime was used, this year the potatoes were very badly scabbed. In other experiments I have found that the effects of lime in the soil last for several years. Sometimes I can neutralize the effects of lime with muck, but on the whole, raising potatoes as I do, I have abandoned the use of lime, and seek to control the acid problem and the potato problem by other methods.

THE POSSIBILITIES OF IMPROVING CROPS BY SEED SELECTION.

By WILLIAM D. HURD, Amherst, Mass.

Doctor Merrill, your enterprising State Dairy Instructor, has set me no easy task. He gave me this subject, but there he left me, saying that I should outline a plan to improve the common farm crops grown in this State, in accordance with an act passed by the Maine Legislature of 1909.

The resolve reads as follows:

"The Commissioner of Agriculture shall gather statistics of information concerning agriculture and publish the same annually; he shall assist the farmers of the State, in so far as is practical, to secure farm help, and to promote increased production of farm crops through the selection, the growing and the dissemination of superior strains of seeds. An appropriation of three thousand dollars annually shall be made, to be expended by the Commissioner of Agriculture for the purpose of carrying out the provisions of this section and section five of chapter sixty of the revised statutes, and for such other purposes and in such manner as in his judgment will best promote the interests of agriculture in this State."

This subject of crop improvement is indeed most important, and one that has not commanded the attention of agriculturists, not only in Maine, but in every section of our country, in the past that it should. I often wished while living in this State, that time, money, and facilities were at hand for me to start and conduct some work along lines which I shall mention in this paper, and I congratulate the Department of Agriculture on the great field of usefulness before it if it once enters this important field.

The agriculture of this country has passed, or is passing, through at least three stages. First, the taking up of virgin soil, its cultivation, waste, and depletion by the "soil robber"; secondly, a stage of diminished production for which these "soil robbers" seemingly cannot account; and thirdly, the studying of soils and crop production from a scientific standpoint, and an improvement of methods which usually results in a constantly increased production. Much of the western part of the United States is still in the first two stages. New England is, or should be at least, in the last; and I believe that you are now ready to consider some of those factors which would lead the way toward an increased yield and quality of our farm crops. Not the least of these factors is the possibility of improvement through simple seed selection.

Maine ranks high among her sister states in crop production. According to the latest statistics given out by the United States Department of Agriculture, Maine last year produced farm crops in acreage and yields to the acre, and ranks with the other states as follows:

Crop.	Acreage.	Yield per acre in bushels.	Ranks according to yield per acre.
Corn	14,000	40.5	3rd
Wheat	8,000	23.5	8th
Oats	119,000	34.0	9th
Barley	8,000	28.0	13th
Rye	....	....	....
Buckwheat	23,000	30.0	1st
Potatoes	116,000	225.0	1st
Hay	1,400,000	Tons. 0.9	47th

The above figures are no doubt surprising to many of you. We know that in this State the methods commonly practiced do not yield the highest returns, and we can but speculate on what the results would be if more attention was paid to seed selection and better cultural methods.

A significant fact, and one that must not be overlooked, is that despite all the work of the United States Department of Agriculture, the State Experiment Stations, and the Agricultural Colleges, the information spread broadcast by the agricultural press, the Farmers' Institutes, and other sources, the average yield of the principal farm crops over the United States has not increased appreciably in the last forty or fifty years. This is probably not the fault of any of the agencies named above, for each has made a mighty effort in its way. It is due rather to the fact that the average farmer does not put into practice what is sent him in the Station or Government bulletin, or what he learns from the Institute lecturer. In other words, most farmers "must be shown." A new line of teaching is now being developed,—the co-operative or demonstrative idea, the value of which I hope to prove to you in this paper.

There is no subject that should be of greater interest to the farmer than the improvement of crops by seed selection. Too much effort has been given to attempting to produce new things rather than to the improvement of the desirable forms which we already have. There are several reasons why Maine should seek to develop strains of seeds and plants within her own borders. The soil and climatic conditions of this State are distinctly different from those of the states from which the seed used within this State comes, and Maine, as most of you realize, imports practically all the seed used excepting potatoes. Stop for a moment, if you will, and consider the sources from which your seeds come. Your corn comes from Connecticut, New York, Illinois, Michigan, Ohio, Iowa, and perhaps even farther south. A large proportion of the oats used as seed comes from the middle west. Of the five kinds of clover commonly grown, the crimson and alsike are imported largely from Europe and Canada. The red clover comes from the Mississippi and Ohio valleys, and farther west. (New England formerly grew clover seed and should return more to this practice. I found heads of clover last fall in the vicinity of Orono which produced from fifty to sixty-five seeds each.) Alfalfa, if you are using it at all, comes from Nebraska, Montana, California, or is imported from foreign countries. Field peas come chiefly from Canada, but are sold here without respect to variety and there is a vast difference in yield as shown by the reports of the Canadian stations. Timothy comes from the Mississippi valley, and as far west as Idaho. Perhaps the southwestern part of the State of Iowa produces more timothy seed than any other region of equal area in the world. Kentucky Blue Grass, the good old native New England June grass, comes from that region which has improved it so much and given it this new name. Redtop from southern Illinois, the other states of that region, and in quite large quantities from New Jersey. The millets, from Georgia, Tennessee, Texas, Indiana, Wisconsin, Michigan, and Illinois. Canada thistle, Orange Hawkweed, witch grass, chess, dodder, King Devil weed, sorrel, wild carrot, mustard, kale, daisy, buttercups, and dozens of others from everywhere.

The point I wish to bring out in this connection is that in most cases seed produced in the states I have mentioned has not been grown in an environment which suits it at all to Maine conditions.

Maine has one of the best seed laws in this country, and under the fair and impartial enforcement of Doctor Woods it is accomplishing great results. The principal sections of this law read as follows:

Section 27. Every lot of seeds of agricultural plants, whether in bulk or in package, containing one pound or more, and including the seeds of cereals, except sweet corn, grasses, forage plants, vegetables and garden plants but not including those of trees, shrubs, and ornamental plants, which is sold, offered or exposed for sale for seed by any person in the State shall be accompanied by a written or printed guaranty of its percentage of purity and freedom from foreign matter; *provided,* that mixtures may be sold as such when the percentages of the various constituents are stated.

Section 28. Dealers may base their guaranties upon tests conducted by themselves, their agents or by the director of the Maine Agricultural Experiment Station; *provided,* that such tests shall be made under such conditions as the said director may prescribe.

Section 29. The results of all tests of seeds 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 of seeds were obtained. The said director shall also publish equitable standards of purity, together with such other information concerning agricultural seeds as may be of public benefit.

Section 30. Whoever sells, offers or exposes for sale or for distribution, in the State, any agricultural seeds without complying with the requirements of sections twenty-seven and twenty-eight, or whoever wrongly marks or labels any package or bag containing garden or vegetable seeds or any other agricultural seeds, not including those of trees, shrubs or ornamental plants, 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.

It will be noticed that two things are looked after, purity and in most cases germinating power. The law does not, and cannot of course, cover the points which relate to vitality, trueness of type, and high productive power of the seed. These most desirable characteristics may be entirely lacking. Nothing brings out this difference in vitality and individuality in seeds better than the recent work in corn improvement, where, to all external appearances, ears were of equal value, yet when tested by the ear row method great differences were shown.

The losses due to the obstructions to the growth of our farm crops are enormous each year. The loss due to disease is a great tax on the expenditure of labor by the farmer, as well as seriously affecting the financial returns. It is estimated that potato diseases cause an annual loss from that crop of $36,000,000; that oat smut causes losses from the oat crop of $6,500,000; that stinking smut of wheat causes a loss of $11,000,000 annually. The losses from "rusts" are estimated at hundreds of millions each year. These do not include insect injury, and the damage by weeds, the latter being estimated to detract at least thirty per cent from the value of the crop. Not only does the farmer suffer direct losses, but he must also make the outlay of money for spraying material and appliances; and the great industries depending on the crop for their maintenance are also seriously affected. It is apparent that any work, either by breeding or seed selection, which would lead to the development of farm crops with extra disease resistance ability, would lessen to a great extent these losses. This work is well inside the possibilities of seed selection.

There is no waste on the farm greater than that which comes from using poor, unknown seed. The Maine farmer should constantly keep at least three things in mind in making his selection; namely, seeds that will give an increased yield, seeds that have strength to withstand unfavorable temperatures and soil conditions, in other words, seeds that have vitality, and seeds that will produce a crop which will mature in an average season of growth. The work now being done on this last point on sweet corn alone, by the Maine Station, ought to be of inestimable value to this State in the future. Increased yield must be obtained because increased land values, and expenses of operation and living, demand it. New uses for farm crops in the great industries make increased production desirable; and eternal vigilance must be exercised in selecting seeds or plants, for crops left to themselves, or propagated by haphazard methods, "run out."

The improvement of farm crops by selection does not involve a knowledge of plant breeding. It is not intricate work. It may not be breeding at all. It is simply recognizing the laws of nature in which like may be expected to produce like, and the "survival of the fittest." Man simply steps in and does in a short time what nature takes years to do and sacrifices countless individuals to accomplish. The improvement of farm crops by seed selection is simply the weeding out by a rapid process of all unfit individuals. The principal things necessary for success are a desire on the part of the man to improve, an eye keen enough to detect desirable characteristics worth retaining, and a willingness to put some time and thought on the matter.

It is strange that even in this State the subject of the improvement of crops, except in here and there an isolated case, should go so long without having much attention paid to it. Many of you have been keen to the possibilities of improving your herds of animals by selection. You would not think of using any but the best individuals, and those that you felt would have the power of transmitting the desirable characteristics which they possessed to their progeny; and yet in your farm crops you have been content to use seeds which came from no one knows where. Plant breeding is just as sensible as animal breeding, and why not organize in different localities societies for the improvement of your farm crops just the same as you have organized cow testing associations for determining the profitable animals in your dairy herds, and animal breeding associations for the study of breeding problems, and for the added financial gain which co-operation brings to you in the sale of your animals.

Now it is hardly enough that you should simply obtain some good pure seed,—pedigreed seed perhaps. Success in crop improvement will depend quite as much on the conditions under which you grow the crop from that seed, as on the seed itself. It can hardly be expected that the best of seed would give the desired results in a "run down" soil, or where it had to fight for its very existence with weeds in untold numbers. It means that if you are to improve the quality of your crops grown, you must practice better preparation, cultivation and fertilization, keep the land free from weeds, and then select the most promising individuals.

So far I have tried to call your attention to the desirability of farmers themselves giving more attention to this important matter of seed selection, and to the comparative simplicity of the work. During the six years that I worked with you in this State, I came to feel that there were great possibilities with many of the crops now growing here.

Just at the present time there is much enthusiasm being shown in corn culture, and well there should be, for last year's corn crop aggregated $1,615,000,000 in this country. When corn could be laid down in the markets of New England for twenty-nine or thirty cents a bushel, there was perhaps some reason why you, in Maine especially, should not grow corn. But with the price ranging from seventy to ninety cents, as it has during the past ten years, there is every reason to take up corn growing again with renewed vigor. Unless one has studied the types of corn growing in Maine, he will really be surprised at the amount of good corn growing here. The yield, too, is astonishing. Last week's Maine Farmer reported Baker and Priest, of Cornville, only a short distance from where this Dairymen's Association is now meeting, to have produced eight hundred and thirty-three bushels of corn from five acres; and last year my attention was called to a forty-five ton silo over in East Sumner that had been filled with silage corn grown on two acres of land. Doctor H. M. Moulton, of Cumberland Center, told me in a letter last week that he had raised this year nearly six hundred bushels on a little over three acres.

In my talk before this association last year I outlined briefly the methods to follow in improving a variety of corn. That paper is published in the annual report, and space need not be taken at this time to repeat the directions. Suffice it to say that corn is one of the easiest and most fascinating plants to work with. You can do almost anything you desire with it in a short time.

You probably never stopped to think how important a single kernel of corn is, or how that kernel may multiply itself in three generations. One kernel of corn will produce an ear. There are from four hundred to twelve hundred kernels of corn on individual ears, varying with the type and variety. Taking eight hundred as an average number, each ear will produce in the next generation, eight hundred ears; and these eight hundred ears in the next generation will amount to six hundred and forty thousand ears, or approximately six thousand to eight thousand bushels. How important, then, is this insignificant kernel of corn with which you start.

Doctor Hopkins, of Illinois, produced almost sterility in a strain of corn by selecting the poorest yielding stalks in four generations. On the other hand, in ten generations, by selecting for the desired characteristics, he increased the protein content from 10.92% to 14.26%. He also decreased the protein from 10.92% to 8.64%. He increased the oil content from 4.70% to 7.37%. The Nebraska Station found the difference in yield from different ears to range from thirty-five bushels to eighty-one bushels to the acre. The Wisconsin Station found the variety Silver King to vary, using different ears, from fourteen bushels to ninety-seven bushels to the acre, and the yields from single ears to range from one and one-half to fifty-six pounds to the ear. One year's selection of ears showing marked vigor and vitality at Wisconsin, showed a gain in favor of the selected corn as follows:

1905	22.5	lbs. seed corn
	97.0	lbs. marketable corn
	7.2	lbs. nubbins
1906	53.1	lbs. seed corn
	132.0	lbs. marketable corn
	13.0	lbs. nubbins

The Government tested three thousand ears for vitality, and found fifteen hundred of them unfit for seed. An increase of fourteen per cent in yield was secured as a result of the better stand, and more productive plants, coming from this selection.

The Maine potato crop cannot be surpassed by any state, either in yield to the acre or quality of tubers. Compared with the work done on wheat and corn in this country, that done toward improving the potato crop falls into insignificance. Just one or two illustrations will serve to show the possibilities of improving this crop by better seed selection.

The Ohio Experiment Station (Bulletin 174) shows what was accomplished there in increasing the yield by selecting the best hills. The experiment covers the years 1904-1906 inclusive. "In 1904, ten hills were planted from potatoes selected from ten heavy yielding hills, and likewise five hills each from seed from twenty low yielding hills of the crop of 1903. These one hundred hills of each crop were compared with one hundred hills planted from seed selected in the ordinary way. In 1905 and 1906 the experiment was repeated, the seed having been selected respectively from the high yielding and low yielding hills of the preceding year's crop."

The results are given in the following table:

Source of Seed.	Yield of 100 hills. Total 1904.	Total 1905.	Total 1906.	Average 1904-6.	Number of tubers in 100 hills. Total 1904.	Total 1905.	Total 1906.	Average 1904-6.
High yielding hills ...	125	173	116	138	781	865	676	774
Check rows	115	136	79	110	713	630	479	607
Low yielding hills....	84	75	61	73	566	546	364	492

The yield of potatoes from the high yielding hills was 25% greater than from the hills planted after the usual method and an increase of approximately 89% over those from low yielding hills. From the standpoint of yield per acre in bushels the results would be as follows: If 200 bushels to the acre could be raised by selecting seed by the haphazard method, 250 bushels might be raised from the same amount of land, labor and fertilizer, and 378 bushels to the acre when compared with the yield to be obtained if the seed came from low yielding hills.

Mr. L. G. Dodge reports in Farmers' Bulletin No. 365 results in improving the yield of the potato crop as follows:

"One man in Michigan started several years ago by saving a large number of separate hills of potatoes. Each hill was from one seed piece, and only such hills as contained six or more smooth tubers of merchantable size and no cull tubers were saved. Of the potatoes grown in the field the first year, only sixteen hills out of every 100 were of the standard required. All the tubers from these hills were planted, and soon enough seed was available for the entire crop, the selection in subsequent years being made from the more thrifty-appearing portion of the field. After the plan had been followed for five years, seventy hills out of one hundred were found which met the requirements, i. e., the percentage of good hills had been increased from sixteen to seventy in five years of selection. The yields on this farm were about double those on the ordinary farm in the same locality, and all the increased yield could not be attributed to the better culture of the crop. The yielding power of the good hills of potatoes in this case was not necessarily increased at all, but the progeny of various plants furnished more and more of the seed for the crop. The writer has had the opportunity to select hills of Rural New Yorker potatoes for two years. The first year eight per cent of the hills were saved, and of the crop grown from that eight per cent the second year there were found to be twenty per cent which met the requirements."

Besides the matter of increased yield by proper selection, the same system might be carried out in hastening maturing, giving more vigor to the plant, increasing its power to resist blight, and other desirable qualities.

I could continue to give you statistics showing how all of our leading farm crops can be improved by seed selection, but these would only weary you. The reports of work along this line can be found in quantity sufficient to fill volumes in the reports of the experiment stations of this or other countries.

I am sure you will all agree that the Maine hay crop is not what it should be. It is the crop universally grown by farmers in this State, and yet when we consider that the yield is only nine-tenths of a ton to the acre, it does not begin to pay for rent of land, fertilizer if any was applied, seeding, and the cost of cutting, curing, and storing the crop.

Timothy and clovers have been neglected to a great extent in our study. We seem to have been content with the original type given us by nature. Perhaps in no other line have the seeds been so poor as with the grasses and clovers. More than a million pounds of clover, having the following composition, was imported to, and sold in this country in 1906.

Analysis of sample:

Red clover	74.06%
Other seeds	12.17%
Dirt and broken seeds	13.86%
Live red clover seed in the sample	43.16%
Price paid per one hundred pounds	$7.61
Actual cost per one hundred pounds, based on percentage of good seed	$20.39

A low priced sample of crimson clover, selling at $5.75, had only 0.82% of good seed. It contained less than a half pound of actually good seed per bushel. Based on the price paid, a full bushel of good seed at this rate would have cost something like $703.00.

My authority for the above figures, which may seem almost astounding to you, is the year book of the United States Department of Agriculture for 1908, and Farmers' Bulletin No. 111.

But there are several other things needed to improve the hay crop of Maine, besides the using of good seed. There are needed, better preparation of the soil, better fertilization, and a discontinuance of the practice of robbing the soil (a ton of ordinary mixed hay carries off about $6.50 worth of nitrogen, potash and phosphoric acid), and more attention must be paid to time of cutting. The character of both timothy and clover plants needs studying, and selection should be practiced. You should select a type of timothy that will mature nearer the time that red clover matures, and one that would have a tendency to produce a second crop. Early, medium, and late sorts should be developed. These would allow the cutting of the hay to be carried on to better advantage. Varieties having more leaves, stronger stems, more vigorous stooling habits, and those adapted especially to hay making and to pastures, should receive attention. It would no doubt be as possible to develop by ten years selection, a type of timothy having a high content of protein, as it was to change the protein content of corn.

Clover should be selected for hardiness, yield, power of adding more nitrogen to the soil and protein content. Perhaps our good red clover, by proper selection, could be made to approach alfalfa in protein content if a little attention were paid to it. My observation is that a good deal of valuable co-operative and demonstrative work might be carried on in this State, in proper methods of preparing the soil, seeding, fertilizing the hay crop, and in demonstrating the value of early cutting in prolonging the life of the hay field.

Pastures are another thing on which very little work has been done in the East. A pasture usually means some rough, bushy, half cleared place, which dries up early in the summer, and from that time on until the next summer yields practically nothing. For some time to come the dairyman will depend largely on his pastures as a source of summer feed. We recognize the value of soiling, but still stick to our pastures. In the matter of pastures, our Canadian friends, and more especially our foreign friends, are far in advance of us. There are certain grasses, like Russian Brome Grass, and others, adapted to rough, dry land, which are being successfully used in Canada for pastures. It would be a valuable piece of work if some one would test out some of these desirable pasture grasses on the so-called pastures of this State. Seeds had already been purchased before I left Orono for a test in the pastures on the College farm, and I hope those who are to have this work in hand there in the future, will interest themselves in this problem.

No less than a dozen men in this State have told me that alfalfa was growing wild, and had so grown on their farms for years. If alfala could be successfully grown in Maine, it would be the "salvation of the dairyman." I have long felt that one solution of the alfalfa problem, if it could be solved here in the East, would be through the gathering and selection of seed from these plants already acclimated, and the improvement of the crop carried on from this selected seed.

With sweet corn the work is already under way, and no doubt within a very few years you will have developed a strain of corn maturing two or three weeks earlier than it now does, and still retaining the quality which gives Maine sweet corn first rank in the markets of the world.

There is one crop which I have not mentioned. It is consumed in great quantities in the State, was formerly produced here in sufficient amounts for home consumption, and can and should be grown as extensively again. It is a shame that Maine should look to New York and Michigan for the most of her beans. So far as I know, the only drawback at present is the rust and anthracnose. If blight resistant potatoes, tomatoes, and other plants, can be developed by selection, it would seem that it would be within the range of possibility to develop a rust resisting bean.

There are other crops of minor importance that would yield to the skill of proper selection. You realize the need of this as well as I, and it is not necessary to treat this part of the subject at greater length.

If it is highly desirable that this State should foster the introduction of good seeds, it is just as desirable that some study should be made of those obstructions to growth which lessen the yield and entail the expenditure of much time and money in warfare against them. In this State a study of the methods of eradicating the Canada thistle, witch grass, orange hawkweed, daisy, buttercup, and other pests, together with insects attacking the crops, should go hand in hand with the movement to improve the crop.

I have said nothing about the improvement of fruits, vegetables, and flowers. Opportunities equally as great with these await the man who will devote his time and effort in that direction, but a discussion of these more properly belongs to the work of another association. These crops, however, should not be left out of consideration in a movement of this kind.

If a State-wide movement in Maine for the improvement of our farm crops is to be started, it must be carried on along the lines of an organized co-operative effort. As examples to follow we have plenty of successful enterprises of this nature in Canada, and in other sections of the United States. In Canada they have associations organized for the study and improvement of every crop they grow. I pointed out in detail the success of their co-operative fruit growing associations in my paper before the Pomological Society at Norway three weeks ago. Their grain growers' associations have been equally successful.

"The Ontario Agricultural Experiment Station Union," organized and fostered by the Ontario Agricultural College at Guelph, is one of the most famous movements. This union has been organized twenty-four years. It is an outgrowth of the experimental work on the College farm, by Professor Zavitz. Here about fifty acres are used for the experimental plots, which number about five thousand. Co-operative experiments were carried on, on eight thousand farms in that province last year. There were thirty-eight experiments in agriculture alone. In fifteen years more than nine thousand people have been interested in horticultural experimentation.

Since the union was organized, more than forty-nine thousand people have conducted this co-operative work. The method of conducting the work is as follows: Circulars describing the work in detail are distributed each spring. Those are sent out broadcast through agricultural organizations all over the province. Careful instructions for conducting the experiments are sent later. The experimentors keep full data and furnish this to the union to be used at its annual meetings. This work brings a large number of people into sympathy with the movement. It brings people to the college,—forty thousand farmers visit that institution annually and over three thousand of the experimentors gather at the college to talk over the work at one time. Last year more than seven hundred people applied for admission to the union, but could not be taken in.

Even in what to us seems far-off Saskatchewan, they have well organized grain growers' associations. An especially active one has prize competitions in standing fields of grain. The by-laws of this association say that it is organized,

"1. To stimulate an interest in first-class seed.
2. To encourage the maintenance of breeding plots aside from the main field.
3. To obtain pure seed.
4. To increase the yield.
5. To encourage intelligent farming."

There are various other associations in Canada. I think I have seen as many as twenty-five different bulletins issued from the Department at Ottawa. These treat nearly every phase of crop production, including germination, fertilization, seed selection, judges' score cards, and dozens of papers on allied subjects.

Mr. James Robertson reports that one of the results of the organization of the "Canadian Seed Growers' Association" was an increase in the value of the grain crops of five hundred thousand dollars in one year.

Coming to the work done in the United States, we find that the middle west is already well organized for crop improvement.

The work of the Illinois Experiment Station led to the organization of the "Illinois Seed Corn Breeders' Association." This organization, at its own expense, now employs experts to study corn and other grains, and has well equipped laboratories which are at the disposal of its members. Seed corn associations exist in nearly every county of that state, and many of the members of these have taken up the production of seed corn and grains commercially.

Iowa has organized similar associations, and due to the great work of Professor Holden, has placed itself in the front rank of states offering improved seeds for sale.

Nebraska, for the past ten years, has carried on a series of most valuable co-operative experiments, covering all of the principal grain crops.

Kansas, through the Department of Agronomy at the State College, has undertaken to supply seeds of high grade to farmers at prices considerably above the usual market price.

"During the past three years the Agronomy Department of the Kansas Experiment Station has distributed nearly four thousand bushels of good seed of the best producing varieties of winter wheat, fifteen hundred bushels of well bred seed corn, eight hundred bushels of seed oats; five hundred and fifty bushels of barley, and smaller quantities of emmer, rye, flax, millet, cowpeas, soy beans, and Kafir corn and sorghum, or a total of about seven thousand five hundred bushels. Our seed grain is sold by order and is distributed in relatively small quantities—not more than twenty bushels of wheat or five bushels of corn to a single purchaser. This method allows for a wide, though not very uniform distribution. We advertise through correspondence, by circular letters and through the farm papers, mainly by publishing replies to inquiries. We keep a record of each sale and record the address of each purchaser, and usually ask for reports every season, sending out a list of questions for each grower to answer.

Some twenty questions are asked in the blank forms which are sent to the several growers. These questions are usually not very fully answered, yet on the whole, some valuable data are being secured in this way regarding the adaptation and productiveness of the several different varieties in different sections of the state. One of the main purposes of the report, however, is to learn the purity and quality of the seed and what quantity of the seed grain the party has for sale.

These replies are listed and the list is sent to other farmers who inquire for improved seed grain. In this way we distributed some 20,000 bushels of Kharkof and Turkey Red wheat and other improved seed grains last fall. The seed wheat and other seed grain sent out by the Department have given uniformly good results. Farmers have generally reported increased yields from the College seed, varying from ten to one hundred per cent above the crops from common or average seed grown on the same farm or in the neighborhood.

It is true that not all of the replies are favorable, but the unfavorable results may be usually traced to carelessness in handling or to unfavorable conditions of soil or season.

This year one of our assistants in the Department, Mr. C. S. Knight, made an automobile trip through the great central belt of the state just about harvest time, and inspected a large number of the fields of wheat grown from College bred seed. The farmers who are growing the purest and best grade of wheat were requested to save their wheat for seed, and later this list was published and supplied to those desiring to purchase well bred seed wheat.

Up to this time the seed distributed by the Department has been largely well selected and well graded seed of some of the best standard varieties or new importations which have been tested and proved superior to the common varieties generally grown. In the judgment of the writer the distribution of such seed has been of immense value to the state. There is a vast difference, as every agronomist knows, in the productiveness and hardiness of different varieties of the same crop, and it is true of nearly all crops grown on the farm that they are all badly mixed. Take wheat for example: Kansas is one of the great wheat producing states, and yet I find in traveling over the state and observing samples of grain exhibited and delivered at the elevators that we have no pure bred wheat; it is all mixed. There is some well bred wheat, especially since the Station began to distribute seed wheat, and some of the farmers are doing good work in growing seed wheat and keeping their wheat as pure as possible, but there is no pure seed wheat to start with. The Station is producing pure bred varieties by breeding by the "head-row" method, but even the best varieties with which we start are usually badly mixed. While the varieties of wheat may vary greatly in yield and quality of grain produced, the product from planting the grain of selected heads of a single variety in separate rows may show even greater variations than the average crop from different varieties. With nearly all of our standard crops, the first step towards improvement is to secure a pure bred strain or variety."

I have purposely left the work of the Wisconsin Agricultural Experiment Station Association until the last because this organization seems to be accomplishing as good, if not better, results than any of the others. The association has been in existence for eight years, and is made up almost entirely of ex-students of the long or short courses in agriculture at the University of Wisconsin. The purpose of this Association is well set forth in its declaration of purposes.

"The object of this Association shall be to promote the agricultural interests of the State:

1st, by carrying on experiments and investigations that shall be beneficial to all parties interested in progressive farming.

2nd, to form a more perfect union between the farmer and present students of the Wisconsin College of Agriculture, so as to enable them to act in unison for the betterment of rural pursuits in carrying on systematic experiments along the various lines of agriculture.

3rd, by growing and disseminating among its constituency new varieties of farm seeds and plants.

4th, by sending literature bearing upon agricultural investigations to its membership.

5th, by holding a meeting in order to report and discuss topics and experiments beneficial to the members of the Association."

The work of this Association is aided greatly by an appropriation of $30,000, made by the State for the purpose of carrying on itinerant schools of grain growing and judging, animal husbandry, dairying, horticulture, and soils, all over the State.

The Association now has a paid-up membership of over eleven hundred. Reading their annual report I find this statement:

"The marked influence of having so large a membership to carry on tests and experiments where the average farmer can see them, is bringing great results throughout our State. Many of our farmers will not read, but they are close observers, and will readily banish scrub grains, scrub stock, and scrub farming, if shown that it is wise to do so."

This Experiment Association means much financially to its members. They had a display at the National Corn Show last year which attracted much attention to their State, and sold thousands of dollars worth of their seed. It is estimated that the members sold more than $200,000 worth of select seed last year.

The Wisconsin Agricultural Experiment Station Association is a living medium that is constantly in touch with the source of investigation and the practical operation of the farm.

They furnish their seed to Wisconsin's leading seedsmen and cannot begin to supply the demand. Along with their other work they have taken up a study of weed extermination. In the back part of their annual report a list of the members who grow select seeds of different kinds can be found. If you are in need of seeds, turn to these pages and you will find where you can obtain them.

The two things most in favor of this Wisconsin plan, it seems to me, are: the intelligence of its members,—they have all had ambition enough to go to their State College at least for the Farmers' Course; and secondly, the farmers themselves reap the benefit of their work and experimentation, aside from the good received in making the study, in the added financial gain.

The time is certainly ripe in Maine for some such movements as I have described. The first step is to secure desirable seeds, and then convince the farmers of the advantages they may gain by planting this better seed, and giving more attention to the care of the crop. Field meetings to work up general interest should be held. Better seed trains should be run over the railroads and trolley lines. Extensive fair exhibits, with lectures and demonstrations, should be planned. Advertising matter, showing the results of the use of better seeds, should be distributed everywhere. Field agents, working in the same capacity as the dairy instructors and testers of the Cow Testing Associations, should be employed; and the Experiment Station, the College of Agriculture, and the State Department, should get together in a concerted effort for this extension work.

I understand that Commissioner of Agriculture Gilman expects, in the near future, to begin some work along this line. The success which he and his co-workers have attained in the organization of the most successful Cow Testing and Breeders' Associations in this country, insures that his work toward directing a campaign for crop improvement will be equally successful.

The Dairymen's Association, being the general agricultural association in this State, should interest itself in the movement, should back him up in this work, and you should see that he is provided with sufficient funds to prosecute this work satisfactorily and effectively.

The movement toward crop improvement by the farmers themselves is one of the evidences of the "new agriculture." It means no more haphazard methods, at least in this one direction. It means that one of the greatest wastes on the farm will be stopped. To be of most value, seeds should be bred near the place where they are to be used. A combined co-operative effort to improve the crops of this State by seed and plant selection, and adapt them to conditions here, will do more to make a permanent and prosperous agriculture in Maine, than any other one thing that could be mentioned. Are not some of these things worth thinking about and adopting in this State?

PROF. SANBORN—I hardly know how to enter into a discussion of the subject of the paper in any broad way. One thing is certain,—the revenue of the farmer is derived from the plant. Plant raising is the business of farming, and not only are plants the measure of the farm income—all animal products are derived from them—but really they are the measure of all values from the beginning. I apprehend that there is no subject of deeper importance to the farmers of the State than the breeding of seeds to a higher level of production. No crop is so flexible in the hands of man as the corn crop. I remember distinctly some experiments made years ago in Mississippi, in which the crossing of two varieties of corn, not widely dissimilar (that is never desirable) resulted in increasing the crop, if I recall correctly, at least ten per cent. Take two varieties, one in each row, and then just before pollination tear the tassels out at one side and that will force the crossing of the varieties, and if it is a wise cross you will have a phenomenal crop. At the cost of a few cents per acre you will be able to increase the crop ten per cent. These facts are current literature in America, but strange to say, almost no farmer does these things. It is passing strange to me that with material so open to every farmer and knowledge possessed by many of them, these are not used. It is the same with other seeds. While they are not so easily controlled as the corn crop, yet they are controllable, probably, in the same degree. Corn is very easily controlled. If you have a stalk too light, or if you have a plant that runs to stalk, and little to ear, observe those points. Fix in mind the type of corn you want and by selection in the field you will be able very quickly to fix that type. Nothing in all my experience in breeding impressed me so much as the ease with which the whole plant of corn was changed by selection. How far that would be permanent I do not know, but at least it is so quickly and easily changed that it can be made a part of a permanent system of corn growing, and a vast amount of wealth can be added to the State of Maine at a slight expense by this matter of selection of seed of corn. It is within the knowledge of every one that corn is high, and prices today are well within the limits of high profit. The time now is when our corn can be raised at a very great profit. Last year you came very near paying one dollar for a bushel of corn. And I have no doubt the corn crop in the future will pay nearly as well as the potato crop. I can but feel that the drift of Maine agriculture toward more corn growing in connection with better tillage is the most promising line of farming.

C. S. STETSON—I am not competent to discuss any of the admirable papers to which I have listened, and the one excuse which I can have for taking any of your valuable time is that I want to be identified with the work which this association is doing. I want it definitely understood that the organization which I represent is a part of this work and that the members of the organization are a part of the work and are to be identified with it. I can see no reason why the agricultural interests of our State should not work together in harmony for better conditions in rural Maine. So far as I am concerned, and so far as I can dominate the policy of the State Grange of Maine, we will all work together along these lines, so long as I am Master of the Grange; and I cordially invite you, Mr. Chairman, as the head of one of these organizations, to use the grange, and use their homes and use their meetings for promulgating your gospel.

It occurs to me that this Dairymen's Association has been a potent factor for good in our State. I well remember the time when the Dairymen's Association was organized. It was several years ago; and in looking back over the time which has elapsed between that day and this, I think I can see great improvement in agriculture, in farm conditions, in farm homes, and especially in the dairying interests of our State. And I believe that a large amount of the credit is due to the work which this organization has done. I also notice that there are many of the farmers of our State, many men who are engaged in agriculture, who are willing and sometimes it seems as if they are anxious to say that Maine and the dairy interests in Maine are behind those of other states. They do not seem to be willing to say a good word for Maine and for its dairying interests. I respect the man who is willing to shout for his own State. I went down to Aroostook County in June to attend grange meetings and talk to grange audiences, and incidentally to talk grange work to people who were outside of the Grange. After I had been there a few days I found that it was absolutely impossible for me to talk grange outside of a grange hall. The people wanted to talk potatoes, and to talk about Aroostook County. I went there again in August and I made a resolve that I would not talk about potatoes or Aroostook County, but in five minutes after I crossed the line I was talking about both. It is a pretty good county, but I believe that a large part of the prestige which Aroostook County enjoys in our State and outside of it, comes from the fact that the Aroostook people stand up for their county. I believe in Maine; I believe in every county in the State of Maine. We ought to have a Boosters' Club, and I believe that every man, woman and child who lives in rural Maine ought to join the Boosters' Club. If there was one organized in Aroostook County I think they would all join that club. My friends, when each and every one of us gets in just the position where he ought to be, when we are willing to join the Boosters' Club, when we are willing to strike hands with every other citizen of rural Maine in getting better conditions for Maine, and leave out the petty personal jealousies which enter into our work, the fear that some other man will get in advance of where we are, then I want to say to those who put up this motto, they can eliminate that and say that Maine leads instead of "Maine must lead." Brother Bradford said it was not a very far cry from the whitewashed tie-up to the family bath tub. I believe that better conditions in any department inspire in us a wish for better conditions in all departments of our home life and our home work. The time is coming when clean milk from a clean cow housed in a clean barn and milked by a clean man, will find a ready market at a very remunerative price. I want to assure you that as Master of the State Grange I wish to be identified with anything that benefits rural Maine.

C. L. Jones—I have been very much interested in the papers and discussions here today. I am in sympathy with any and all movements which would tend to increase the value of the dairy products of our State. And yet as a producer I feel as though there are many things which are pretty hard for the average farmer to comply with, in order to produce products which are essential for the markets at the present time. Prices as we all know are comparatively high, but when we stop to consider the cost of production, I think it has more than kept pace with the cost of the product. My good friend Mr. Bradford brought out the idea that we wanted larger dairies, and that is true, I think, both for the creameryman and for the farmer. How to care for them is the problem which is confronting the most of us, and it is one thing which is having a tendency, I believe, to decrease rather than increase the dairy products of the State of Maine. It seems to me that here is a question that we ought to consider, from the standpoint both of the creameryman and the producer, and in some way try to see if it can be solved.

I notice that the Boosters' Club calls for better dairy animals. That is something that we certainly need in the State of Maine, and how to secure them is one of the problems with which the most of us farmers have to deal. Certainly we cannot buy them, and it is difficult to breed them under present conditions; for as our State laws have been, every man who tries to make an improvement in the stock industry of the State by the importation of pure bred stock has simply been a target for the man who advocates the testing of animals for tuberculosis, and I think the stock industry of the State, the dairy industry, has suffered from the fact that it has generally gone out that pure blood animals are more susceptible to the disease. I think you will all agree with me that it is through the medium of pure blood stock that we must seek for the improvement of our dairy animals.

I am free to confess that I do not like coming up to the dairy meetings every year and hearing the dairyman assailed, the man who milks the cow, as being so careless and indifferent, because he is not. He is not as a rule a dirty or a filthy man, and if the man who assails him had as much work to do and was obliged to do it himself, with the meager pay which the dairyman gets, he would go out of the business. In my section of the State probably the inspection of milk is as rigid as anywhere in Maine, and yet we find no difficulty in the majority of instances in producing milk which is satisfactory to that market.

IMPROVING THE NATION'S MILK SUPPLY.

Extracts from Stenographic Report of Lecture Illustrated by Stereopticon.

By Prof. IVAN C. WELD, Washington, D. C.

We have come together tonight for the purpose of discussing some of the things which will help improve the nation's milk supply. When we speak of the nation's milk supply we are speaking of a tremendously big thing. We know that this nation is growing and developing very fast, and that the demand for food products has pretty nearly caught up with the production of those products; and we are told that of all the products that are used by the human race there is none of greater importance than milk. The milk question is being agitated throughout the entire country and throughout the length and breadth of the civilized world. The demand for pure, clean milk is a demand which is growing, and a demand which the people of the country are beginning to realize must be met. What really are the people asking for? What is there to be desired that we do not now possess? Dr. Jordan of Boston, whom you heard this morning, says that it costs money to keep dirt out of milk. That is why clean milk is somewhat more expensive than the other kind. It costs money to produce it, but the cost need not be excessive. It need not be such as would prohibit the use of that article. We are met here for the purpose of looking into these conditions and studying for a little while some of the whys and wherefores. Cleanliness is essential; low temperatures are also essential, and when you have said those two words, cleanliness and cold, you have answered the whole question. Those two are the only really important things in the improvement of the milk supply. First, cleanliness, second, cold.

We will attempt to discuss these conditions as the slides are shown.

I want you to realize that the dairyman has to confront a pretty serious proposition. The picture on the slide shows the bottom of a bottle of milk which was set on a doorstep in Washington, and when you look at the dark ring around the bottle and note the sediment spread over the entire surface, you realize that rather dirty milk was being sold in the city of Washington. The price of that milk was eight cents per quart. In examining something like 200 samples of milk in that city, not a single sample was found entirely free from these objectionable qualities. The condition which prevailed in Washington at that time is typical of the conditions that prevail in the majority of our large cities. I have learned this from my personal observation, and I know it to be true.

You have seen the condition of this milk on the screen; at the same time in that city, milk from another farm located about one mile distant was being sold at the same price, produced under entirely different conditions. In the one instance the farmer was probably a clean, painstaking man, and in the other instance he was not. This illustrates the fact that in altogether too many cases the whole producing body of dairymen are blamed when in reality the blame lies with comparatively few. The difference between clean and dirty milk is very apparent in cheese making. In the curds made from clean milk we have a firm, solid texture, a good, smooth, hard curd. Those who are cheese makers will recognize that it is this curd that produces good cheese. In dirty milk there is another condition. In other words, the germs associated with filth and dirt often produce gas and wherever those germs are distributed through curd, in developing and producing the gas they have formed little holes, just as yeast produces openings in the dough when the bread is set beside the kitchen stove at night. Much as is said regarding disease germs, and much as is the danger from them, in all probability the germs associated with filth and the ordinary stable dirt produce more sickness and death among babies than all the disease germs combined. Disease germs play a very important part in the death rate among infants, but dirty milk usually plays a much greater part. This is the report of scientists who have made a careful study of the subject.

Some of the sources of milk contamination are as follows:

1. The atmosphere of the stable. In many cases the cans are taken into the stable, and there the milk is strained. I regret to say that this is being practiced in altogether too many cases today. During the last few months it has been a part of my duty to visit quite a good many farmers, some of whom have

been in New England, and let me say right here that in New England this practice is being continued to a much greater extent than I had supposed.

2. The old fashioned tie-up, a tie-up which is full of cracks and crevices, with a loose ceiling. The dust accumulates on the ledges and the beams and a little puff of wind will send it flying into the atmosphere. It is pretty hard to keep such a stable so that clean milk can be made in it. I will now show you a few views of modern stables, which can be easily kept clean.

Here we see a cow stable which in many respects illustrates the modern ideas of light and cleanliness. Such a place need not be expensive. You see that this is shingled on the walls, and windows extend the entire length in practically an unbroken chain. It is not an expensive place and yet it is a place where the animals can at all times be clean and comfortable, and where the dairyman can do his work in broad daylight and with a sense of cleanliness and pride which would be difficult to have in some other places. In such a barn the hay is usually brought in from an overhead truck or else on a trolley. This barn runs north and south, and I believe that wherever it is possible a dairy barn should be so located, especially in the North, where we desire to get as much benefit from the sun as we can. A building located in this way receives the morning sun on one side and the afternoon sun on the other, while at noon, when the sun is least appreciated, it is overhead.

In this illustration we see a section of floor for a dairy stable. It does not matter particularly what material is used, but we do believe that in the majority of cases cement will be found to be the most economical; and where a tight floor is desired, and we all know that it is quite desirable if we expect to maintain clean conditions, we believe it can be constructed of cement for less money, and that it will be of a more permanent, durable character. One of the first things to be considered in the building of a cement floor is to get that floor above the surface of the ground so that all the moisture will drain from the floor rather than on to it. That will go a long way toward maintaining a dry condition, which is necessary in order to have a comfortable condition. You will notice a little depression which enables the farmer to keep the bedding where it belongs a little more readily. The walk back of the gutter should be broad enough so that the cows can pass there without any serious interruption. I presume there is no one plan that is being followed so generally throughout the country today as this. It is a plan which provides the maximum efficiency and the minimum service. That is, there is just as little area to clean and care for as it is possible to have, and yet have a good, solid, rigid stanchion support. We should study not to put as much into our our stables as we can, but rather to keep out all that we can, and have as few corners and cracks, and places for dirt to accumulate as possible.

Ques. What do you mean by a rigid stanchion support?

Ans. I mean a support for a swing stanchion which will be rigid and firm. I do not mean a rigid stanchion. We have passed the day when we desire to put expensive, elaborate stanchions and mangers into our cow stables. We have reached the day when we study to keep out everything we can, to have straight lines and as much open space as possible.

Ques. Will that arrangement keep the cows clean?

Ans. I think that it will be as efficient as any arrangement can be. There is probably no arrangement by which it is possible at all times to keep the cows clean. In constructing a stable, it is a wise policy to make the platform at one end of the stable shorter than it is at the other end, so that the cows may be arranged according to their size. That will help to maintain a clean condition.

Ques. Is there any trouble from the cows getting sore on a cement floor?

Ans. I do not hear any particular complaints as regards that. Occasionally you will hear some one speak of it. Personally, I have seen more cows with bunched knees and sore spots from standing on wooden floors or an uneven surface than I have ever observed from cement floors.

Ques. In the winter time, isn't a cement floor liable to be colder than a wooden one?

Ans. A great deal depends upon how it is constructed. If the floor is built high above the ground so that natural drainage is away from it, and if you have put in a foundation, so that the cement is raised from the ground underneath by means of large rocks, I do not anticipate that you will have very much difficulty. If, however, in constructing a cement floor, you can use soft coal cinders, a layer two or three inches deep over the gravel before you put on the cement, you will have effectually shut off the moisture from underneath. There is another way which has been suggested and I think has proved to be very good. After you have put down the foundation for cement, if you will give it a coating of hot tar, or possibly put on a sheet of tarred paper, and then drive that full of spikes leaving the heads projecting about one-fourth of an inch, and then put on the surface cement, it will be impossible for any moisture to come up. The spikes will hold the cement in place.

There is more or less discussion regarding cement floors and because of that I have made it a point wherever I have had an opportunity, to make inquiry regarding them; and I have yet to find a man who is using a cement floor or who has ever used one, who has any fault to find with it. The only men whom I have heard condemning the cement floor severely have been those who have never tried it.

Ques. Do you leave it perfectly smooth?

Ans. It is probably better to leave the surface a little rough; I mean not to give it that smooth finish that could be secured with a trowel. I believe that a cement floor that is put down in reasonably good shape will be a much more comfortable place for a cow to sleep on than will a wooden floor over a barn cellar or otherwise, unprotected from the winds underneath.

Ques. Can a cement floor be put over a wooden floor?

Ans. That would depend, I think, on the suitability of the foundation. It could be put over a wood floor provided the wood floor and the beams under it were sufficient to support the additional weight.

Ques. How thick should it be laid over a wooden floor?

Ans. It should be laid thick enough so that there would be no possibility of its breaking and cracking. If the wooden floor rests upon a firm foundation, you would not need to use it very thick. Possibly it would require a rather larger amount of cement than you would use in an ordinary cement floor. The thickness probably need not be more than three or four inches, perhaps not as much as that.

The next illustration shows the inside of one of the best barns from a sanitary standpoint that has ever been constructed. We see the swing stanchion in place, the iron pipe construction, separating the stanchions at the top, the bottom part imbedded in the cement. An unnecessary expenditure of money was made when this cement construction was carried up between the cows. In this particular stable, a plank was laid for the cows to stand on, up to about fifteen inches from the gutter, which was of cement. There was a walk five or six feet in width, and the cement work was carried up to the base of the window, enabling the dairyman to maintain a clean condition. If he desired to turn the water on there he could do so. Sharp corners were avoided in the construction of this barn. A great deal of unnecessary expense was put into the mangers in front of the cows. Yet it was a very good place, a kind of place in which some of the highest grade milk that has ever been produced has been made. This is the property of Mr. S. L. Stewart, Newburg, N. Y., probably the most famous dairy in the world; an example of cleanliness which perhaps we would not do well to attempt to duplicate, but from which we can gain some ideas which will be of benefit to us. We will now see the dairy house where the milk is handled. After it is drawn from the cows it is emptied into a tank and is conveyed through a pipe into a cooler, and in about ten minutes from the time it is drawn from the cows the bottles are sealed, and in about five minutes more they are inside the refrigerator. It was in this barn that the famous dinner party was given, where Mr. Stewart entertained his friends to whom he was selling milk, and he did so for the purpose of impressing upon his customers the fact that the place in which the milk was produced was a clean enough place in which to eat.

The Department has been studying dairy barns and dairy houses and we have endeavored to make some plans with the best features that we have been able to discover, and at the present time we are able to furnish free of expense to the dairymen who desire to rebuild or remodel or build anew, such plans and specifications as will enable them to erect a structure with all the necessary requirements, for the minimum expense.

3. The third source of contamination to milk is the place where it is cared for outside of the stable. The next slides will show you some of the places where I have found milk kept,—a kitchen where the dog makes himself at home, a horse stall

with harnesses hanging on the sides, and the end of a tie-up, the cobwebs about the door separating it from the cows indicating that the door has not been closed for at least a day or two.

The next picture illustrates what may be accomplished for a very little money in the building of a place for the storage of milk, where milk is wholesaled. It need not be more than eight feet square but it should be located where it will be free from contaminating surroundings.

4. The next source of contamination is found in the hair and dirt which fall from the cow's flanks. In this illustration we see what may result from a single hair plucked from the udder of a cow and laid across the culture dish. You will see that the bacteria from that hair have grown and spread in every direction

5. Unclean or rusty dairy utensils. You will see in the illustration a milk pail in which the rust has eaten through and the little openings have been stopped with cotton rags. This milk pail was in use on a farm where we had a right to expect better things.

In this connection I will show you a slide which illustrates the principle of the small top milk pail. By the use of that pail two-thirds or three-fourths of the dirt which would ordinarily fall into the old styled milk pail can be eliminated. We must realize, however, that the first time we attempt to use a new tool we may find it a little difficult, but just so surely as we practice just so surely we will succeed. It is just as well to draw the milk into a small opening, in a majority of cases. Nine cows out of ten, and probably a larger per cent than that, can be milked, and very readily milked, into a pail having a small top.

We must keep the dirt out of the milk pail so far as possible. If we clean the udder of the cow with a damp cloth, to remove the floating dirt, and use the small top milk pail, and then cool the milk quickly to fifty degrees or lower, it will go a long way toward solving the problem of a clean milk supply.

6. An impure water supply. In this view, taken in Louisville, Kentucky, we see a pool of stagnant water and beside the pool a load of manure from a neighboring barn. The outbuildings and the general uncleanliness of the whole surroundings indicate what a source of contamination to milk this must be.

The fences were so arranged that three different herds had access to this pool of water and they were evidently dependent upon it for their water supply. In another place the manure was carefully removed from the barn into the yard so that it would not contaminate the stable, but every time there came a rain, or during a wet season, the drainage was such that a little rivulet was formed and passed down four feet from an open well and the water supply from this well was used for dairy purposes. I think that in altogether too many cases we fail to appreciate the danger that may result from such contamination; far too often our wells are located near the barnyard. I believe our water supply is a matter into which we should look very carefully if we expect to produce the right kind of dairy products.

7. The fly is another source of contamination. The picture on the screen is designed to show that a fly's foot has a good many parts and those parts are pretty well adapted to the carrying of filth. You remember that the fly has six feet and often he feeds in the most unclean places, and on those feet there may be an accumulation of filth which will be carried to everything with which he comes in contact. In Denver, Colorado, a year ago this fall, the flies were held responsible for 56 cases of typhoid fever on one milk route, and seven deaths resulted. The trouble was due entirely, as investigation showed, to the flies feeding upon the excreta from typhoid patients and then covering the dairy utensils and the surroundings where the milk was handled.

In the next illustration we see that the flies were feeding on the milk strainer and the cooler. Those of you who are dairymen—and I presume the most of you are—will realize that there is another condition here, perhaps fully as serious as the fly, because you will recall that you have never seen milk coming from a clean cooler in that way. You will remember that when the coolers are clean the milk comes out in a thin sheet spread evenly over the entire surface. In this case it comes in streams because the cooler is covered with dust.

8. The unsuspected but dangerously tubercular cow. On the screen before you is a photograph of a cow 18 years old when the picture was taken. She does not look particularly smooth; naturally a cow of that age would not. She was a

cow kept by the Government for experimental purposes and was known to have had tuberculosis for six years, or from the time she was 12 years old. She is known to have been distributing the germs of tuberculosis through the medium of her feces during that time, and yet so far as physical examination by competent veterinarians could determine, no traces of the disease were apparent. The tuberculin test was the only agent that revealed it.

We will now look at another cow, a young cow in very good condition, evidently good for beef. She reacted to the tuberculin test, however, and was condemned and slaughtered. The disease had developed so that tubercles were found not only in the lungs and liver but on the ribs and they were as large as walnuts. This again shows us clearly that the unsuspected cow may be the most dangerous. I do not believe that we, as dairymen, should go on indefinitely breeding the germs of tuberculosis. I realize that we have a deep interest in the public health, but even if we did not care at all for the public health, from an economical standpoint I do not believe that the dairymen of this country can afford to expend fourteen millions of dollars yearly, which is the estimated amount of the economic loss from this source, for the purpose of feeding tuberculous herds.

The result of an investigation carried on by the Wisconsin Experiment Station, in herds where no animal showed any physical symptom of disease, proved that in practically every instance the disease was present, and in some instances there was a considerable number of diseased animals. It may be hard to eliminate the diseased animals, but I believe that if the conditions are allowed to continue for ten years more, or even five years more, it will be much harder than if the work is done more promptly.

9. Another source of danger to the milk supply and one which has given to the health officers more trouble than all others, is the one or two-cow dairy located in the back yards of our cities and towns. The picture on the screen represents such a dairy, of one cow, in a back yard, with an accumulation of rubbish and refuse, and general surroundings which are anything but healthful and right. In the next illustrations we see where the milk from such dairies is kept,—in the pantry with

other food products or in the kitchen where it is subject at all times to contamination; also the place from which it is distributed, which is far from an ideal place.

10. Another source of contamination is frequently found in the dirty markets and shops in which milk is distributed. I believe the people who are handling milk in the cities and towns are equally responsible with the producer. That is very clearly illustrated by the work that has been done in the city of Boston. I do not know of any city in the United States where you can see a comparison which is quite so clear as the comparison which has been made there by the examination of the milk on the cars as it comes into the city, and when it reaches the consumer. About 62 per cent of all the milk examined on the cars is within the required standard of 500,000 bacteria. When that milk goes on to the wagon and is distributed, only about 47 per cent comes within the 500,000 mark, and when it gets into the store from which it is sold, there is only about 22 per cent that comes within the limit. So you can see that the contamination does not take place entirely on the farm. As I have shown, about two-thirds of the milk that goes into the city of Boston is within the required standard so far as the farmer is concerned; about one-half so far as the wagon is concerned, and one-fifth so far as the storekeeper is concerned.

11. There is one other source of contamination, and that is found in the homes of the consumers, and I do not hesitate to tell them about it when I have an opportunity. In this home upon the screen one quart of milk was received daily, and if you count the open bottles there you will know how long it had required to accumulate that exhibit. If you note these bottles carefully you will see that some of them are far from being clean. In fact, none of them had been washed. Some had been emptied and in some the milk had soured and the watery part had separated. If there are any consumers here tonight, I want them to realize that they, too, have a responsibility in this matter. Furthermore, the consumer who puts his bottles on the back porch beside the garbage can is doing just as much to destroy the children of our cities and towns as is the careless producer or dealer. There is no chance whatever for the consumers to shirk their part of the responsibility. If we are ever to have a good milk supply it must start from the

barn in good condition, it must go through the plants of the city distributors in good condition, and it must be cared for in the homes of the consumers.

To further illustrate the importance of clean milk, in the next slide I will take you down to Kentucky, to a farm where a man and his wife and four children were living happily together four or five years ago, and where as the result of the neglect and carelessness of that man in the production of milk two of his own children were taken ill and one of them died. He was a poor man with no funds; he barely owned his farm, but he made a resolution then and there that if he ever produced any more milk it should not be milk that would kill his children or those of any one else. He made up his mind that if he ever produced any more milk it would be a clean, safe food. He did not have the money to buy expensive equipments, but through the advice and assistance of some people in that location he developed a degree of cleanliness which insured a clean product. The barn which he had was not very well adapted to modern ideas of milk production, but he made some holes in the walls and put in windows and used some cement in the interior, procured a water supply from not far away, whitewashed the place and did away with the dirt, dust and manure. Then he cleaned his cows and kept them in a clean condition, and sent to the market a different product. One step followed another until two years ago the product of this man had reached such a degree of excellence that a medical society was willing to certify to the product as coming from clean, sound cows of known health, tuberculin tested, produced by clean people and handled in a clean barn and a clean dairy, where low temperatures prevailed.

This milk as it comes from the cooler goes into an ordinary bottle filler and is immediately placed in the bottles. These are at once covered with parchment paper held in place by rubber bands, and put into cases covered with crushed ice. From the time the milk leaves the cow to the time it is under ice is probably not more than fifteen minutes, and in the majority of cases not more than ten.

This farmer and his wife are now happy in the consciousness that they are not doing work that is in any way a menace to human health, but that they are ministering to the wants of their own children and the children of others who are not so fortunately situated. They have now 100 cows and are prospering.

I want you to realize as perhaps you have not realized before the importance of producing clean milk. When you as dairymen realize that this is a substitute for the mother's milk, when you realize that it is a food for children, you will have become conscious of the fact that the production of clean milk is an important and an attractive business.

Closely allied to cleanliness is the matter of low temperatures. The next picture illustrates what low temperatures accomplish. We have here at the start one germ at a temperature of 50 degrees. In twenty-four hours that has multiplied to five. In the same milk kept at 70 degrees for the same length of time, the germ has increased to a very much larger number.

The large increase in the death rate among infants in our cities receiving bottled milk, during the heated portion of the year, which sometimes reaches 250 out of 1,000, in comparison with 35 out of 1,000 receiving the mother's milk, emphasizes the fact that it is a desirable thing to cool the milk as well as keep it clean.

It has been my observation that the producers of milk are very ready and willing to do the right thing when they know clearly just what it is and just why it should be done. Dr. Woodward several years ago conceived the idea of giving certain definite mathematical ratings to certain dairy conditions, and growing out of that idea the score card for dairy barns has been developed. One card has followed another until a year ago last August the National Association of Dairy Instructors and Investigators adopted the card which I have here, and it has since been used by the health officials, the state dairy and food commissioners and the state boards of health in many cities and towns throughout the country. Something like 130 officials are now using the score card system. It has been generally believed that so far as dairy inspection is concerned, a poor inspector can do as little harm and a good inspector can do more good with the card than without it. It certainly furnishes a guide. You all know that the man with meagre equipment and whose ideas of cleanliness are right and who uses good methods in his business can produce a better article than the man with the expensive equipment who employs poor methods. The result of the use of this score card in one city was rather striking. In May, 1907, the inspector for Richmond, Va., began the scoring of dairies supplying Richmond with milk. The average score for all dairies for the first month was 41½ points. In the second month, the month of June, the average score for the whole 70 dairies was 364. It was a little warmer weather and the dairymen did not at that time realize the necessity of properly cooling the milk, so the score was a little lower. The next month, July, it was up to 47.5; September, 51.4; October, 57; November, 58; December, 60; January, 70.4; February, 69; March, 71; and in April, the end of the first year, the average score of the dairies was 72 points. This gain was brought about by simply letting those men know just what was necessary and how to set matters right.

Another thing which has interested the producers of milk in several localities is the dairy contests such as you are holding here in Maine in connection with this meeting. The score card for milk is helping not only the producer but the consumer. When an exhibitor receives his score card, he realizes that in flavor there is something to be safeguarded, that his composition must be right, that he must have a low bacteria count, that the acidity must not be too high and that the package must have a good appearance. When definite mathematical values are attached to these conditions, he can readily see just wherein he was right or wherein he failed. In other words, the score card applied to milk and cream is doing just what the score card has accomplished for butter and cheese, and we believe that in these educational exhibits there will be an additional stimulus for the study of the question of how best to improve the supply. Just so surely as we begin to study the situation, just so surely we want to improve.

I believe that in the future even more than in the past those of you who can produce clean, wholesome goods will be the people who will have the markets and the other producers will naturally be eliminated from the business.

THURSDAY, DECEMBER 2.

TALK AND DEMONSTRATION OF CORN JUDGING.

By William D. Hurd, Amherst, Massachusetts.

We are gathered here this morning for the purpose of studying the characteristics of a good ear of corn. Just at the present time there is a movement on foot in this State for the improvement of this most important crop. Next fall, in one of the largest cities in New England, a New England Corn Exposition will be held, which ought to be one of the greatest booms to New England agriculture that has ever taken place. If this is to be a success, and if you here in Maine are to do as well in this Corn Exposition as you did in the Fruit Show, it means that everybody must get busy in order to get ready for it.

There are a great many desirable types of corn grown in the State at the present time, and it is to the matter of corn selection and improvement that I wish to direct my remarks this morning. I am sure it is not necessary at this time to talk to you about the desirability of growing more corn. You have heard this year after year in the addresses given at this dairy conference.

There is a good deal more to an ear of corn than can be seen by examining it externally. There are at least four questions which you should make every ear of corn answer. The first is, "Will this ear of corn grow?" The second is, "Will it mature?" This is very important in Maine. The third is, "Has it constitution and good productive power?" Fourth, "Has it good breeding characteristics, or is it a type which has possibilities in it?" There is just as much in performance in an ear of corn as there is in a dairy animal or driving horse, and we ought to look at what an ear of corn will do in just the same way as we consider the amount of milk a dairy animal will produce or the amount of speed a driving horse can develop.

Hundreds of tests which have been carried out by Experiment Stations show that ears of corn differ greatly in their individuality. The United States Department of Agriculture tested three thousand ears of corn at one time, and found fifteen hundred unfit for seed. Out of a large number of samples tested for vitality at the Indiana Experiment Station, the percentage ranged from twenty-three to ninety-nine.

I desire to repeat what I said yesterday about the importance of having a good kernel of corn to begin with. An ear of corn, according to variety and type, has from four hundred to twelve hundred kernels. Eight hundred would be a fair average. There is no reason why every kernel should not grow, and it is perfectly reasonable to suppose that the eight hundred kernels from a good ear of corn will produce eight hundred ears. In the second year each of these eight hundred ears will produce eight hundred kernels, which, it is reasonable to suppose, would produce six hundred and forty thousand ears. This means that in the third generation you would have from six thousand to eight thousand bushels of corn. So you see the importance of having a good kernel of corn to begin with.

We are to score this corn this morning simply by external characteristics, but it is necessary to look back of the external appearance of the ear in order to find what the ear can do. I would not pay a cent more for the best ear of corn here in this show than for any other good ear, until I had a chance to test it both for its germinating power and its productive power in the ways I shall describe later. In other words, the external characteristics are not sufficient to use entirely as a guide in selecting seed corn.

The first thing to do in an attempt to breed corn is to get good seed, and the place to select good seed is in the field. There are several reasons for this, rather than selecting it in the crib. In the first place, if you go into the field you can see the plant which produces the ear of corn, and you can determine whether it is a strong, well-grown plant. You can select the ear of corn for its position on the stalk. You do not want a large, coarse stalk with an ear as high as you can reach; you want an ear well down on the stalk. If you are selecting in the field you can also select for maturity, and of course this is one of the most important things here in the North. Another point to be taken into consideration in field selection is the manner in which the ear hangs on the stalk,—whether it drops down and is easy to break off in husking, or is hard to break off. You can also select for size and shape of ear. Go into the field, look the corn over carefully and select about three times as much as you will need, in order that you can go over this once or twice later in the season and cull out the ears which do not meet the ideal when judged from the external characteristics.

Now to go further back than the ear itself. The first thing to do is to test these ears for their germinating power, and I am very sure when you do this once you will feel that it is time well expended, for you will find there is a very great difference in the way in what you consider to be good ears will germinate. It is not a laborious nor an expensive method. It can be done in the winter or spring when you are not busy with other work.

Take a box two feet long, one foot wide, and three inches deep. Fill it with earth, sawdust, or some other material which will hold moisture. Mark this off into two-inch squares by driving tacks into the edge of the box and stretching strings across. You will see that you then have seventy-two squares. This is space enough to test approximately a bushel of corn. Number the ears to be tested by fastening a little tag on the butt of each ear. Take five kernels from ear No. 1 and place in space No. 1; five kernels from ear No. 2 and place in space No. 2; and so on until you have filled the seventy-two spaces with an equal number of kernels from the seventy-two years. Put this box in a place where the temperature is right and watch the germination. Discard all those that do not show strong germinating power.

In the last six years that I have worked in this State I have been impressed with the fact that there was a great chance for some one in Maine to develop a good strain of Maine corn.

After you have weeded out a number of ears low in germinating power, the next thing is to test the good ears you have retained by what is known as the ear row test. I am not talking now about what should be done on large field areas, but am giving this information for the benefit of those who might desire to improve a variety of corn. In other words, we are talking now about a breeding plot. The ear row test method consists simply in numbering the ears as has already been described, planting ear No. 1 in row No. 1 in the field; ear No. 2 in row No. 2; and so on until you have them all planted. It is usually best to remove a few kernels at the butt and also from the tip. In this way you get the stronger, more matured kernels from the center of the ear. The rows may be any desired length; usually a hundred hills to a row makes a convenient sized plot. Grow these throughout the season, giving the plot the best of cultivation and good fertilization, and pulling out the suckers and weak sprouts. In this way you can test the producing power, or performance, of the different ears. I am sure you will find several, when tested by this method, that you do not care to use further as seed.

In-breeding is just as injurious to corn and other plants as it is to animals. In order to prevent this it is best to detassel before the fertilization of the silks takes place every other row in your breeding plot. You understand, of course, the general structure of the corn plant. If you will examine a stalk just above one of the joints, you will probably find a small, undeveloped ear, showing that originally the corn produced a large number of small ears. Man, by selection, has developed the plant so that instead of producing a large number of small ears, one or two good ears are produced on each stalk. The matter of stand is very important, and I believe should have more attention that it has had in the past. It seems to me it would be better to attempt to get every stalk to bear than to have more than one ear borne on part of the stalks. You probably know that the silk on the ear represents the pistil, or female organ of reproduction of the plant. The tassel represents the stamen, and furnishes the pollen. The pollen is shaken down over the silks and fertilization takes place, each silk running back to what will afterwards become a kernel of corn. The reason for detasseling is to prevent the pollen from a plant fertilizing the silks of the same plant. The reason that corn mixes so badly is because there is so much pollen produced, and this is blown about over long distances by the winds, and is carried by birds and insects.

Ques. How many kernels do you plant in a hill?

Ans. Four or five; and in this breeding plot it is best to take the weaker stalks out so there will be three left standing.

I have already told you why corn should be selected in the field. After it is harvested and placed in the crib you cannot tell anything about the kind of plant that produced the ear, its maturity, its position on the stalk, or any of the other characteristics which I have spoken of. The men in Maine should be more careful in the buying of seed corn than they have been in the past. Most of the corn that has been sold in this State has been in the shelled condition, and most of this is simply western corn just as it comes from the cribs. It may have come from nothing more nor less than nubbins. If the kernels are not uniform it means that the planting will not be uniform when a machine is used. You should buy seed corn in the ear,—and the best seedsmen are selling their product in this form at the present time. Another thing I believe you should do, and that is, develop some of the Maine types rather than go great distances for seed.

No matter under what conditions you grow your seed corn, the corn may be ruined if it is not properly stored and cured. Allow the ears to mature as much as possible in the field, and then after the corn has been harvested take great care that it is properly dried before it freezes. Corn when taken from the field usually contains from twenty-five to thirty per cent of moisture. A good sharp freeze, when the corn contains this amount of moisture, may ruin it so far as its vitality for seed purposes is concerned. After seed corn is properly dried it will stand any temperature to which it may naturally be subjected without affecting its vitality. If you are going into the production of good seed corn it will pay you to build racks on which to lay the ears so that they will dry. Tracing in small traces is all right, provided you put the trace where it will dry and not freeze. Do not put the seed corn into boxes or barrels.

So much for the subject of corn improvement. Now we come to the use of the score card in determining what is a good ear of corn from its external characteristics. The score card is supposed to have been originated by the late Orange Judd. There is a great variation in score cards, and unfortunately most of them have been made for Dent corn rather than Flint corn. You already know the use of the score card in the judging of animals, the scoring of stables, and the scoring of milk. The score card in judging corn is used for several reasons. It aids the man who is judging the corn to keep in mind all the different characteristics. It furnishes a uniform basis upon which to work. It prevents a man from laying undue stress upon one or two points which may be his particular hobby. In the use of the score card, or in judging corn by any other means, we should always keep in mind the fact that in all of our work along the lines of corn selection and improvement, the one thing we are working toward is better corn,—corn that will produce more to the acre.

Now if you will turn to the score cards which have been given you, you will notice that ten points are given to uniformity of exhibit. This means uniformity as to the size of ears, their length, shape, color, and general appearance. I notice in the exhibits a great lack in selection as far as uniformity is concerned. The Maine varieties have been so mixed that we cannot lay much stress on type, but a uniform exhibit would show that the corn had been developed to the point where the ears were somewhat alike. A good ear of Flint corn should be from ten and one-half to twelve inches in length, although some varieties are much longer; among these would be the Longfellow. The ears should be of fairly good size and circumference. Increasing the size and depth of the kernel, and decreasing the size of the ear, gives us a larger supply of corn. In Dent varieties the circumference should be two-thirds the length of the ear. This is a little too large for the Flint varieties.

The variation in tips is largely a seasonal variation. In a poor corn year the tips will not fill out well. The better the tips are filled out, and the better the butts are filled out, of course the higher the percentage of shelled corn. Five points are allowed for a well filled tip. The samples of Dent corn which I hold here in my hand show good tips and poor tips, good butts and poor butts. You may desire to know how much to cut for the tips and butts in this exhibit which is before me. If in looking over the exhibit of ten ears you find seven with good tips and three with poor tips, you should take three-tenths from the score. The butts should be scored in the same ratio. You will notice that there is a general tendency in Flint corn toward swelling of the butt. The butt should not be too large, because it adds to the labor in husking and also reduces the percentage of shelled corn. The ideal ear is one that is filled out all round the cob and at the tip, the cob being not over three-quarters of an inch in diameter. The more uniform the kernels, the straighter they are arranged in lines, the better looking the ear will be, and the percentage of shelled corn will be larger. Be careful not to cut too much for these small points.

You should look for discolored and broken kernels. It is allowable to cut one-tenth of a point for every kernel that is found missing. A judge is right in supposing that these kernels were off color and were taken out. For the same reason a poultryman would pluck black feathers from a white hen.

The shape of the kernel is very important, and I think it should be given more than the five points allowed in this score card. The shape of the kernel affects largely the amount of shelled corn you get from an ear. The shape of the kernels as shown by the drawings on this chart, will show you what I mean. They may be too wedge shaped so that space is lost both next to the ear and between the rows of kernels on the outside. The ideal shape of kernel is a broad wedge, the edges being nearly straight so that one fits closely against another. The shape of the kernel determines the composition also. The broad, wedge shaped kernel usually has a large germ, and most of the oil of the corn is in the germ. The shape of the kernel also affects uniformity of planting when a machine is used. Usually four to six kernels are removed from each ear in order to find out what their shape is.

The next point to be considered is the color of the corn and of the cob. I notice there is some lack of uniformity in color in these exhibits here. Some are light in color, and others are a deep golden color. The cobs should be either all white or all red. If there is a white cob in an exhibit which should have red cobs it shows poor breeding. Usually in scoring corn, three cobs off color in an exhibit would disqualify it. The color of corn has a good deal to do with its vitality. The deep golden lustre which some of these ears have would probably be enough to convince most of you that the corn was well matured and in pretty good condition.

In relation to the space between the rows, you will not find much trouble with Flint corn; and you should look out for this condition because it means loss of percentage of shelled corn. If the rows are far apart, and the kernels not wedge shaped, there will be more or less loss of space, which is undesirable.

The vitality, I think, is the most important point on the score card. The general appearance, color, maturity, as found by examining the kernels and by twisting the ear of corn, all go to show the maturity and seed condition. An ear of corn is not good unless it will grow, and I hope that in the judging which you do, you will plan to cut more severely on this point than on any other.

The next point on the score card is trueness to type. As I have previously said, the corns grown in this State have been mixed up quite badly so that it is hard to say very much about type. If we had Longfellow, King Philip, Sanford, Leaming, Boone County White, or Reid's Yellow Dent, we could lay more stress on type, for these have certain well defined characteristics. But in this case I think it will be best to disregard type, unless the ears are badly misshapen or do not represent anything in particular.

The only way to determine the proportion of corn to the cob is by actual weight. Take a couple of ears from the exhibit, weigh them before they are shelled, and then shell them. Divide the amount of shelled corn by the total weight of the two ears and you will get the percentage of shelled corn. It ought to run from eighty to eighty-five per cent in Flint varieties. The standard for Dent corn is eighty-seven or eighty-eight per cent. Of course we will not do this in our judging here this morning.

Ques. In considering the vitality or the seed condition, does the scorer take into account the color?

Ans. I think he ought to. If the corn is of a dull color instead of having a bright golden lustre he ought to score it off for vitality. I should say that the bright, rich, golden color had something to do with the maturity or seed condition.

Ques. Should not an exhibit of ten ears of corn be just as unform as a box of apples?

Ans. I think that uniformity should be taken into consideration on a score card. A uniform ten-ear exhibit shows that a man is growing something true to type and breeding, and I do not think it is setting our standard too high to say that we should expect an exhibit of corn to be just as uniform as an exhibit of fruit.

Ques. Every year, perhaps some years more than others, we have corn that will fail to send up clean, straight shoots. As near as I know how to express it, it is "clubby" corn, and is practically worthless. Can you tell me what is the cause for so much of that?

Ans. It may be the seed,—perhaps poor corn was used. It may be something in the season, or it may be something in your fertilization. I suppose, however, that your land was well manured or fertilized. It may be due to some insect or worm working around it or in the roots.

Mr. Gray—I have had that trouble a good deal and I think I am justified in saying it was caused by a worm.

BREEDING FOR PRODUCTION IN DAIRY CATTLE IN THE LIGHT OF RECENT ADVANCES IN THE STUDY OF INHERITANCE.

By Raymond Pearl, Biologist of the Maine Agricultural Experiment Station.

(Read by Dr. Chas. D. Woods.)

There is probably no branch of animal breeding which has been more highly or successfully developed than has breeding for dairy production. The records of milk production of some of the best of the dairy cattle of the present day may be pointed to as among the finest and most convincing examples of the value of careful attention to breeding in agriculture. The prices at which fine dairy animals are sold is again, in another way, an indication of the possibilities of breeding. It is now generally recognized by wide awake dairymen everywhere that, however important feeding and management may be in regard to profitable milk production, in the long run dairy qualities must be bred in the strain if a herd is to be permanently profitable. The importance of work in this field is attested by the formation of our cow testing associations and co-operative breeding associations in the work of the Department of Agriculture of this State.

The great problem which confronts every dairyman is how he shall best breed for dairy production. In spite of the notable success which has been attained in this direction it remains a fact that our knowledge in this field is still too largely of a somewhat haphazard and empirical character. It is an obvious fact that some cows which are great producers, perhaps nearly as great as we shall ever see, have been bred. But if one tries to breed more like these he too often meets with failure where he hoped to succeed. Even though one studies most carefully the pedigrees of a great producer and attempts to repeat as nearly as possible the same kind of breeding he usually does not get his desired result. The reason of course is that there are factors involved in the breeding of the great producer which he overlooks, because he does not understand them to be of importance. If one attempts to learn from the breeder of a great dairy cow how she was produced or how a great milking strain was bred he will in practically every case find that the breeder either cannot or will not give him the kind of information which will make it possible for him to go out and do the same thing. Further, if one attempts to learn from the published pedigrees in regard to this matter the outcome is that different men draw different conclusions as to what is the factor of primary importance in a given pedigree.

The real fact is that in the present state of our knowledge regarding inheritance and breeding nobody can tell for most animals, and particularly for dairy cattle, what are the facts of real significance and importance as distinct from those which are trivial and accidental in a pedigree. Pedigrees are the ultimate foundation of all breeding operations, but before we can reach the condition where the results of breeding will be certain and sure, we must learn how to separate the wheat from the chaff in pedigrees. No one who has studied the breeding of dairy cattle doubts that much in the pedigree of any of the great performers has no real significance whatever in the attainment of that performing ability. But how shall we know what is of real importance in a pedigree, and what can without harm or loss be neglected as of no significance? If breeding for dairy production is to be put on the sure basis of exact scientific knowledge so that the farmer will not be forced from necessity to try costly and doubtful experiments for himself, but instead can breed his cattle with the assurance of good results provided he feeds and houses them decently, then we must have thorough and systematic studies of the inheritance of dairy qualities.

It will be the purpose of this paper to attempt to point out certain directions in which the study of breeding problems would seem particularly likely to be suitable and profitable in dairy cattle, reasoning by analogy from results which have been recently obtained in breeding other animals and plants.

During the last decade there has been a very great change in the ideas of the most wide awake breeders all over the world in regard to the basis on which practical breeding operations ultimately depend. This change has been so great that it might almost be called revolutionary. In order that a concrete idea may be gained of the nature of this change in thought and viewpoint it will be well to review briefly the results of certain extensive studies of breeding. In the first place let us take some work with plants. Plants are simpler in organization in some particulars than animals and breeding problems especially are more easily attacked with plants which self-pollinate than with sexually reproducing animals.

Nearly 20 years ago there was begun at the Agricultural Experiment Station at a town in the southern part of Sweden an attempt to improve the common grains so that they should be better adapted to the conditions in that country and hence more profitable for the Swedish farmer. This work was begun and was carried out strictly on a practical basis. It was at the beginning not financed by the government but largely by private enterprise; in fact, by co-operation among the farmers themselves. This is mentioned in order that it may be understood that this work was not undertaken to defend any theories or from deep scientific motives. It was strictly a business proposition. The Swedish farmers wanted grain crops which would mature under their conditions and make a profitable yield.

This work in the improvement of seed grains was put in the hands of practical men who had had in addition to farming experience thorough scientific training. They worked for a series of years steadily with a large staff of assistants and plenty of land and every opportunity to bring about the improvement in seed which it was hoped would be produced. The method which was used in the attempt to bring about that improvement was one with which you are all familiar and was in principle the method which is used by the majority of dairymen (but not by all) in their breeding work every day. This method was in principle simplicity itself. Let us take the case of oats for an example. In attempting to build up a strain of improved oats the method was at the beginning to test out a number of varieties, then to go through the fields, pick out the best heads, and in this way select enough seed for the next year's planting of the best of the first year's crop. This supposedly best seed selected in this way was all mixed together and planted the next year and again men went through the fields and selected what seemed to be the best seed, mixed it all together and planted it the next year and so on. This process of selecting what seemed to be the best on the basis of performance alone to breed from in each successive year was continued for eight years. It would be reasonable to expect that within that length of time continued breeding for the best ought to have brought about a great deal of improvement. As a matter of fact the actual results obtained were quite different. There was no distinct and fixed improvement whatever as a result of this long continued selection in any grain, it made no difference which. All were practically alike in this respect.

At the end of these eight years the men who were doing this work called a halt and took account of stock of their method. The net result was to show clearly that the indiscriminate propagation of individuals selected simply on the basis of their performance alone led to no definite or permanent improvement in the race.

Now it is an interesting and significant fact that while this work was going on with grain crops in Sweden exactly the same kind of an experiment carried on by exactly the same kind of methods was going on in this State in the attempt to bring about increased egg production in poultry by breeding. In 1898 the Experiment Station began an experiment in breeding for egg production in which the method of procedure was as follows: A trap nest record was kept of the egg production of each individual bird. Only those birds were used as breeders in each year which made the highest egg records in the year before. Just as in dairy work an "advanced registry" of hens was established. Any bird was eligible to and was entered in the "advanced registry" if she laid 200 or more eggs in her pullet year. This kind of breeding from the highest egg producers, making the selection simply on the basis of trap nest performance alone, was continued for nine years. Then, just as in the Swedish work with plants, an account of stock of the results was taken. The general result was exactly the same as in the case of the cereal work. The average annual egg production per bird showed no definite increase as a result of the close selection practiced. On the contrary an actual decrease in the average egg production per bird was observed. The plain and definite result of this experiment was that the practice of simply selecting the best layers as breeders did not improve the egg production of the flock.

Not satisfied with the results of this long selection experiment alone, the matter was put to a test in another way by comparing the egg production of the offspring of the "advanced registry" birds—that is "200-egg" hens—with the offspring of birds not in the "advanced registry." The upshot of this experiment, continued through a whole year, was also perfectly plain and definite. The daughters of "200-egg" hens were no better layers and in fact were not quite so good layers as the daughters of other birds.

The fact that the general results of these two long and extensive selection experiments, one with plants and the other with animals, carried on with the utmost care by different people in different parts of the world and without any connection whatever, should turn out to be in essentials identically the same, must make us pause and wonder whether the general theory of breeding on which they were based is not lacking in some essential qualifications from the standpoint of the practical man. There seems to be no escape from the conclusion that the method followed in these experiments is not a good method for the practical breeder when, if it is subjected to the most careful and painstaking test, it fails to obtain the desired results.

As a matter of fact in both cases the failure of the old methods of selection to obtain results led to the adoption of a new method essentially alike in the two cases, differing only as to details conditioned by different modes of reproduction in plants and animals. This new method has proved itself in the hands of plant breeders all over the world, but led by the Swedish investigators and farmers, to be brilliantly successful. It has resulted in putting cereal breeding on a sure and definite basis. With animals this new method is only beginning to be tried in a systematic way. It is being tested thoroughly in breeding poultry for egg production and with results which even after only two years work are, from the practical standpoint, very satisfactory, and which promise abundantly for the future.

Now, just what is this new method of breeding? It can be best explained by contrasting it with the old method. In the old method of breeding practically the entire emphasis was laid on *performance* as the sole basis of breeding. To make it concrete, it was assumed in this method that a "200-egg" hen was better to breed from than a "190-egg" hen because she had laid

200 eggs and only because of this, and regardless of everything else. Her *performance* alone was made the basis of the estimation of her worth as a breeder. The new method of breeding starts out from the standpoint that performance has no more relation to the worth of an animal or plant as a breeder than do many other factors. In other words, it says that a "200-egg" hen is of no value as a breeder *unless her daughters are high layers.* The ability of an individual to *transmit* its performing qualities, not merely to have them, is made the basis of breeding work according to the new method. Now, as a matter of fact, actual experiments with hens show that the high performer in the vast majority of cases does not produce chickens which are themselves high performers. The high performers usually are the offspring of birds which were not themselves such extraordinary producers. But it is a plain, common-sense proposition that the most valuable animal *as a breeder* is the one that gets progeny that are high grade performers. If one can find a hen whose daughters invariably lay more than 170 eggs apiece in a year it is of no particular consequence whether that hen herself lays 100 or 200 eggs in the year. The case is the same with cows. There have been many Jersey cows that were greater milk producers than was Figgis or Marina Pogis, but how many of them can produce a son that will get nine or fifteen daughters in the advanced registry?

I know of no instance which illustrates better the distinction between the two methods of breeding than is to be found in the advanced registry of dairy cattle. In all of the dairy breeds so far as we have looked into the matter the essential facts are these: A cow is eligible to advanced registry essentially on the basis of her own performance alone. In other words, this is the old principle of selection, in so far as advanced registry relates to breeding. On the other hand, a bull is eligible to advanced registry if a certain number of his *daughters* have made records which entitle them to entry in the advanced registry. This is essentially the new method of selection. If a moment's consideration is given to the subject it will be plain that that which admits a cow to the advanced registry has no necessary relation whatever to her *breeding* worth. Advanced registry of a cow tells one nothing about whether her heifer calves either are or are likely to be good producers, but the case is quite different with the bull. The bull in advanced registry is there just because he has *proven his ability to transmit high dairy qualities*. He has shown himself to be prepotent, in other words, with reference to dairy characteristics. The cow in advanced registry has shown nothing except that she is a good milker. She may be and too often is absolutely worthless as a breeder.

This illustration which has just been used to bring out the distinction between the old and the new view-points as to breeding will serve in a measure to indicate how those ideas may apply to cattle. In theory at least, the advanced registry of dairy cattle is intended as a guide to the breeding value or worth of individual animals. It is the assumption that if a dairyman had all the money that he wanted with which to build up his herd, he could attain this end and even get results yet undreamed of if he were to cull out everything else and use nothing but advanced registry animals for breeding. But now would he, as a matter of fact, make any very particular progress in the direction of breeding increased milk production into his herd by this method? There are no facts which demonstrate that he would, except in so far as the male animals which he might have would help him.

Let us make an appeal to the facts here by way of illustration. Suppose a man wanted to learn how to breed Jersey cows of advanced registry quality in milking performance. The most logical starting point at which to begin in the acquisition of this knowledge would be, I think all will agree, to ask this question: "How have the existing advanced registry cows been bred, as a matter of actual fact? If I know this it may help me to breed some more like them." Now there are four possible kinds of matings which may be made with reference to the advanced registry. These are:

1. Both sire and dam may be in the advanced register.
2. The sire may be in the advanced register and the dam not.
3. The dam may be in the advanced register and the sire not.
4. Neither sire nor dam may be in the advanced register.

Now if we inquire how the last 162 cows (Register of Merit Nos. 200-361 inclusive) in the American Jersey Cattle Club's Register of Merit have, as a matter of fact, been bred, (not how they theoretically ought to have been bred but how they actually *were* bred), we get the results shown in the following table.

*Breeding of 162 Advanced Register Jersey Cows.**

Character of Mating.	Number of advanced registry cows produced by each specified mating.	Percentage of cows produced by each specified mating.
Sire *in* Registry of Merit; Dam *in* Registry of Merit	11	7
Sire *in* Registry of Merit; Dam *not* in Registry of Merit	70	43
Sire *not* in Registry of Merit; Dam *in* Registry of Merit	13	8
Sire *not* in Registry of Merit; Dam *not* in Registry of Merit	68	42
Totals	162	100

Too much stress should not, of course, be laid on these figures. As they stand they have no great scientific value. They suggest a whole series of questions which need more data for their final solution. But the only point which it is intended to bring out here is that the practical breeder will have a great deal of difficulty in finding anything in these figures to indicate that he will be likely to produce more heifer calves that will qualify for advanced registry if he breeds only from advanced registry stock than he will if he breeds from non-advanced registry stock. It is the story of the "200-egg" hen over again. In other words, the chief function of this table is in a sense to show how little we really know about the fundamental principles which underlie breeding dairy cattle for milk production.

But it is just this knowledge of the fundamental factors in breeding that the dairy industry needs. It is here that thoroughgoing investigations are wanted. Fortunately much of this work with dairy cattle need not be experimental at the beginning. Experiments have already been performed and the data are available. In the advanced registries and herd books of

*The percentages given in the above table are intended to represent the relation the number of cows in the column headed "Number of advanced registry cows produced by each specified mating" bears to the total number under consideration (162) and has no specific relation to the total number of matings which could be and of course were made in each of the specified matings mentioned in this table. (Sec.)

the four great dairy breeds there exists a mass of as yet unanalyzed* data for the study of inheritance of milk production. In the course of a few years we shall have in addition to this a splendid collection of material obtained under local conditions, in the reports of the cow test associations which are exhibiting such a healthy and vigorous growth in this State.

There is no dearth of pedigree data for the study of the problems of breeding for milk production. What is needed is to have these data analyzed and reduced to systematic form. Then to supplement and extend the principles gained in this way we need to have carefully planned breeding experiments carried out under conditions which while scientifically controlled are at the same time such as may be realized on any well managed dairy farm. Further, we need careful and thorough experimental studies in regard to the physiology of milk secretion, before we can get very far towards a final solution of the problems of breeding for milk production.

All told it is safe to say that nowhere does there exist today a more interesting and fruitful field of work for the investigator than is to be found in the problems of dairy biology, and on the other hand there is no phase of agriculture in which the practical farmer needs the help which the scientific investigator can bring him more than in the dairy industry.

Discussion of Paper by Director Woods.

The problems which confront the dairy farmer of this State need, and need badly, all the investigations which have been suggested in the paper just read. That work in these directions will be undertaken and energetically prosecuted in this State sooner or later is just as sure as that the dairy industry is one of the most important agricultural interests of Maine. The Experiment Station stands ready to take up work along these lines just as soon as the dairymen of the State say that they want such work to be done. The new experiment farm at Monmouth gives the Station what it has never had before, namely, adequate land facilities to undertake experimental work on problems of dairy husbandry. It only remains for the people

* It should be said that Rietz: Biometrika, Vol. VII, pp. 106-126, has made a start in dealing with this material.

of the State to say that they want the work done and are willing to support it.

There are two definite things which I should like to suggest to this Association for discussion which arise from the thoughts which have been presented in this paper. The first is that, so far as we can learn, there does not exist any where in this State in one place a complete collection of the herd books and advanced registry books of all of the four great dairy breeds—Jersey, Guernsey, Holstein and Ayrshire. So far as we can find out if any member if this Association wanted to consult the complete files of these pedigree herd books he would not be able to do it unless by chance he knew of some private individual who may have them. Therefore, I would like to suggest to this Association that, for its own use as well as to advance the study of inheritance in dairy cattle in this State, it acquire by purchase or in some other way a complete set of the herd books and advanced registry books of the four breeds named and deposit these books as a loan collection, the ownership to remain vested in the State Dairy Association, in the library of the Maine Agricultural Experiment Station where they shall be open to inspection by any member of the Association or any other person in the State who may wish to make use of them. If the Dairy Association will undertake to do this, the Experimention Station will undertake on its part to see that the books are properly catalogued, cared for and shelved in such a way as to make them most useful and accessible to any dairyman who wishes to consult them. It is little short of a disgrace to the dairy interests of this State that these important record books are nowhere available for consultation in the library of a public institution. Provision, of course, should be made also for the up-keep of the collection so that additional volumes as they are issued may be added in order that the collection may be kept for all time complete and up-to-date. It is doubtful whether this Association could do any one thing at an equally small expense which would do as much as this would to advance our knowledge of fundamental factors in breeding dairy cattle.

The second recommendation which I should like to make is that this Association seriously and earnestly consider whether it wishes to have the Experiment Station undertake systematic investigations along the lines of dairy problems. If after due deliberation the Association should come to the conclusion that it does desire to have the Station undertake such work it would then be necessary to look to ways and means to provide the funds. We have the farm and the greater part of the scientific staff necessary to undertake this work. What is needful is an annual appropriation of in the neighborhood of $5,000 to provide the necessary clerical and scientific staff, to purchase stock, and to provide material facilities for the carrying on of the experiments. The Station will at the end of another year get $30,000 a year from the federal government. But it is impossible to use any of this money to undertake new lines of work either in dairy husbandry or anything else. This money is now and must continue to be all used up in the carrying on of lines of work already established. If the Station is to undertake new work it must have new funds additional to those it now has. Work in dairy husbandry of the kind discussed will if it is undertaken be new work for the Station. I estimate that it will need for its proper and adequate prosecution not less than $5,000 a year. Before the work can be undertaken this money must be provided for in some way.

It should be clearly understood that I am not here in the position of asking anybody for such an appropriation. What I wish to do is merely to suggest to you dairymen of the State whose practical business interests are concerned in this matter to consider whether you wish to have the Station take up work which will bring the help of science to you in your dairy operations.

BREEDING PROBLEMS AND HOW TO RAISE THE STANDARD OF DAIRY HERDS.

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

In reply to Secretary Merrill's invitation to address you on the subject announced, I stated that I made no claim to a very deep insight into the philosophy of breeding, or into its practice, and I regretted that the subject had not fallen to the lot of some close student of the problem, having a wide experience. However, I have founded some successful herds for state colleges, as well as for myself, yet I am left with the feeling that knowledge of breeding as a science is very incomplete.

I assume that I am expected to show how a high average may be obtained, and once obtained, held. Many herds have flashed across the dairy horizon, only to disappear from sight in a brief period. In view of the oblivion into which splendid herds, created by genius, have passed, I have come to feel that it is easier to attain a record high above the average than to hold it there. Your Mr. Ellis, who had carried his herd of Jerseys to a high yield, once said to the writer that he could not hold it there, though doing his best, and that he had known others who came to the same ending. It is now well known that the poultry record of the Maine State College hens, high above anything before attained, in its unstable equilibrium tottered back to the point from which it was raised. Dr. Pearl, in his paper just read, tells us that seed breeding by the Swiss, after nine long years of hard endeavor to secure improvement, at length yielding to the laws of inheritance, dropped to the original level. The fate of the Bates' Shorthorns, the Booths, the Cruickshanks, and of lines of Jerseys, Holsteins and other breeds where subdivision into special families, highly artificially bred, is more or less famliarly known to breeders, has been much the same.

Is the fate above named due to the attainment of the breeders' ideal and then a relapse, is it due to the exhaustion of the animal, or is it due to inadequate feeding, bad environment conditions, or to bad breeding? Breeding is not a fixed science, whose laws are so clear that like a problem in mathematics, they enable us to determine in advance the results that will be derived from certain processes. We say that like begets like, that variation is an associate law, and that qualities seen in an individual can be fixed by selection. Like produces like within the species, an oak an oak, and a horse a horse. Within varieties some general qualities are reproduced approximately accurate, yet in no case identical, otherwise sameness would be the rule. Each descendant is the product of two individuals in the animal kingdom that are unlike. This unlikeness can but produce the unlike or variation. This variation is at once the hope and the puzzle of the breeder. Upon the rock of "Like begets like" our breeders in a multitude of cases split. The novice has come to feel that all that is to be done is to breed from a pure bred or registered animal and that somehow only good will result. The more important law of variation that clothes the world with variety and beauty is overlooked, or if not overlooked, is not studied far enough back in its ancestry nor far enough forward in its ideals towards which breeding should move, and move with well thought out plans.

IMPERFECT KNOWLEDGE AND PRACTICE.

I have intimated that our knowledge of heredity is imperfect and our methods of fixing variation insecure, and that selection is conducted on principles so vaguely understood as to result often, if not generally, with little advance, and not infrequently with loss. I desire to fix this point more definitely than in my opening remarks. While associated with the Agricultural College of Missouri, I gathered several animals each of the Shorthorns, Herefords and Angus, the grades of these pure bred animals, and from the woods of the Ozark mountain region of Southern Missouri, brindled, ringstreaked and speckled descendants of the original French stock of the first settlers of the state. The pure breds were from the hands of skilled breeders, and the scrubs the best samples of the kind, probably, to be found in this country. They ran in the woods in the summer, and fed around straw stacks in the winter. At the close of the feeding period, which began at six months of age and continued until the animals were about three years of age, weighing from fifteen hundred pounds to seventeen hundred pounds each, the lot of twenty steers had made an average gain per day of 1.45 pounds, and the scrubs a gain of 1.49 pounds. The gain was made on less food per pound of gain for the scrubs than for the pure breds and grades. The sum of the breeding genius of man since Bakewell, the father of the art of breeding, covering a century and a half, met the children of nature and was defeated in a most important factor. Range sheep against pure bloods at a subsequent trial gave me no better results. Later, the Ontario College found that range sheep against pure bloods came out at the summit. The Geneva Experiment Station of New York selected twenty cows of pure breeding, the grades of pure breeding and two scrub cows. At the conclusion of a year's work in weighing rations and milk products, the four grades stood at the apex, and over these the scrub cow Sue towered above all the rest, giving 131.81 pounds of butter fat, her nearest competitor being a grade the value of whose product was $6.42 less, while the others were far behind.

I have as yet seen no data that tell a contrary story. Such data at first startle us. On reflection, they appeal to probability.

WHY THESE RESULTS?

First, let me make it clear that I am not disparaging the breeders' art as a whole, but only in some of its phases. Breeders have fixed form, in the meat producing breeds, and form is of much economic importance. It places the maximum development in the parts that have the highest selling value. Breeding has fixed in the butter line of cows a large ratio of fat to total solids, a very important point, since butter fat sells for several fold the price of other parts of the milk solids. It has also fixed other hereditary qualities of value, so that in a general way like begets like and is fixed by selection. But selection has failed in a most important particular, or more correctly, breeding has not fixed a most important factor, not because it could not have been fixed, but because no one has directly tried to fix it. This is the power to increase the ratio of food given that goes to production, and we are without any evidence that pure bred animals make more economic use of food so far as production goes, per unit eaten, than scrubs and grades, except in ratio of butter to total solids in the butter breeds; nay, there is good evidence that they do not. This sustains in a large measure the contention of farmers that they cannot perceive any gain in the efficiency of food when fed to pure breeds. They are wrong, decidedly wrong, as to the value of the product, though probably right as to volume of product.

It appears to the speaker that the next great advance in the art of breeding must come from the experimental attempt to fix consumption, digestion and assimilation of food as inheritable qualities of higher efficiency. This can be done with certainty only by the test of breeding animals for these qualities. A line of bulls and cows can be so tested, and those selected as breeders that give the largest product per pound of food. This will be an expensive process, yet small for the benefit received. The steam engine has been very greatly increased in efficiency during the present generation, saving for the nation millions of tons of coal annually. Could the efficiency of the cow as a machine for the production of butter fat be increased ten per cent in food economy it would mean an annual saving to Maine of a million dollars. No doubt this saving can be made upon the same principles that any other inheritable quality can be fixed. The State College could do initiatory work, your county breeders' associations, or better, a State association of breeders, could grapple with the problem in case private wealth does not enter the field. Our race requires food at its cheapest, and the problem of cheap dairy products is one of large moment.

It will be contended that breeding from the best leads directly to the efficiency advocated. Data do not show this to have occurred. Are there any special reasons why this is so?

PEDIGREE.

Pedigree, to a material extent, came to stand in the public mind for animals bred from the best. Holders of pedigreed animals had a monetary interest in propagating this view. The press that carried advertisements of pedigreed animals had an interest in abetting this view, aside from a natural belief that animals bred from the best ought to be the best. Public speakers assumed the same attitude and naturally so. These conditions gave to animals a sale value apart from their inherent superiority, if such superiority existed. This led breeders to register all or substantially all their pure bred animals whether of superior merit or not.

Pedigree came to mean registered scrubs in far too large a proportion of the total, for bad qualities inherit as well as good ones. Our stock registers carry many an animal that the common farmer would not retain, for he would be without the incentive to retain it. This material has been a dead weight and reduced the efficiency of the pure bred animals as a whole.

The beginner at breeding has attached too much importance to pedigree, as it has blinded him to the necessity of going behind the pedigree for study of the merits of the animal. Pedigrees merely trace the parentage of an animal and do not tell the merits of that ancestry. Pedigrees have no value beyond the assistance that they render us in tracing that parentage. It is left to the buyer or the breeder to search out the merit of the parentage as best he may. Associated with pedigree there should be some record of performance.

We do now have the advanced registry that gives the production of the registered animal. It would be of far more importance if it contained a statement of the food consumed, for these products are the results of forcing processes and give us no idea of the food fed per pound of milk given. The importance of this factor will be seen further along, but I may say that it is often the case that common animals would have made equally as good a showing if given equally as good treatment. This is seen in the cow Sue quoted and in the scrubs that I fed. The public discount, and often too much, the value of pedigrees, and this is a condition that breeders must meet by making pedigrees mean more than they now do.

INHERITANCE COUNTS.

Every calf is the product in ten generations back of over ten thousand ancestors. These converging blood lines form a family or a race level of attainment. When lifting descent far above this level by taking advantage of a favorable variation and by breeding and selection along its lines, we are working against the dead pull backward towards the race level, which is ever active. It was this force, no doubt, very largely, that turned backwards the gain made by the Swiss breeders quoted in the paper of Dr. Pearl and that was effective in the backward swing of the high-producing hens of the college farm. Great producers are highly artificial productions with, in their unstable equilibrium, a strong tendency to revert back to the level from which they were forced up. Every breeder must meet this steady pull and avoid all those forces that tend to weaken his product.

His first care must be to acquaint himself, not alone with the father and mother, but with the parentage of several generations back. Fortunately the influence of each generation preceding decreases in a mathematical ratio, until in the fifth generation the influence becomes a negligible quantity. Again, as well be on the ocean without a compass as to start breeding without a future ideal towards which a fixed and well thought out plan of action clearly leads. How far shall it include

INBREEDING AND LINE BREEDING.

Darwin showed by long continued and brilliant investigations that as a rule inbred plants and animals were less prolific and grew less rapidly than cross bred ones. These data of Darwin's have never been met by others that run counter to them. Breeders and thinkers there are that hold that inbreeding, in and of itself, is not necessarily attended by an impairment of vitality. At the same time these advocates of inbreeding freely admit that inbreeding will fix a defect as well as a perfection. This admission is enough, for in our highly artificial animals towards which we strive there is a strong tendency to reversion towards nature, and the fixing of a weakness attaches a strong backward pull. If this weakness be that of constitution or lack of vitality it is a fatal one, for high production stands alone upon a vigorous bottom.

Nature, through the law of variation, seems to design variety and to abhor sameness. Inbreeding and line breeding tend towards the uniform.

Such breeding surely tends to hold only the level already attained, since it fixes the results accomplished by the use of near relatives. It is not progressive breeding and any change must gravitate to the lower. The prevalent opinion of good judges opposed to inbreeding, supported by the researches of Darwin and those of others, must stand until rebutting experimental evidence assumes major importance. We know that most of the families of cattle, sheep and hogs, and special creations of families within the breed, attained by inbreeding by such masters as Bates, Cruickshank, and others for other breeds, did not last long in their dazzling superiority. I can but conclude that much that caused the discouraging showing of the pure breds in the trials quoted was due to the constant close breeding that has occurred with pure bred stock.

HOW TO BREED.

I do not know, and hesitate to advise. The road is not clearly enough charted. Of one thing I can speak with a measure of assurance. Much that appeals to the eye is the product of what has been quaintly termed the "Corn crib cross." "Breed goes in at the mouth." The experiments quoted in a modified way sustain this view. Others confirm it, including those of both the experiment stations of New York, that of Michigan and others. Common cows have been picked up for research work and soon carried for herds above the 300 pounds mark of butter production, and have shown that under the high pressure system that brings for private individuals the remarkable records that have challenged the credulity of many, there were individuals in the group that could easily go into the advanced registry with honor. As viewed by the speaker, food has been a more potent factor than blood, save in the factors related above, of form and ratio of fat. Good breeders who have made their mark have been good feeders. This is as it should be. It must not be understood that food is all, or that with any animal or cow large yields could be secured by good feeding. Far from it. It is no more possible to get a large milk flow from a cow of low constitutional capacity to produce milk, than it would be to get great speed from a Cyldesdale cart horse by liberal feeding. No dairyman should be caught feeding such a cow. But I mean that such cows are to be found as well in the pure bred animals as in the common stock of the country, though perhaps not in the same ratio. But at this point I must specially note that the statement as made applies more correctly to meat production than to the specialized function of milk, and especially butter production. It would not, or may not and should not be true as applied to butter production, since the butter producing breeds have had fixed in them the power to turn a special ratio of their food to the making of butter fat, and on this ground would win out.

Secondly, then, in improving the butter fat herd, I would select those animals or that breed that applied the largest ratio of food consumed to the production of butter fat. There have been many, yet not enough, tests of the breeds and non-breeds for the production of dairy milk and butter under weighed rations. These have had one general trend. I will quote that of the New Jersey Station as it is most conveniently at hand. The trial, as I recall, was for one year. The cost of the butter fat from the Guernseys and Jerseys was 16.6 cents per pound, and from the Shorthorns, Holsteins and Ayrshires, 21.26 cents per pound. For milk, the figures were reversed, standing as 1.81 cents per pound is to 1.70 cents per pound. Usually the cost of milk from the two lines of cows is more favorable to the milking strains. Thus far the Guernsey has produced butter fat the cheapest by a very close margin, and Holstein over the Ayrshire also by a very close margin.

But turning back to breeding I venture the unorthodox remark that I should hold sharply to selection within the breed from those animals that stood high as producers whether it sacrificed uniformity within the herd or not. The uniform is, in a degree, the inbred. Unlikes, within limits when mated, invigorate and are desirable. I would eschew fancy points for the useful, if performance was the end desired, rather than the catching of the careless eye as against the alert mind. But I desire it fully understood that I do not speak with authority other than my personal opinion based upon the general fact brought out by Darwin, and confirmed by common observation, that unlikes produce vigorous offspring. It is the question of merit, versus attractiveness. Personally, I might find the unlike as interesting as the uniform. But please bear in mind that it is not wide crossing or mating I advocate.

SMALL POINTS.

I have already said that I would select the butter line of cows for butter production, and the milk producing breeds for milk sales.

Vitality would in every case be an invariable demand. Vitality means a large power to resist disease, to consume, digest and assimilate, to produce its own characteristics. Such an animal should be of good size, not necessarily large to the extreme, but surely not small of its breed. A medium is usually better than either extreme. I find that the small cow, though capable of good work for a time, will not stand to a good age, strenuous work. Our times demand high pressure farming all along the line for satisfactory success. The authorities are in some conflict on the question of size, yet the preponderance of evidence favors the cow of good size of her class.

Some divergence of opinion prevails in relation to the time of breeding. It perhaps is generally held by good observers that the milk producing tendencies of a heifer should be cultivated before the fattening tendencies are beginning to be brought into play. This time for mating is placed so that the heifer should drop her first calf at two years of age. Obviously, the time must depend somewhat upon the development secured by good feeding and management. I should desire a well developed heifer at two, if she is expected to drop a calf at this age, as the tax of the rapid growth at that time plus a good milk flow would be a severe one, and require very heavy feeding or be followed by a stunted condition.

It will be observed by the trials quoted that grades made a good showing. First crosses are productive in conformity to what appears to be a natural law. It has been said that the bull is half the herd. If selected as I have indicated, from an ancestry having in common the desired qualities for some generations, both on the male and the female side, he will be prepotent, and when mated with the common stock will impress his qualities upon the offspring, more than the mothers whose qualities are less firmly fixed. The result will be a lift of the level of production, not only of the herd as a whole but of most of its individual members. These crosses should never be bred together, since their qualities are more unstable. The result will be unevenness of character and attendant reversion to the former level. The continuous use of the pure bred animal should follow.

The production of such a herd well bred, should equal that of a pure bred herd, and if such a herd of pure bred cows have been bred for fancy points, or inbred, they will prove their superiors.

While believing that the improvement of Maine dairy animals must come in the direction named, and come without sacrificing efficiency, it follows, not that pure bred animals are to be neglected, but on the contrary they are more called for, especially the males, since the general adoption of this policy would make a greater demand than could at present be filled. It would also make a permanent and profitable demand, and create a class of breeders to supply this demand. A class having a regular demand that was intelligent in its aims would be induced to greater responsibility and to adopt a higher standard of breeding.

As the true shade of one's meaning in a hasty discourse on a large theme is often lost, I make haste to say that I would not have it understood that I hold that breeders as a whole have been irresponsible or thoughtless. The breeder's road has not been clear nor the demand for his animals of such adequacy as to seem to him to warrant unlimited time and expense to be devoted to his art.

It was stated at the opening that breeding is not a fixed science. I did not overlook the Mendal law that assumes in part or largely to follow mathematical laws and to abbreviate the time required to fix new qualities. It requires the discovery of recessive and dominant qualities. These may be observed in plants and animals producing numerous progeny, but for our domestic animals whose product is but one, it is not as yet clear to me that much has been clearly shown to have been gained. By whatever laws that are or are to be unfolded we may pursue in breeding, it will yet remain necessary to breed from the best or to breed from selection.

By the Mendal law or by the modification proposed by Cook or by Davenport, if these prove of value, we may find a means of more readily determining what is the "best." The friends of the Mendal law tell us that it represents the most important discovery in the laws of heredity yet made. Spillman and others claim things already accomplished and more yet to come, possibly, perhaps probably correct, yet if correct, the door is but opened for a wider use of skill.

Finally, when we have attained the right dairy cow, it should be our aim to hold her in good health and vigor by the aid of well lighted and well ventilated barns. These are an essential part in lifting and holding the level of our dairy herds.

FEEDING THE DAIRY COW FOR PROFIT.

By Lowell Roudebush.

Among the essentials in feeding the dairy cow for profit is the man! the man! always the man with scales, milk sheet and the Babcock tester; the cow, her food, environment and excreta.

No animal or plant has the natural or acquired ability to make something out of nothing—hence the dairy cow must be fed, and in that feeding there should be a net profit.

There are many carriers of the different nutrients with which she may be fed. In the selection of these carriers a number of factors must be considered. Cheapness is fundamental, otherwise there would be an actual loss. Palatability should always be given a value because it increases the secretion of the digestive fluids and sharpens the appetite, hence there is more food eaten, and better digestion and assimilation result. A carrier with a large amount of ash or mineral matter is to be desired, so that the toxics generated in the synthetical processes—digestion and assimilation—may be neutralized, and the food supply of the bony structures be equal, and in the immature member of the herd, greater than the waste. Volume or bulk has a value greater than most of us give it. The cow has four stomachs and they should be filled at least once in twenty-four hours. Porosity or good mechanical division will add very much to the digestibility of the food eaten. Carriers of muscle, hair, hoof, horn and milk-producing nutrients must be fed and are essential to growth, repair and the pail.

Comfort is not without value. It is vital. Good air, plenty of sunshine, and good sanitary surroundings are necessary, particularly good air. Cultivating a close intimacy with each member of the herd is all important. If you can't be the calf in the eyes of the cow, get out, get away, the sooner the better for both.

Regularity in feeding, milking and watering, plays an important part. Unusual or unnatural noises must be eliminated. The up-to-date dairy cow is for the most part an artificial product, the feeding and general management of which require a high order of intelligence and skill, that she may respond at the pail, with profit to us and without hurt to herself.

Now that we have called your attention to some of the factors in the feeding of the dairy cow for profit, let us for a time consider the relative value of the many carriers grown on Maine farms, and the endless by-products offered in the market. Before going further in this discussion, we wish to say that in our opinion the German Standard, so far as it relates to the nutritive ratio, is wrong; 1 : 6.5 is much better from the points of economy, health and production. In this wider ratio, all the factors above mentioned must be given due consideration. We think it wise to grow all the hays, fodders and roots, and more or less of the grains that can be utilized. If any food is purchased, let it be the highly concentrated, all else being equal, thus saving freight, sacks, and commissions on valueless substances.

In the following carriers, we have based their relative values on the amount of digestible protein they are supposed to contain. For maintenance, work, and the shambles, it would be necessary to give value to the carbohydrates and fats. Timothy hay is grown on most Maine farms. It is deficient in ash, constipating, and not always palatable. A ton, which sells for eighteen dollars, is supposed to contain eighty pounds of digestible protein, which costs twenty-two and one-half cents per pound. Red clover is also generally grown. It is laxative, contains considerable ash, and contains one hundred and sixty-six pounds of digestible protein, which costs, at seventeen dollars per ton, ten and one-half cents per pound. Alsike sells for the same price, but contains one hundred and seventy-four pounds, costing 9.8 cents per pound. Silos are quite numerous, and silage, when made from average corn in stalk and ear, is a summer food in winter, palatable and laxative. A ton contains about twenty-five pounds of digestible protein, and costs about twelve cents per pound. Corn and cob meal contains one hundred and eight pounds of digestible protein and costs thirty-two dollars per ton on the market, or 30.5 cents per pound. Corn is worth thirty-three dollars per ton, and contains one hundred and fourteen pounds of digestible protein, which costs twenty-nine cents per pound. Both of these carriers are palatable, but the latter is deficient in ash, but gives quality to milk and its products. Oats can be grown successfully everywhere in Maine, a ton of which costs forty dollars, and contains one hundred and sixty pounds of digestible protein, costing twenty-five cents per pound. They are porous, hence bulky, and are rich in ash. Wheat-bran is a by-product, is porous, bulky, and rich in ash. It costs twenty-nine dollars per ton, and contains 250 pounds of digestible protein, which costs 11 3-5 cents per pound. Gluten meal is a corn by-product, is palatable, costs thirty-four dollars per ton, and contains five hundred pounds of digestible protein, costing six and four-fifths cents per pound. Oil meal is a laxative of some medicinal value, rich in ash, and can be bought for thirty-six dollars per ton, and its six hundred pounds of digestible protein will cost you four and one-sixth cents per pound. Cottonseed meal is constipating, cannot be fed in large quantities without danger, especially where roots or silage are not fed, and is not always palatable, but is rich in ash. It costs thirty-two dollars per ton, and contains seven hundred and twenty pounds of digestible protein, at four and one-half cents per pound. It is the cheapest by-product in the market, and for profit should be a part of each dairy ration. During the summer months—June, July and August—the mixed grasses furnish a very cheap yet ideal ration, succulent, bulky, palatable, well balanced and economical, on many farms. Where intensive farming is practiced, soiling crops, as a part ration, are cheap but require labor. Rye, red clover, and sweet corn can be utilized with corn silage once a day.

I have given you the relative values of quite a number of carriers of digestible protein, and their characteristics. Now you want to know what you would feed the dairy cow for profit, in Maine. In my opinion there are but two purely forage crops that I would feed a dairy cow in the Northland, alfalfa and red or alsike clover. Timothy is all right for the livery horse all the year, and on a farm during the heated term, but for a cow, never. Where you have not enough red or alsike clover, I would always use corn silage. Well, I would use it in part, anyhow. In short, the farmer or dairyman who is selling whole milk, cannot compete with the farmer who has a silo, all else being equal. I would feed corn and cob meal or ground oats and cottonseed meal, the cheapest carrier in the market of digestible protein. Clover, corn, oats and silage are home products. Would you not feed wheat bran? No, it is too expensive—not concentrated enough—too much so-called filler. About what proportions would you give a dairy cow producing thirty-five pounds of milk per day? This would be about right: Silage, thirty pounds; clover hay, ten pounds; corn and cob meal, five pounds; cottonseed meal, two pounds; oil meal, two pounds. This ration is only a base from which you may work.

The dairy cow should receive from one-half ounce to one and one-half ounces of salt in her food per day. Condimental stock foods are a tax on the credulity of the dairyman who uses them. If your cows need medicine, consult a veterinary—if food, ask the cow. It will be cheaper and the part of wisdom. Don't buy mixed feeds. They are, generally speaking, the offal at best, and too much of the farm thrown in for good measure. Mixed foods are sold at the value of the highest priced ingredient, and that may be the least in amount. They offer a temptation to the mixer to misrepresent, and you pay dear for your whistle. Yes, Jones pays the freight, and you are Jones with a big J.

Each herd, in many respects, is a law unto itself, because of the individuality of the members. It is well to study ration tables, but if you wish to succeed, you must study the individuality of your cows. No two animals can be fed exactly alike, with good results, for no two are alike.. The right kind of food for our domestic animals is not all of profitable feeding. You must know your business. Your animals are and are not machines. You must establish and maintain a friendly relation with them. This is not all; the maximum amount of comfort must be given, and this comfort cannot come unless you become their friend. Then you can and will realize what bad odors, bad air, absence of light, cold draughts, filthy bedding, unclean walls, and inconvenient mangers mean to the cow, the reflex action of which hits your bank account a body blow and profits go fleeting, and you are undone. Again, the indirect profits may ultimately be made to give direct ones. Rotation alone will not maintain the fertility of your farms. Commercial fertilizers are no better, but a short rotation, with clover once in three years, with the rational use of commercial fertilizers, supplemented by the excretion of your dairy cows will maintain soil fertility. By fertilizing or dressing your young clover, you can grow more of it—hence more corn—and with more corn, more silage. With more of these carriers, your cottonseed meal can be purchased, the manurial value of which is almost equal to its feeding.

One thing more and we are done. You may buy and grow the best feeds; care for the animals properly, and sell the product to good advantage, but without a cow that is a persistent milker, giving not less than five thousand pounds of four and one-half per cent milk,—what's the use? One-half of the cows in many states are kept at an actual loss. Get rid of the star boarders by testing and weighing the milk of all the members of your herd. Sell them for bologna—give them away rather than keep them longer—give them to a millionaire, never to the poor widow.

In conclusion, feeding the dairy cow for profit means the man and the cow working in harmony, the one seeing and doing things, the other, in return for kindness, like a willing slave, doing the best she can, and that always gives a profit to the man.

SOME PHASES OF ECONOMICAL FEEDING.

By Chas. D. Woods, Director Maine Agricultural Experiment Station.

When your secretary asked me to prepare a paper for the State Dairymen's Conference along the general topic of economical feeding of dairy cattle I hesitated. It is nearly forty years since my teacher and former chief, Doctor Atwater, presented at a meeting of the Maine State Board of Agriculture, the first attempt, so far as I know, to bring to an English-speaking audience the chemistry of cattle feeds and their use in the animal body. Since then the feeder of dairy animals in Maine has become quite familiar with the chemistry of feeding stuffs that he uses. He has learned to calculate rations for himself and I had begun to have the feeling that it was no longer the mission of the investigator to talk along these well trodden lines. In talking the matter over with your secretary, who, through the cow testing associations and the cow breeders' associations, is so closely in touch with many of the best handlers of dairy stock in Maine, he convinced me that there is still a mission along this line.

What I shall give you this afternoon is an informal talk rather than an address. Our talk is sure to take us over a familiar road and my only excuse in so doing is to point out some of the pitfalls that your secretary has more than intimated were giving practical difficulties to some of our dairymen.

We have become so familiar with the terms of protein, fat, carbohydrates, crude fiber, nitrogen-free extract and ash in talking of feeding stuffs that it might seem unnecessary to touch in this paper upon these constituents common to all feeding stuffs, but I wonder if it is not possible that because of our very familiarity with the terms we may have failed to grasp all that the names imply.

I frequently hear men talking of the protein of a feeding stuff as though it were the name of a thing which enters into the composition of a food in much the same way as common salt or sugar, for instance. Protein is the name not of a substance but of a class of substances that may differ very greatly in their chemical composition and in their nutritive values. Doctor Osborn of the Connecticut Experiment Station has for the past twenty-five years devoted his whole time to the study of some of these protein bodies and in all these years he has only been able to work out the definite composition of the proteids of a few of our more common cereals and seeds. The Maine law regulating the sale of concentrated commercial feeding stuffs defines protein for the purposes of the law as the element nitrogen multiplied by the factor 6.25, so that when you purchase a feeding stuff which bears a guaranty of, for instance, 30 per cent of protein, it simply means that those goods when submitted to chemical analysis will carry 4.8 per cent nitrogen. Now nitrogen is an exceedingly important element both in plant food and food of animals, but uncombined nitrogen is of no value to either higher plants or animals. It is only when nitrogen is in combination with other forms of matter that it can be utilized by the higher forms of life. Plants are able to feed upon nitrogen in very simple mineral combinations such as in the form of ammonia or of nitrate of soda. Animals in order to utilize nitrogen must have it in combination with elements which go to make up the so-called organic compounds or bodies. These organic compounds are not simple but are very complex. In order that the animal may best use these nitrogen compounds they must be more or less analogous to the tissues of its own body. Nitrogen even in some organic combinations may not only be of very little nutritive use to the animal but may be actually poisonous. The alkaloid poisons are rich in nitrogen.

These compounds of nitrogen which have very little nutritive value do not belong to the class of proteids and should not be included under the name protein. If, however, you give an entirely unknown feeding stuff to the chemist he may analyze it and find it rich in nitrogen and consequently report it high in protein when its feeding value may be low, or even inimical to the good of the animal. It is only by giving the feed to the animal itself that we learn anything as to its feeding value. Chemistry never discovered that a material was poisonous, nor has chemistry ever discovered that any material was good for food. After a certain substance was found to be poisonous chemistry has shown us what that substance is, and when a material has been found to be of high feeding value chemistry has been able to show what particular materials in the substance had these properties.

In so far is it true that the protein bodies in order to be of the most nutritive value should be closely analagous to those in the body itself, that it has been found that flesh-eating animals can utilize the protein from their own kind better than protein from other kinds of animals. For instance dog fed upon dog meat has been found to thrive better and with a smaller ration than when fed upon other kinds of meat, and it is very likely that there was really some physiological truth underlying the thought of the savage that when he ate the flesh of his human enemy he gained a certain something from this diet that he did not obtain from ordinary food. While this reasoning would not apply to the herbivorous animals that live not upon animal foods but upon vegetable foods, yet there is without doubt a very great difference in the nutritive value of the protein matter derived directly from the higher bred grains than when taken from certain refuses. Therefore the source of a protein that we feed to our animals is not a matter of indifference. We cannot take a table giving the composition of feeding stuffs and make up a ration containing so many pounds of protein taken from different kinds of feeding stuffs and be sure that our totals are anything like the same, so far as the animal is concerned, when we get our given weight of protein from one class of feeding stuffs, as they would be from an entirely different class of feeding stuffs.

This is even still truer of the fats than of the protein. Fat as determined in the chemical laboratory is the ether extract and ether dissolves a good many things other than the true fats. The ether extract of corn meal and the ether extract of cotton-seed meal, both of which are called fat in tables of composition of feeding stuffs, differ greatly in their composition and in their nutritive value. Just as there are many kinds of protein, there are many kinds of fats and oils. Then ether dissolves out of feeding stuffs some of the resins, out of grasses the coloring matters, so that, for instance, the so-called fat of timothy hay has very little feeding value and is not at all analagous to the fat of linseed meal or the grains.

There is only one known way to test a new material to see whether it is good for plant food and that is to attempt to grow plants with it. In like manner there is only one sure way to try a new feeding stuff and that is by giving it to the animal and carefully noting the results. We have found that certain classes of feeding stuffs contain certain kinds of materials and the chemist is able from the analysis of the feed to reason that the feeding stuff which contains these materials may be of feeding value, but it is only when the feed is put to the actual feeding test that anything definite can be learned relative to its nutritive value.

The moral of this is that the feeder should go slow in adopting new and untried feeding stuffs, no matter what the analysis may say of their content. We are, for instance, at the present time having thrust upon us molasses feeds to which I expect to again refer in this paper. Molasses has been fed to animals and found to be a good feed, but it contains only carbohydrates. A balanced ration may be made out of molasses by adding to it materials containing protein and fat, as, for instance, cotton-seed meal. If that were all, the case would be plain, but the uncertainty comes from the materials that are used for absorbing and drying the molasses. They have been found in many instances to be made up of various refuse materials and frequently contain large quantities of weed seeds whole or ground. Seeds are always rich in nitrogen and when these feeds are analyzed the nitrogen of the seeds adds to the percentage of protein of the molasses feed. The analysis gives no information as to the nutritive value of the so-called protein derived from the weed seeds. Some weed seeds are known to be poisonous. Little or nothing is known of the nutritive value of most weed seeds. The only way to find out relative to that is to feed them to the animals themselves. I do not want to discourage or confuse you relative to the chemical constituents of feeding stuffs but I do want to make it clear to you that a pound of protein from one source may not be at all like a pound of so-called protein from another source. As simple a thing as the gluten of wheat, the most valuable vegetable protein in the diet of man, is not one definite substance but is a mixture of at least four different materials and the quality of the gluten of different wheats varies as these constituents vary in their proportion in the wheat berry. The nitrogenous bodies that are left in the wheat bran are not at all like the nitrogenous bodies that go into our wheat flour, so that the so-called protein of the whole wheat berry is a very different thing from the protein from either wheat flour or wheat bran taken by themselves.

DIGESTIBILITY OF FEEDS.

Very little is known about the digestibility of the individual compounds that go to make up a feeding stuff. While we know from experiment the approximate percentage of the protein of wheat which an animal will digest under normal conditions, we know almost nothing of the differences in digestibility of the half dozen different bodies that together constitute wheat protein. While the sugars and starches are pretty nearly if not quite completely digestible, the different kinds differ greatly in time necessary for their digestion. Investigations show that this variation reaches such a degree that under precisely the same conditions certain of the starches require eighty times as long as others for complete solution. From this it follows that at present we must base the digestibility of different feeding stuffs upon the results of experiments with that material and not upon its chemical composition. The chemist can take a new feeding stuff and from analysis tell quickly and accurately how much crude protein, fats and carbohydrates it contains, but he cannot tell until after definite digestion experiment with animals how much of these are available for the purposes of nutrition. It is not enough to know the chemical composition of a given food material but it is equally essential to know how much of the nutrients will go into solution through the action of the ferments of the different digestive juices of the stomach and intestines. While a comparison of the composition of closely allied feeding stuffs will be a fair measure of their comparative food values, this is not true of different classes of food materials. For example, wheat bran and clover carry about the same percentage of protein, but nearly eight-tenths of the wheat protein is digestible and less than seven-tenths of the clover protein.

INFLUENCE OF DIFFERENT CONDITIONS UPON THEIR DIGESTIBILITY.

The results of digestion experiments with reference to different conditions of coarse fodders will help to a clearer understanding of the way these crops should be handled.

The Digestibility of Green or Dry Fodder. Fodders, if cut at the same time and cured without loss of leaves, etc., seem to be equally well digested whether used after curing or fed green. In general, owing to loss of leaves in curing, the green fodders are better digested than are the cured.

The Influence of the Method of Haymaking. As applied in the above, the method of haymaking has a great influence upon both the composition and the digestibility of hay. Other things being equal, the more rapid the curing the better.

In ordinary field drying and handling of alfalfa there was enough of the leaves and more delicate portions of the plant lost to reduce the protein one-tenth and the fat one-third, and to increase the fiber correspondingly. And there were 4.4 per cent less of the protein, and 17.6 per cent less of the fat digested in the hay as ordinarily cured than in that which was dried without loss of the finer and more delicate portions of the plant. There was no added digestibility of the nitrogen-free extract, and very little of that of the fiber to compensate for this loss.

This indicates the great advantage of making hay with the least possible handling, and the advantage of drying only enough to insure the hay keeping, and thus avoiding, so far as possible, the loss of the delicate and more digestible portions.

The Influence of Period of Growth of Fodder Plant. In general, the percentages of protein, fat, and nitrogen-free extract decrease as the percentages of fiber increase with the age of the plant. Also, as a rule, with added age, the nutritive ingredients of the plant are rendered less digestible.

It does not follow, however, of necessity from these facts that a given plant should be harvested as early as possible. The total yield of digestible nutrients is of more importance than percentage composition and digestible coefficients. It has been found by careful experiment that the largest yield of digestible nutrients is not obtained by repeated cuttings of a forage plant. The important practical point is to harvest the crops when there is the maximum of digestible nutrients. On the whole probably the best time to cut most of the plants used for forage, whether to be fed green or to be cured and fed as hay, is when they are in full bloom. If cut much before this there will be a loss in yield per acre, and if allowed to stand much later than this the deterioration in quality is greater than the increase in quantity.

Influence of Weather in Different Years. Crops grown upon the same soil in different years, even when supplied with the same fertilizers, differ greatly in composition from year to year. As would be expected, the crops also differ very considerably in digestibility. This is largely due to the weather and conditions outside of the control of the grower, and hence does not need consideration except as it is of importance in estimating the value of a feeding stuff.

Influence of Long Keeping. Many experiments agree in showing that keeping impairs the value of a fodder, rendering it less digestible. There is a loss in dry matter due to the loss of leaves, etc. The "dust" that is always in hay indicates that a loss is taking place. This loss is important, and taken in connection with the impaired digestibility points out the disadvantage of keeping over hay from one year to another.

CLASSES OF CATTLE FOODS.

The numerous and ever increasing number of materials used for feeding animals can be readily grouped in two general classes: the coarse fodders, including ordinary fodder plants, green and dry, the roots and tubers and concentrated fodders; the seeds and grains, milling products and the refuses. The forage plants of the greatest value belong for the most part to two great botanical families: the legumes, which include the clover, alfalfa, peas, lupines, vetches and beans; and the grasses, which include all the English grasses and the grains. The roots for the most part belong to the mustard family, and rape, which is coming to be used considerably as a green fodder, also belongs to this family.

Valuable as are the ordinary grasses, on many accounts the legumes are still more valuable for feeding and manure. Among the reasons that legumes are specially valuable are:

They contain large proportions of protein which serves to form blood, muscle, bone and milk. As for instance, hay from our ordinary grasses carries from 4 to 6 per cent of protein, while hay from clover or soy beans will carry 8 per cent or more.

Plants of the clover family respond readily to the application of mineral fertilizer. The plants of the clover family have the ability to acquire atmospheric nitrogen and on this account can be grown without the more expensive fertilizers.

The manurial value of the legumes depends upon the large amount of plant food in both the tops and the roots. When the crop is fed, four-fifths or more of the nitrogen and a still larger proportion of the mineral fertilizer constituents go into the excrement and if these are preserved make a very rich manure. If the crop is plowed under, this plant food, including that acquired from the air and that gathered from the subsoil, is left for the use of succeeding crops. When the crop is removed the roots and stubble with their large amounts of fertilizing material still remain to be plowed in and enrich the land.

GREEN FODDERS FOR SOILING CROPS.

The production of green crops as a supplement to or substitute for pasture is a practice essential to the highest success on many farms. There are few Maine farms that can be relied upon to offer grazing in August and September sufficient in quantity and quality to maintain a satisfactory milk flow. Doubtless on many farms soiling can be substituted entirely for grazing to advantage. On the farms with upland pastures in which native grasses of high quality grow, soiling may not be called for, but wherever the conditions call for intensive farming, grazing on permanent pastures cannot be a part of such practice.

Much more feed can be produced on a given area by soiling than by pasturage. Furthermore, grazing is wasteful because of the imperfect use of the growth that is made. Much grass is trampled down and fouled. The matter of fencing which is saved by soiling is also an important item in farm economy. If soiling is to be practiced to help out pasturage during the late summer or early fall, a limited number of crops will meet the demand. Three or four sowings of peas and oats in late May and early June and two plantings of corn a fortnight apart, would usually furnish sufficient green food when it is most likely to be needed for the Maine farmer.

SILAGE.

In the neighborhood of thirty years ago this process of preserving grain crops was introduced into the United States. At first the silo met with considerable opposition from the more conservative, but now it is unquestioned that it is usually the most economical way of handling certain fall crops, more particularly Indian corn. Many farmers have gone so far as to feed silage the year round; certainly there are some reasons why this is more advisable than growing soiling crops, for soiling has the disadvantage of harvesting in small quantities, which is always more expensive than harvesting on a larger scale. There has been considerable discussion and experimenting as to the relative losses in the ordinary method of curing corn fodder and the losses which take place in the silo. The results of these experiments seem to show that there is about as much loss in one case as in the other. Silage has the enormous advantage over field curing of furnishing succulent food throughout the winter months. Corn, oats and peas sown together, and clover and cow peas, include the plants that can be well made into silage. Abundant experiments have shown that silage made from corn well in the dough stage contains larger amounts of digestible matter than if harvested earlier. It follows from this that the variety of corn to be grown for silage must be one which would in ordinary seasons mature. Experiments at the Maine Experiment Station indicated that it would take 180 pounds of immature Southern corn to equal 100 pounds from the silage made from mature field corn.

CURED FODDERS AND HAYS.

In general it is true that the maximum quantity of dried matter is secured when crops are allowed to fully mature and ripen. But legumes such as clover are an apparent exception to this because when at maturity the leaves rattle off and are lost during the process of curing. It, however, does not follow that because the crop increases in the yield of dried matter the nutritive value has proportionately increased. The change in texture and in composition of the dried substance sometimes renders it less digestible and this may more or less offset the greater yield. In the ordinary English hay this is the case. The dried matter of matured grass contains a much larger proportion of fiber than the immature. The fiber is not only quite indigestible of itself but it reduces the digestibility of the other food constituents. For example, three American digestion experiments with timothy hay cut in full bloom showed an average digestibility of 62 per cent, while hay from the same fields cut when past bloom had a digestibility of only 55 per cent. The increasing yield with the mature hay showed that there was practically the same amount of digestible dried matter in both the early and the late cut, but the early cut was much more palatable, which gave it added feeding value.

While early cutting should be the rule with the ordinary grasses used for hay it does not follow with Indian corn. Mature corn contains less fiber and more soluble carbohydrates than immature corn and as is well known the dried matter in corn continues to increase until the corn is mature. Hence, for palatability, digestibility and yield it is advisable to allow corn to mature before harvesting; and this is equally true however the corn is to be cured, as fodder or made into silage. The advantage of the clovers and rowen hay as a source of protein is very evident since they have about double the digestible protein found in ordinary grasses when made into silage.

OATS AS HAY.

It is quite a common practice with many farmers to harvest oats before the grain is mature and cure them for coarse fodder. This is a very desirable plan to follow at times when the hay crop is short, or in localities where the land is badly infested with noxious weeds like the Canadian thistle or wild mustard, both of which should be cut before they seed.

The oat plant, however, is not an ideal one for making hay. The stalks are hollow, coarse and hard, and unless dried very quickly in a bright sun they become bleached, even when cut green, so that they look little better than straw. To cure the crop in its best condition and retain its bright green color and palatability, it should be dried in a bright sun for a few hours, with liberal use of the hay tedder when there is a heavy growth; then raked together and the curing completed in the windrow or cock, with as little exposure to moisture as possible. If the weather is unfavorable, as is frequently the case during the latter part of July or first of August when oats are mature enough to cut for hay, they are very liable to be seriously injured and rendered unpalatable.

Oats, however, when not sown too thickly, have an advantage over other plants, which make more desirable hay, of being a fairly good catch crop for seeding to grass, as they mature early enough to allow the young grass to get a good start in the fall, and for this reason are desirable on the farm.

Experiments at the Maine Experiment Station show that oats cut in milk stage contain a great deal more digestible protein than at any other stage of their growth, and also that they contain a maximum amount of digestible dry matter at this stage. A study also was made of different sections of the oat plant, one of which was the first eight inches of the lower part of the stalk, another the second eight inches and the third the remainder of the plant or top. The bottom section had very little food value; the second section had only about half the protein of the top section and is less digestible. In cutting oats, therefore, for hay it is better to leave a high stubble, for the loss incurred by leaving the coarsest part of the stalks on the ground is more than compensated by the improved quality and palatability of the remainder.

OAT AND PEA HAY.

Oats and peas grown together and harvested when the oats are in the early milk stage make a forage crop very much superior to oats alone for either hay, soiling, or silage. As peas are a leguminous plant they increase the protein of the fodder, and also improve the soil by leaving behind, in their roots and stubble, a part of the nitrogen which they take from the air. By growing the mixture then, both the fodder and the soil are improved, whereas if oats are grown alone a rather poor fodder is obtained and the soil reduced in fertility. This combination makes one of the best soiling crops for feed in July and August before corn or Hungarian is mature enough to cut. If the crop is allowed to mature and the two grains are ground together, the result is a most excellent feed for dairy cows and is much used by Canadian farmers. The chief objection to the material for making hay is that it dries rather slowly. The pea vines are like clover in this respect and should be cured in much the same manner, in the windrow or cock. When fully cured without too much exposure to moisture and sun it makes a fodder fully equal to our best English hay. In case of bad weather the silo can be resorted to as a means of curing for the crop, but the material should be run through a silage cutter before ensiling, otherwise it is liable to be poorly preserved.

Oats and peas cut green run through the silage cutter and put into the silo have, at the Maine Station, kept perfectly. At time of feeding they were in a palatable condition and were as well relished by cattle as corn silage.

ROOTS AND TUBERS.

Roots and tubers are advantageous foods because they furnish very palatable, succulent foods which may be kept in perfect condition during the entire season. Because of their palatability they have an advantage which cannot be wholly measured by the actual nutrients which they carry. The disadvantage of this class of foods, particularly as compared with silage, is that they are expensive to grow. It is, however, possible to get practically the same yield of digestible dry matter per acre from roots and tubers as from corn.

Potatoes have a greater nutritive value than the roots, but because of their market price and the relatively small amount which can be grown per acre, they cannot usually be fed economically. While they contain considerable protein, much of the protein of the roots and tubers is not in the best nitrogen form. In order to store roots through the winter without loss, they should be kept as near the freezing point as possible and be well ventilated.

HOME PRODUCTION OF FOOD.

It is impossible to too strongly urge the home growing of foods for carrying dairy stock and other animals. While probably it is not possible on most farms to grow all the protein needed for carrying dairy stock, there is no reason why all the carbohydrate material cannot be home produced on most farms. While there is no one crop that will give so much digestible dry matter per acre as corn, there are other crops which will give larger yields of protein per acre and will thus make it possible to help balance the ration with home grown products.

Field peas sowed alone or with oats will give a large yield of protein per acre. When allowed to mature and ground, either the peas by themselves or mixed with oats make a valuable food for all classes of animals, including milch cows. Feeding these home grown crops makes it possible to convert the cruder materials of the farm into the finished products and thus provide a home market in which the field crops are disposed of at a good market price. It needs only a cursory examination of Bulletin 3 of the Maine Department of Agriculture reporting the Cow Testing Association work in Maine to show that the farmer sold roughage not only of English hay but of swale hay, peas and oats, corn fodder, silage, etc., at prices which must have been profitable returns upon production.

After the average dairyman has grown as much food as he can for his animals upon his farm, he will still probably need to purchase concentrates and this must be done with due consideration to the food that he has on hand in his barns. To the farmer having an abundance of hay and other dried roughage with silage or roots there is no excuse for buying feeding stuffs high in carbohydrates and consequently deficient in protein matter.

THE BEST CONCENTRATES.

In these days with so many companies preparing dairy rations which claim to be made of excellent materials and well balanced, the careful feeder is finding it still more difficult to obtain in the market the high grade nitrogenous foods, and as evidenced by the reports from the Cow Testing Associations, feeders that have wanted to buy only such things as cottonseed meal, linseed meal and gluten feed, have been forced because of the market conditions to purchase compounded rations low in nitrogen and loaded with materials that they do not need and in some cases materials that were absolutely objectionable, such as weed seeds. Cottonseed meal has been fed extensively to cows in the New England states for the past thirty years and despite its degeneration in quality still stands pre-eminent among nitrogenous feeds as the most economical source of protein. Practical experience supplemented by carefully conducted experiments has demonstrated the high feeding value of this material for most farm animals. Its value for producing milk, meat and butter has long been established. It is the most highly nitrogenous of the feeding stuffs on the market and is, therefore, the most economical for balancing rations of feed deficient in protein, such as corn silage, timothy hay, corn meal, etc. As time has progressed the demand for cottonseed meal, both at home and abroad, has constantly increased so that prices have very materially advanced and the demand has further increased so that it is possible to find a fairly ready market for a cottonseed meal of inferior quality. It is a matter of more than profound regret that the cottonseed meal has so deteriorated in quality and that the deterioration still seems to be going on. Two or three years ago the guaranty for cottonseed meal coming into the North was changed for the most part from 43 to 41 per cent protein and there is a tendency, at present, to change the guarantees still lower so that 38 per cent, 38.50 per cent and 39 per cent are common guarantees upon many of the brands now offered. In Bulletin 115 of the Maine Experiment Station there is published a series of digestion experiments with neat stock of cottonseed meal of varying qualities as represented by the percentages of protein. There was not much difference in the digestibility of the protein from cottonseed meal down as low as 35 per cent protein, but when the protein fell below that its digestibility seemed to deteriorate quite rapidly. In taking up the matter of the low grade cottonseed meal with the shippers, they have put forward the argument that if there was not so much protein there was more of some other materials and some credit should be given for that. In the experiments above referred to it was found that the digestibility of the dry matter of the cottonseed meal was in direct measure with its protein content. With a cottonseed meal carrying 47 per cent protein 90 per cent of the dry matter was digested; with a 43 per cent meal only 86 per cent of the dry matter was digested, and with a 35 per cent meal only 73 per cent and with a 24 per cent meal only 61 per cent of the dry matter was available to the animal. From these experiments it would seem that the protein is a direct measure of the feeding value of the cottonseed meal and the farmer should not be deluded into the thought that if his meal is low in protein it is correspondingly rich in some other digestible constituents. About 83 per cent of the protein of cottonseed meal of 35 per cent or more is digestible.

The price of new process linseed meal has not increased as rapidly in proportion as that of cottonseed meal, consequently today linseed meal is a fairly economical source of protein. It is also a very excellent source of protein so far as its digestibility and its general feeding effects are concerned and in those markets where it can be obtained the feeder will find it a valuable feed with which to balance his ration.

With the increased demand for feeding stuffs not only has the price of gluten advanced but the cream gluten or gluten meals which did not carry corn bran have been replaced by the gluten feeds which in addition to the nitrogenous materials contain the bran from corn. The goods, therefore, are very much lower in protein than the gluten meal of a dozen years ago. It is, however, a bulky ration and a safe one but is not as economical for balancing rations as either of the oil meals.

Distillers' grains differ enormously in appearance from gluten feed but they have practically the same source and the same composition. Both the distillers' grains and the gluten feed have the advantage in giving bulk to the grain ration and with the present high price of bran which has been so highly depended upon to supply bulk and ash, these feeds have a place in the ration in addition to their high protein content.

For the man who does not grow sufficient corn it will probably be still necessary to purchase some corn meal for his ration, for there seems to be something about maize that aids materially in milk production. It is possible to make economical rations that will give high production without the use of corn, but it is much easier to devise a satisfactory ration viewed from the standpoint of production, if corn meal is included among the grains. The refuses from the milling of wheat bran or middlings, or the two run together as mixed feed still have, despite their advance in price, a place in the ration. For the man who has grown practically all of his carbohydrate material, cottonseed meal, linseed meal, gluten feed, distillers' grains, wheat bran, and possibly corn meal make up the purchased feeds from which he should ordinarily select his ration. It may be that some feeders are so situated that some of the prepared rations rich in protein can be economically used. To the man who finds himself obliged to buy carbohydrates because he has not produced enough in roughage or silage it may be economical to use some of the low grade mixture of feeding stuffs.

UNDESIRABLE FOODS OR THOSE OF DOUBTFUL VALUE.

Having thus rapidly gone over the class of concentrates that can be recommended, there is now left to discuss those feeding stuffs in the use of which the economical feeder must practice caution, if he does not cut them out altogether.

Six or seven years ago the State was flooded with low grade, adulterated wheat bran and mixed feeds which led to the introduction of a section in the feeding stuffs law prohibiting the adulteration of "whole or ground grain with milling or manufactured offals or with any foreign substance whatever, or any bran or middlings made from the several grains with any foreign substance whatever, for the purpose of sale, unless the true composition, mixture or adulteration thereof is plainly marked or indicated upon the package containing the same." Because of the enactment of this law and the publicity given to these goods and the co-operation of the best of the large dealers, they have largely disappeared from the market, although they are occasionally found but sold under their proper guaranty. Their sale is lawful with a guaranty but the difference in price is never commensurate with the lowered feeding value of the adulterated mixed feed. There is so much profit in selling ground corn cobs at the price of legitimate feeding stuffs that the consumer must ever be on the watch against this fraud. There is before me a circular letter from a mill whose business it is to grind corn cobs for adulteration. They write, "We are selling a great deal of this meal in car lots and less than car lots to feed dealers throughout the country." They call attention to two enclosed samples. They say, "The value of this corn cob meal will be obvious to you not only as a cheapening of your feed but (and this is added to soothe the conscience of the intended adulterator) it is a well known fact that the moderate use of cob meal in corn meal is beneficial." They go on to say that they sell this at $11 or $12 per ton in accordance with fineness in car lots." Cob meal has very much the same feeding value as oat straw. It may be economical for the grower of corn to have his corn ground cob and all. However profitable it may be to a miller it is never economical for the feeder to purchase for a feed ground corn cobs at any price at which they have been or are likely to be offered.

The market still carries a large number of oat feeds, corn chops, corn and oat feeds and similar offals by themselves and blended with concentrated feeds. They vary in composition from the straight oat hull refuse with perhaps 6 per cent protein, to the blends that carry from 15 to 18 per cent of protein. For the most part these goods are fairly well up to their guarantee and no fault can be found with the manufacturer for desiring to sell these waste products. Few or no claims are made for nutrients which the goods do not actually carry. The feeder has himself to blame if, with barns filled with hay, corn stalks and silage, he buys feeds low in protein instead of those high in protein. An oat feed with 6 per cent protein is no better feed nor is it any better digested than a coarse fodder with the same protein content. This class of foods can probably be economically used only by feeders who find it necessary to buy roughage as well as concentrates.

Feeding experiments with molasses feeds have shown them to be fairly economical. They, however, are not used very much in this State and should not be purchased by the ordinary farmer since they are low in protein and high in carbohydrates. Feeders who find it necessary to purchase nearly all of their food may find these molasses feeds economical.

The molasses and sugar feeds carry on the average about 15 to 16 per cent of protein. It is to be remembered, however, that this class of feeds are sold not as a source of protein but for the soluble carbohydrates which they carry, and the lower protein means more of the carbohydrates.

The chief objection to molasses feed is found in the materials which are used as absorbents. There has been some talk of putting molasses feeds upon the market in which pure ground grains were used as the absorbent. If such feeds have been put upon the market, however, they have not come to the speaker's attention.

The Maine Agricultural Experiment Station made a year ago very extended investigation of the character of the compounded feeds that were coming into Maine ,with their relations to weed seeds and particularly noxious weed seeds. There were several feeds introduced into the State last year which were heavily loaded with weed seeds and which seemed to find ready sales in many sections. One or more samples representative of each of the various feeding stuffs were collected by the Station and were examined. One feeding stuff was found to be composed of from 20 to 60 per cent of weed seeds and it was found that these seeds had not been killed so that it was possible for a hundred-pound bag of the feed to produce nearly two millions of noxious plants. The publicity given to these matters has led to the finer grinding of the weed seeds and in some instances to heating the seeds so that they will not germinate. This leaves the presence of the weed seeds in this class of feeds wholly a nutritive one, and as to their nutritive value there is nothing known. The only dangerous weed so far as poison is concerned liable to occur in feeding stuffs is corn cockle and this may occur in the wheat feeds as well as in the specially prepared mixed feeds.

From figures furnished by one of the largest handlers of feeding stuffs in the country the way in which a molasses feed carrying 16 per cent protein could be made up a year ago shows why there are certain manufacturers interested in pushing the sale of this class of feeds. Starting with 400 pounds of cane molasses, the addition of 500 pounds of sprouts, 150 pounds of cottonseed meal, 600 pounds of weed screenings and 350 pounds of elevator chaff, would give a feeding stuff carrying approximately 16 per cent protein, 4 1-3 per cent fat, and 11 per cent fiber. The cost of these materials assembled in Chicago in the fall of 1908 would have been about $13.00. The expense of manufacturing, including sacks, would bring the cost up to about $16.00 per ton. Goods similar to these were selling at that time in Chicago at $21.00 and delivered in Boston at $25.00. The enormous profit of compounding goods at a cost of $16.00 and selling them in advance of more than 30 per cent readily explains why the East has been flooded with these low grade mixed feeds. Of course, it would be very unfair to confound these low grade molasses feeds with such feeds as Union Grains or other high class feeding stuffs which are made directly from mixtures of standard concentrated feeding stuffs. The crowding in of these low grade mixtures makes it possible to sell a class of non-nutritive stuff such as oat hulls, weed seeds, elevator chaff and such, that the purchaser would never think of buying if sold under their correct names.

The crowding upon the market of this class of feeds has led at least one state—Pennsylvania—to enact a feeding stuffs law which while it does not demand the disclosure of the formula, requires that every package of mixed feed sold in the state shall be accompanied by a label naming every one of the constituents which make up the feed. Such a law is welcomed by the manufacturer of high grade, ready-to-use rations, but it is naturally very strenuously opposed by people who are making feeds more or less similar to the molasses feed described above. Whether it will be necessary for Maine and the other New England States to enact a law similar to that of Pennsylvania for its protection depends very largely upon the attitude which the manufacturers take.

THE KIND OF CONCENTRATED FEEDING STUFFS TO PURCHASE.

The crops grown upon the farm are rich in carbohydrates and poor in protein. Clover will help supply the needed protein, and home grown grains will help out toward a balanced ration. But after growing all the food that can be produced economically on the farm, the dairyman will usually find that he needs to supplement the home grown food by the purchase of concentrated commercial feeding stuffs.

As the farm produces or can be made to produce all the starch, sugar and fiber that are needed, it is not necessary to take these constituents into account in the purchase of supplementary food materials. While they have a part, and a necessary part, in the ration, it is protein that is needed to supplement the home grown foods, hence the cost per pound of the protein in a given feeding stuff is of more importance than the ton price. A ton of cottonseed meal costs more than a ton of oat feed, but the protein in the former costs less than 4 cents a pound and 10 or more in the other. The table which follows shows the number of pounds of protein that a ton of a few average feeding stuffs carries, and the cost of a pound of protein at the usual range in selling price.

Cost of one pound protein in different feeding stuffs at different prices per ton.

Kind of Feeding Stuff.	Protein in ton.	At $18 per ton.	At $20 per ton.	At $26 per ton.	At $28 per ton.	At $30 per ton.	At $32 per ton.
	Pounds.	Cents.	Cents.	Cents.	Cents.	Cents.	Cents.
Choice cottonseed meal......	820	....	....	....	3.3	3.6	3.9
Extra prime cottonseed meal	770	....	....	....	3.6	3.9	4.2
Prime cottonseed meal.......	720	....	....	3.6	3.9	4.2	4.5
Cottonseed feed	440	4.1	4.6	6.0	6.5	....	....
New process linseed meal....	750	....	....	3.4	3.7	4.0	4.3
Old process linseed meal.....	640	....	....	4.1	4.4	4.7	5.0
Gluten meal.................	680	....	....	3.8	4.1	4.4	4.7
Gluten feed..................	520	....	....	5.0	5.4	5.8	....
Distillers' grains.	660	....	....	3.9	4.2	4.5	4.8
Union grains................	480	....	....	5.4	5.8	6.2	....
Wheat middlings............	360	5.0	5.4	....	....	....	....
Wheat bran	300	6.0	5.7	....	....	....	....
Jersey mixed feed...........	240	7.5	8.3	....	....	....	....
Oat feed 7.5 per cent protein.	150	*12.0	....	....	....	....	....

* At $12 per ton, a pound of protein will cost 8 cents.

Ques. I would like to ask what kind of peas are used with oats?

Ans. I would sow Canada peas. Almost everything is now sold under that name, but sometime we will know more about the peas. Some time I am going to be able to answer the question better. The Canada field pea is the best that you can do, but what you will get is what Canada does not want.

Ques. Wouldn't it be practicable in growing clover to invest in hay caps?

Ans. I do not know. In connection with our own farm I have hesitated to make the investment. I do not know whether it would pay or not. Unless you are taking care of them personally the deterioration is very rapid, and the cost of handling considerable.

Ques. I would like to ask in relation to molasses as a feed. Our dealer has furnished a certain balanced ration, with 24 per cent protein, and the man working for me was feeding that grain to his two cows. He got out of that and put in a molasses feed of some 16 per cent protein, for a good deal less price. He hated to make the change but he could not get the other feed. He was surprised to find that those cows increased in milk production.

Ans. He was probably feeding too narrow a ration before and it needed more digestible carbohydrates.

Ques. Is it possible in this climate to reseed alfalfa as you have to clover? Clover runs only two years.

Ans. Alfalfa has to be babied so much the first year that it has never been tried as a biennial, and I much doubt whether this could be done. We had in Houlton for three years probably the best acre of alfalfa that has ever been raised in Maine. We tried it up there thinking that as the snow usually comes earlier and they do not have the rainy conditions, with ice, it would be more favorable. It went through two winters in pretty good shape, but two years ago there was a coating of ice which smothered it out. I think that is the great drawback in Maine.

Ques. If you were feeding clover and plenty of corn silage and had home grown grain,—early oats and peas, what formula would you recommend? What per cent of protein?

Ans. The probabilities are that you will have to figure out your ration. You do not want a ration much wider than one to five. With your home grown feeds you could probably afford to feed a ration broader than if you purchased your feeds. You might feed one to six. Out in Wisconsin they have been finding it profitable to feed a very wide ration, because of the relative cost of feeding stuffs. There is an enormous difference between a physiological ration and an economical ration.

CROPPING SYSTEMS FOR MAINE DAIRY FARMS.

By L. G. Dodge, Bureau Farm Management, U. S. Dept. Agriculture, Washington, D. C.

I might first explain to you what is meant by the "Office of Farm Management." Several of you probably know Prof. Spillman. You have heard him speak in the State of Maine before now. He has under him about thirty men and the majority of those men are assigned to definite districts over the country. I have the good fortune to be one of the charter members, I might say, of that office. I became a member of the office when it was first started as the department of Farm Management. Four years ago last summer I was given as my territory New York and the New England States. At present I have three assistants. One of them, Mr. Stanford, is spending his whole time in the State of Maine. In general our work is to make ourselves familiar with the crops and systems of cropping that are used in the various sections of the country, and to study the profitable growing and use of the leading crops of the different states. In this section with which I have to deal, New York and the New England States, I think I can readily point out some of the general conditions. We have seven states here which have some of the most dense population of any part of our country. I believe there are nine cities each of which has more than 100,000 population. That, of course, includes New York and Boston, with vastly more than this. Fourteen more cities have between fifty and one hundred thousand, and there are an innumerable number, as you know, of small manufacturing towns, especially through the central and southern part of these states. While we have this dense population, we have at the same time a great deal of non-agricultural land,—the lake regions, the mountain regions and the big woods, leaving a comparatively small portion of agricultural land and a comparatively large population to be fed within our borders. From this fact it becomes necessary for us to specialize in our farming. We are not general farmers any more. By our climate we are forbidden to grow a great many crops which are profitably grown in other parts of the country. The northeastern part of the United States has such a climate, topography and soil that grass and trees grow and flourish most naturally. I mean all the grass crops in general, and forest trees as well as orchard trees. In the results of the recent fruit show we have already had given us an example of what orchards will do in these New England States. When it comes to Maine especially, we have what I call four types of land. We have first, land that is adapted to a rotation of crops, land which can be easily plowed. It is neither too wet nor too stony to be worked very frequently with plows and other machinery, therefore adapted to frequent cultivation and a short rotation of crops. The second type of land is either too moist or has too many stones just below the surface to be good rotation land. It is really adapted to permanent meadow, perhaps permanent grass land. Again, we have a type of hilly, rough land which is at its best when producing orchards or pasture grazing; and then again we have that rough, steep land which is out of all these other classes and suited only to wood land. Both trees and grass have been grossly mismanaged here in New England. I was brought up in Massachusetts and when I say anything about New England I am including my own people. I know what some of the mistakes are. We have been making them for generations; by depending too much on our trees and our grass we have got into some pretty slack habits. We have been inclined to let any land that would grow grass grow it, and when the grass crop got too poor to be used for anything we let that land alone and it was gradually taken up by bushes and trees and went back to a forest. In lots of cases this abandonment was what ought to have occurred. The land ought not to have stopped producing forest trees in the first place. On the other hand, I know where there are tracts of land which were good tillage fields forty years ago, which are now grown up to pine large enough for box wood. It was good tillage land, but by raising grass continuously and not trying to grow other crops, in a rotation, it had gradually gone back until it would grow nothing but bushes and trees. For our live stock we have depended too much on this natural grass land. We have been mowing land when it was not fit to mow. I have ridden through or walked through hundreds of acres in New England and in Maine which I am fully convinced are producing only one-fifth to one-tenth part of what they might be producing. I am afraid that selling hay was what brought them to their present condition, and putting on nothing for what they were taking off. With a system like that, where the land was allowed to stay in hay indefinitely,—five, ten or fifteen years without plowing, the grass got poorer and poorer. The best feeding grasses run out, and the poorest, yielding the poorest quality of feed, took their place and these gave place to weeds after a while. It is the hardest proposition to fertilize meadows when allowed to stay in grass like that. I know a few farmers in New York and New England who, by applying a little grass seed and with continued light applications of fertilizer, particularly stable manure, are able to keep those old meadows in good producing condition, but that is not usually the case. When a man gets very little but grass on his farm he has but one crop to harvest, and as a general principle in the United States and in other countries of the world, single crop farming has turned out to be a poor proposition. A system of single crop farming has fallen down sooner or later, whether cotton in the South, wheat in the middle West or some other crop. It is the same with our grass farming.

Then there is another drawback. When we stick to one crop we have all of our harvesting coming at the same time. If we have fifty acres of tillage land and the greater part of it in grass, we have most of the work at haying time, and but very little the rest of the year. We have to hire a lot of labor when labor is the highest; we have our teams overworked for a month or six weeks, and nothing for them or the laborers to do the rest of the year. Not only that, but as sure as we have so much haying as that to do, no matter how early we begin and how good a condition the first of that hay is in, before we get to the end or anywhere near it, we are getting poor stuff, hardly worth hauling into the barn. I think you will agree with me that late cut hay is pretty poor property, especially when it is to be fed to dairy cows. The most successful dairyman in New England, I have found every time I have visited him at that season of the year, was well under way with his haying before the month of June was over. Up in central Vermont I found them getting the best of their hay into the barn before the end of June.

There are some other results from this sort of a system. When you grow hay you do not grow anything else; you do not grow any grain, and if you do not grow any grain and you are feeding dairy cows, you have to buy it. I do not believe there is a dairyman here but understands that we must stop buying so much grain. The day of cheap grains in the East has gone, and I think it has gone forever. Not many years ago we could buy bran, gluten meal and almost any kind of feed we wanted at a low price, and we could afford to buy it, but when the price of those products is doubled, what are we going to do? Our land must be given up or else we must make it produce the things we need. When we buy grain, perhaps three-fourths of what we use, I say we are nothing better than so many traders. We are not farmers. We are like a man running a shoe store, who is buying all his materials, hiring men and selling the finished product. If we were farming we would not be satisfied unless we were growing a large part of the material to feed our cows. I think one of the first men who forced this on my attention when I was studying dairy feeding in New England was Prof. Sanborn. He said he did not so greatly regard how much he could make an individual cow produce in milk or butter as how much he could make a single acre produce in milk or butter. If we are going to call ourselves farmers we must regard what our acres will produce. A good deal of this applies to pastures the same as to mowing lands. We have abused the pasture grasses; we have grazed them too early, we have over-grazed them and neglected to fertilize them, and pastures and meadows alike have suffered from one result aside from those we have spoken of. The land suffers in a dry season. It is getting weaker and weaker in humus. When our meadows are not turned over, the surface soil that should be black and deep has become shallower and shallower every year. Our subsoils come clear to the surface. The result is that when we strike one of our dry seasons we have nothing in the way of a sponge to hold the moisture, and in a very short time the drought has had a chance to take hold of the grass, and just so long as we neglect the proper treatment of those acres, we are going to suffer more and more from the droughts that are bound to come to us, sooner or later, every few seasons.

There is another thing, in relation to fertilizing. I know men—and I have seen it in a great many places—who have been making heavy applications of manure, and not applying it very often. I find that the successful dairymen, almost every one of them, are applying as little manure as they can put on the land, and applying it as often as they can make it go around. Of course ten loads per acre will go around the farm a great deal quicker than forty loads to the acre. Ten loads per acre every two years are going to do a great deal more good than forty loads per acre once in eight years. Down in Pennsylvania at the State College they carried on a series of rotation experiments for a number of years. I do not usually quote experimental work, but I think this bears on the question. They had a four years' rotation—corn, oats, wheat and hay. They applied manure twice during the rotation, on the corn and on the wheat. Lumping the whole four crops of the rotation together, they found that twelve tons of manure increased the yield $2.16 a ton over what they could get when no manure was applied. On the other hand, when they increased the application to sixteen tons per acre they got back only $1.66 in increased production for every ton. When they got it up to twenty tons per acre they got only $1.44 increased production for every ton of manure. The conclusion is very simple. The more we increase the application of manure the less value each ton of that manure returns to us in increased crop production. I think there is a very legitimate explanation of that in the fact that in the larger application a large amount is bound to be wasted,—washed away or evaporated into the air; whereas a much greater per cent of the smaller application is taken up by the plant at once and utilized. I know there are many men here who are very good farmers and very good dairymen, and I am almost tempted to challenge about fifty per cent of them to take me to their farms and show me conditions other than those which are the result of too much hay and too long a time in hay, for most of their acres. There are some of you who are growing very good corn and clover, but I tell you there are a great many men in the State of Maine, as there are in the rest of the eastern states, that are depending upon timothy hay to feed their stock. You remember what our friend from Ohio said about timothy hay. I think that will apply here in the State of Maine, just as well.

After being brought up on a dairy farm in Massachusetts, and having had to work at farming a little bit once in a while, for the last four and one-half years I have had to study a dozen or two successful dairy farms here in New England, and I am going to give you a few figures in relation to the stock and crops on those farms.

Table showing acreage of the several crops and per cent. of land in each crop.

Farm of	Acres of tillage.	Approximate No. of Acres (1) in			Percent of Tillage in		
		Corn.	Other cereals.(2)	Grass and clover.	Corn.	Other cereals.	Grass and clover hay.
Jones	40	12	10	14	30	25	35(3)
Sanborn	200	50	100	150(4)	25	50	25
Noyes	18	4.5	4.5	9	25	25	50
Smith	75	22	22	31	30	30	40
Chittenden	175	58	17	100	32	10	58
Davis	28	6	2	20	21.5	7.5	71
Holt	74	25	20	29	34	25	31
Sadd	80	30	....	50	37.5	—	62.5
Wilson	65	16	16(5)	32	25	25	50
Ames	16	....	4	11	—	25	70(3)
Avery	18	2(6)	....	16	11	—	89
Harward	60	14	15	30	23.3	25	50

(1.) These figures are only appproximate for the acreages vary slightly from year to year.

(2.) Includes either Japanese or Hungaran Millett on a few farms.

(3.) On Jones and Ames farms respectively a small area out of the tillage is used for potatoes.

(4.) Includes fifty acres of pasture in wheat.

(5.) On all except Wilson farm other cereal crops than corn are used for hay or silage. On Wilson farm they are cut for grain.

(6.) All corn raised is for silage except on the Avery farm, where corn is raised for grain, and figures there apply only to winter feeding.

Table showing relative number of live stock and acreage.

Farm of	System.		Acres tillage.	Acres pasturage.	No. Cattle.		Acres tillage per animal. (1)	Pasture per animal.
	Silage.	Grain.			Cows.	Young stock.		
Jones......	Silage....	Purchased.....	40	40	25	15	1.09(2)	1.
Sanborn...	Silage....	Purchased.....	200(3)	225	140	100	1.05	.9
Noyes.....	Silage....	Purchased.....	18	150	11	3	.95	- (4)
Smith.....	Silage....	Purchased.....	75	75	55	25	1.10	.93
Chittenden	Silage....	Purchased.....	175	100	110	25	1.40(5)	.75
Davis......	Silage....	Purchased.....	28	36	25	15	.83	.9
Holt.......	Silage....	Purchased.....	74	40	70	25	.89	.42
Sadd......	Silage....	Purchased.....	80	-	45	-	1.77	- (6)
Wilson....	Silage....	Raised.........	65	60	35	12	1.56	1.28
Ames......	No silage	Purchased.....	16	40	11	3	1.23	2.85
Avery.....	No silage	Purchased.....	18	-	20	-	.90	-
Harward..	Silage....	Raised.........	60	93	25	15	1.66	2.82

(1.) Two horses are kept for each 18 or 20 cattle on most of these farms. The horses do not use any pasture, but must be counted in connection with the crops raised. In reckoning tillage or pasture per animal two young cattle or five sheep are counted the equivalent of one cow.

(2.) In reckoning tillage land per cow, only that used for raising feed is counted.

(3.) Figures on the Sanborn farm refer only to the part used to supply dairy feeds.

(4. On Noyes farm 32 sheep are kept in addition to the cattle, and so the surplus pasture is partly utilized.

(5.) Considerable hay is sold annually from the Chittenden farm.

(6.) There is no pasture on Sadd farm. Cows are stall fed the year around.

I have here some twelve farms, located all over New England. I grouped them according to the silage, as all but two out of this group of twelve are using corn silage. I have taken the number of acres of tillage land, the number of acres of pasture and the number of cattle. I have assumed that young stock, all the way from a very small calf up. on the average would not use up so much feed as a cow. In getting the grass and tillage I have used the number of acres as a unit, and taken about half the number of young stock and added to the number of cows. On the first farm there were 1.09 acres of tillage per animal, and one acre of pasture. Some of the young stock were getting a great deal more pasture and not nearly as much stall feed as the cows.

The acres of tillage per animal on the different farms ran from .83 up to 1.77. There are important points regarding the number of animals and the acres utilized. On the first farm, about one-third of the land was in grass. The number of acres required to keep a cow was quite low, only a little over one acre. At the same time the hay was down to about one-third the total tillage of the farm, instead of being nine-tenths as it is on many farms. The second farm had a low number of acres, just a little over an acre per cow, and at the same time there is only 25 per cent of that tillage land devoted to the ordinary hay crops, grass and clover. Of course some of the cereal crops are used as hay, but they form another stage in the rotation, and save all danger of letting the land stay in ordinary hay crops until it gets low in production. The important point is that wherever we find a high acreage required to feed a cow, for instance, 1.77 acres, there is something that breaks up this proportion of hay to other crops, either making the hay crop larger or cutting out the possibility of rotation, or causing a low yield in some way. The fifth farm has 58 per cent of the land devoted to hay crops. This runs more to hay than the other farms and it takes more acreage to feed a cow. On the farm where it took 1.77 acres to feed a cow, the land was such that the farmer was unable to rotate. That fact caused him to require more acres to feed a cow than were required on the other farms. About half his land was good corn land. The rest of it was too clayey and damp to grow corn on, and he was forced into keeping it continually in hay. The result was that his corn yields and his hay yields were lower than on any of the other farms, and it required a larger acreage to feed a cow. On the last farm the acreage runs up to 1.66 to feed a cow. This is caused by an entirely different fact. This man has been growing not only all the hay and roughage but almost all the grain he has fed, on sixty acres of tillage land. He had fourteen acres of corn, fifteen acres of peas and oats and thirty acres in hay. (The other acre he kept for his own use.) Only fifty per cent of his land was in hay, and he was producing almost all his grain. He kept during last winter forty head of cattle and three horses. Of those cattle about twenty-five were mature animals, including a pair of oxen and a bull. The rest were young stock, of various ages. He raised corn silage, hay, and pea and oat grain, and he purchased between seven and eight hundred pounds of concentrated grain,—cottonseed meal or linseed meal; and when spring came he was obliged to buy three or four tons of hay to finish out the feed for his horses. The drought the year before had cut down his hay. The oats and peas he allowed to ripen for the most part, harvested and threshed for grain. Fifteen acres were sown to mixed clover and timothy for hay, and of course this hay stands for two years, giving thirty acres of hay; so that twenty-three per cent of the land was in corn, twenty-five per cent in oats and peas and fifty per cent in ordinary hay crops, and his purchased materials were cut down to a minimum. You may question whether he is making anything by raising that grain to feed. I have a few figures here, but I will not attempt to read many of them. They are the report of the labor distribution which was made up from a very careful record for every day in the year, showing where every hour's work went, on to what field and for what purpose. In his 12¼-acre field of corn, which comprised the larger portion of his corn for that year, the cost in labor was kept absolutely and so far as possible the cost of other materials,—fertilizers, seed, etc. A little of this corn was husked and a little fed green but the most of it was put into the silo. The total value, estimating that cut green at $3 per ton and the ensilage corn at $5, amounted to $534.50, and it cost him to produce it, taking the cost per hour for a man, 11½ cents, for a horse 10½ cents and for an ox 6 cents, $334.26. He had a profit of $200.24 or $16.32 per acre on his corn crop, and if he is doing as most dairymen hope to do he ought to make an equal profit on feeding it to his dairy cows and selling the dairy products. If an ordinary man can make a profit on buying material and feeding it to the dairy cow, isn't he making a profit twice over if he grows the feed and makes a profit on that? I believe we are then getting what we can call farming, not mere manufacturing of dairy products. His other crop to which I wish to call attention is the oats and peas. The entire cost of producing the 14¾ acres was $328.14. The estimated value of the feed and of the straw was $534.30. This gave him a profit of $206.16 or $13.96 an acre. There, again, if he made a profit on raising the crop he certainly ought to be credited with being able to make a profit in feeding it. There are of course a great many objections to raising many of these grain crops and threshing them. This man had a small gasolene engine and a small thresher, and as he harvested the grain he threshed it with his own crew and the principal cost was the gasolene. When it comes to milling he has a neighbor who has a feed mill, and by co-operating with this neighbor, and using the gasolene engine and the feed mill they are able to grind the feed for the cattle to eat. Most of the study I have made of these farms has been published. Probably many of you have received a copy of Farmers' Bulletin No. 337 from the United States Department of Agriculture, which treats upon this subject.

If we are to keep on in the dairy industry we must either have good grazing to pasture our cows, or we must raise the feed on which to feed them in the barn or in the field. The following chart shows the principal crops I find being used on New England dairy farms, to feed dairy cows. They include corn, mixed grains of various kinds, the millets and the clovers.

Table of amount of seed and dates of planting and harvesting for latitude of Concord, N. H.

	Amount seed per acre.	Date of planting.	Date when fit for soiling.	Date when fit for silage or hay.
Corn	12 qts.	May 18–25	August 10	Sept. 10.
Mixed: Oats	1 bu	April 25 to May 10	July 5	July 25.
Mixed: Peas	1 bu			
Mixed: Barley	1½ bu			
Barley alone	3 bu	July 1	Sept. 1	Sept. 20.
Winter Rye	3 bu	Sept. 1–20	May 20	June 10.
Mixed: Winter Wheat	2 bu.	Sept. 1–20	June 20	July 1–5.
Mixed: Winter Vetch	½ bu.			
Japanese Millett	30 lbs.	June 1–30	July 5–30	August 1–30.
Hungarian Millett	30 lbs.	June 1–30	July 20 … August 20	August 1–30.
Clover	12 lbs.	April 10–30; August 1–25	June 15	June 25–30.

The dates given are for a normal season. For points to the North or South of Concord, or in higher altitudes some allowance would need to be made, but the differences will be rather slight.

This chart is made up from pretty careful observation of the dates of planting and harvesting for about the latitude of Concord, N. H. Of course for this section we have to allow planting a little later in the spring, for most crops. On several of these farms which I find doing so well, some system of feeding is being adhered to very closely. On the Holt farm in Connecticut, with 74 acres in tillage, they are keeping 70 cows and some 25 young stock. The grain on that farm was almost wholly purchased, although last year a considerable amount of corn was raised. That man was following one of the most successful methods of feeding I have seen in these seven states. He harrows his ground as soon as he can get his corn harvested for the silo and sows rye at once. In a normal fall he will be able to get a sufficient stand so that it will go through the winter in good shape. In the spring as soon as he is able to drive a team over the land he starts out with a smoothing harrow and harrows it, regardless of the condition of the rye, sowing clover before the last trip of the harrow. The rye is allowed to grow up and is cut for hay or some of it is allowed to ripen for grain, and after that he is very frequently able to get a good growth of clover hay the same season. The following season he is able to get two crops, and in a moist season three crops. This is in Connecticut, where the first cutting of clover may be inside the 10th of June.

I think the second most successful seeding that I have discovered for clover is that which several of these farmers are using,—seeding in their corn at the last cultivation, in midsummer. In Maine I know a great many men are successful in seeding with oats; but as you get into dryer sections (and I am afraid the southwestern part of Maine will suffer from the same cause), through central and southern New England it is pretty risky to seed clover and timothy with oats. Oats are too likely to fall down or take so much of the moisture out of the soil that there is too little left to give the clover and timothy any kind of a chance. They burn up in midsummer. If we are going to feed our dairy cows mostly in the barn we have a considerable number of crops to fill in the gaps,—corn, clover, oats and peas, and perhaps barley. Rye, of course, sown early in the fall, will give the earliest green feed possible in the spring; perhaps peas and oats, or clover sowed the year previous, will give green feed immediately following. I do not think from my observation of these farms that the soiling system throughout is as economical as the summer silo, with plenty of clover hay and pasturage; but there are plenty of dairymen who must have something green to fill the gaps and this table suggests the crops used for this purpose. Until recently I had seen no rape grown in New England, but within the last season I have seen some which was very successful. It was grown for sheep, but would have been also satisfactory for late fall feed for any live stock. It was drilled in with the corn,—used the same way it is used in some of the western states, as Michigan and Wisconsin.

In the handling of New England pastures, stock are turned out before the grass gets a good start and more cattle are kept on them than can be maintained, necessitating some barnyard feeding. If the green parts are kept too closely grazed the plants will grow very slowly. In spite of this fact, the great majority of eastern farmers consider it bad for a pasture to let the grass get a good start. The excellent stand obtained in southern pastures where the grass is allowed to get a good start before being grazed, shows that this statement does not hold true. Men in the southern states do not consider that the cattle do not do as well when the grass gets tall. The best stockmen have learned by experience that whenever the grass gets too tall it is easy to mow it and let it lie on the ground as a mulch. Many believe that by close cropping the weeds will be kept out; but that overgrazing causes the weeds to become more abundant, has been definitely proven. In California as the result of over-grazing the grass plants were destroyed. With the advent of a more favorable season the weeds took the place of the grass plants which had been killed. This has occurred in eastern New York and New England. Grass plants are being killed, and as soon as we get a good moist season the weeds will come in and take their places. It is very essential that steps be taken to improve these pastures. This can be done by better systems in order to prevent too early grazing, by cultivation and by reseeding and fertilizing, and the reduction of weeds.

The question of fertilizer requires more or less experimentation. In some pastures it is easy to put on a light topdressing of barnyard manure. I know of farmers who have done this with marked success both in keeping up permanent grass lands and permanent pastures. Brushing it into the sod with a bush harrow is closely parallel, also the system followed in England, in using what is known as the chain harrow.

Ques. In the tables, do the costs you have figured on the two crops on the Harward farm include anything beyond the labor?

Ans. They include every bit of horse, ox and man labor and a certain proportion of the manure that had been applied that year or the previous year, assuming that the first year takes 60 per cent, the second year 25 and so on.

Mr. Peck in our office who is studying farm records has kept the records of this man for every crop that he has grown. He began a year ago in October, and so we had a year's record completed and could get a fair estimate of the cost of producing those crops.

Ques. Where clover is sown in the corn, how do you get a rotation of crops?

Ans. The men who are using clover in the corn are not the same men who are using pea and oat grain, ground, for feed. The former were getting out of the small grains. It was a rotation of corn followed by two years of hay, the first year clover and the second mixed hay. As a rule that gave rather a larger proportion of hay and cut out the small grains entirely. In the case of this Harward farm, they have been successful in seeding clover with the peas and oats, probably having less difficulty than with oats alone. So far as moisture is concerned, on another farm in the northwestern corner of Connecticut, where it is usually too dry to get a good stand of clover in that way, they have been getting a good stand by seeding alone in midsummer, disking the land thoroughly and harrowing the clover seed in. In that latitude it is usually safe to-sow clover until about the 20th of August, and a stand will be obtained that will last through the spring. As we get farther north things seem to fit in very fortunately, as there you can seed with oats. In a cooler, moister region it would not be so easy to sow clover in midsummer, and have it survive the winter. The principal difficulty on most of our New England soils is to make clover grow. In many cases I think what we need more than anything else is lime. A great many soils are not of limestone origin and have no supply of lime. I have seen plenty of pieces where the potato crop had been fertilized with a fertilizer running heavy in potash and in the clover crop you can see the line showing where the potash was applied. One of these men whose farm is carrying a cow to .95 of an acre, started in with thirty acres of tillage land which would not carry six cows and a pair of cattle. He got it up where it was carrying about twenty-eight head of cattle and three horses. He had used in the first round of his rotation plenty of potash fertilizer, helping him to get a good stand of clover. After that he used very little fertilizer except that produced on his dairy farm.

Ques. Did he use lime?

Ans. This man did not use lime. He had used potash which had evidently given him the same results. The experience of the farmers seems to show that either one remedies to a considerable extent the condition of the soil which forbids clover to grow.

Ques. Wouldn't a good many of those worn-out pastures which you have shown us reseed themselves by letting them go ungrazed?

Ans. There is a good chance that they would. There are several things to be tried,—perhaps resting them even for the first month of the season would help a good deal. We want to get in touch with a few farmers who are willing to try a few inexpensive experiments of that kind.

ANNUAL BANQUET.

On Thursday evening, December 2nd, the eighth annual banquet of the Maine Dairymen's Association was served, at the Grange Hall. This was a very interesting and enjoyable occasion. The attractive menu, the fine music by Towne's Orchestra and the entertaining selections and responses to toasts were fully appreciated.

PROGRAM.

Music,	Towne's Orchestra
Invocation,	Rev. F. A. Leitch
Banquet.	
New England Farmers of Today,	Prof. J. W. Sanborn
The Future of Fruit Growing in Maine,	Dr. G. M. Twitchell
Reading,	Mrs. Maud L. Jewett
Selection,	Orchestra
Our State,	R. T. Patten
My State,	Lowell Roudebush
Reading,	Mrs. C. E. Tripp
Sure Cure for a Kicking Cow,	C. E. Tripp
Selection,	Orchestra
Somerset County's Debt to the Cow,	G. W. Gower
New England Farmers of the Future,	L. G. Dodge
Reading,	Mrs. Maud L. Jewett
The Possibilities of Somerset County,	E. N. Merrill

FRIDAY, DECEMBER 3.

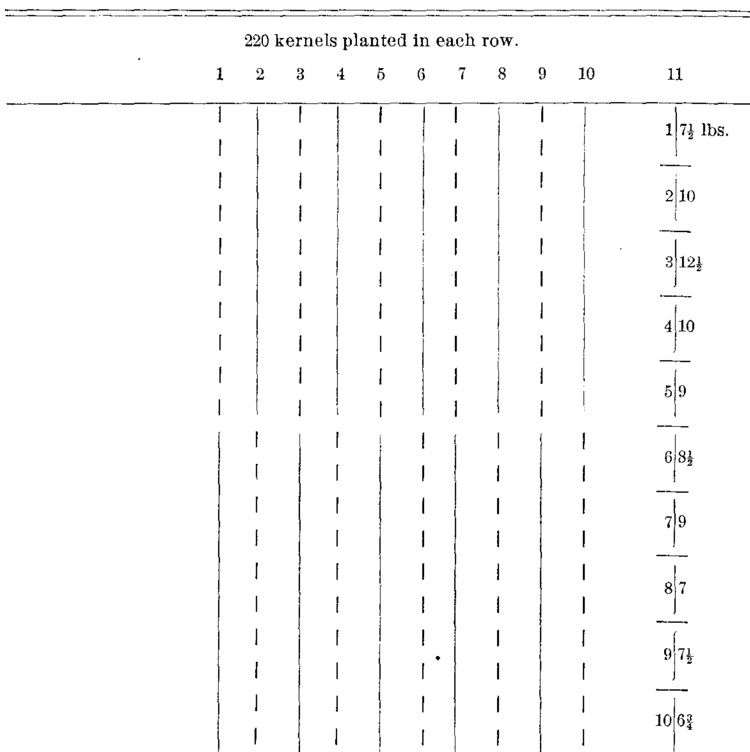
SEED IMPROVEMENT WORK.

By Dr. G. M. TWITCHELL, Auburn.

In all work in connection with agriculture there must be an individual standard, as well as a general standard. The discussion of the past few days, it seems to me, has impressed upon us one lesson,—that there is no arbitrary law which can be applied to all and under which every man must work in order to succeed, but there is a flexibility which allows of individual methods, and results may be obtained equally with different individuals, following different paths leading to the same end. In this matter of corn improvement, so vital to the agriculture of the State, I think this same rule will hold. I do not come to you this morning to indicate any fixed principle, from my little experience, but rather, if possible, to stimulate a deeper interest in the matter of individual work for the increase of the acres and of the crop, and the improvement of the seed. We know that in all the lines of stock husbandry and of crop production there must be on the part of the individual a good firm hold upon his conception of what he wants to do, or there is sure to come a deterioration in his seed or in his stock, or in the individual production on the part of his animals. It seems to me that there is no crop grown which is so susceptible to improvement as corn, so ready to yield and yet so tenacious to revert when man lets go of his work.

I want to talk with you a little while along the line of a simple experiment which I have been trying this past season, following the work of last year. Not that I have accomplished any results that are marked, not that I have been able to reach the yield that has been obtained in many other cases, but simply because it seems to me this little chart offers some suggestions which will not be amiss to the average grower. The greatest loss to us in any line of work comes from the skips, whether in stock husbandry or in crop production, and just in proportion as we are able to reduce these to the minimum, to that extent we shall be able to increase the yield. So in this matter of corn growing the first thing we are to look out for is the germinating power of the seed. This little chart represents one-eighth of an acre of land where I tried a ten-ear test to determine first of all the germinating power and then some other factors. I plowed the land in the fall, worked it thoroughly in the spring, put on one cord of good, well rotted barn dressing and disked that in as thoroughly as I thought was necessary. I tried to give it a good, thorough working, and then used high grade corn fertilizer, at the rate of 500 pounds to the acre, in the drill, planting 220 kernels to the row. I used the seed grown by me last year

Flint Corn Experiment Plot.



Total weight of ears from each row... 73 lbs. 80 93 85 80 82½ 85 73 72 68

— — — — portions detasselled, weights as follows—38 lbs.-45-47-46-36-43½-45-38-38-35.

———— tassels left, weights 35 lbs.-35-46-39-44-39-40-35-34-33.

Field germinating test for each row 195-205-205-207-204-209-207-178-213-197.

Eleventh row was planted with 22 kernels from each of the ten ears. The figures on the right of the vertical line represent the yield in pounds from the several plantings.

with one exception. The row marked No. 1 was sent me by Mr. Winn of Falmouth a year ago last spring. This last year he sent me another lot, from which I planted row No. 2, the same variety of corn as No. 1. This was twelve days later in maturing. The other was the same variety but I had grown it one year, indicating the susceptibility of corn to its environment. In talking with Prof. Woods he called my attention to the seed sweet corn which had been grown in Franklin County for the last few years, by the Station, for seed purposes; and while it proved superior to that furnished for seed by the factories, when it was moved over into Androscoggin County the crop was inferior in quality to that which they were then growing, thus confirming, I think, the statement which has been made. What does this suggest? It suggests, it seems to me, that every grower of corn should depend upon what he has rather than outside seed for the building up of an established strain, and that it should not be outcrossed but inbred; that from the selection of the seed that is adapted to your environment you will in the years find the best results. No man who has been following this work for a term of years, greater or less, but has himself in his own seed that which will give him better results than can be obtained, without considerable extra care and labor, from seed procured from outside.

Then comes the question of germination. I would like to urge a germination test in advance of seeding, but I know that the cares and duties of the farmer are such that a great many would shrink from attempting this. The figures which I have here give you the results from each row in the ten-ear row test. You will see it varies from 178 to 213 stalks out of a possible 220 shoots.

There is another suggestion as to the importance of making tests in advance. When we come to consider the possible value of the corn crop then we will go to making these tests before we go into the field, in order to determine where the seed can be obtained from our own lots which will give us best results. This seed has been pretty carefully selected by individuals. No. 3 is seed of Ordway's Improved, that variety coming from northern Massachusetts, the same grown by the boys last year in competing for the prizes and which is later in maturing than any other I grew by surely fifteen days. I did not test this for germination prior to planting; I just put it into the field.

No. 4 is an ear of corn I got from Mr. Clark of Levant; No. 5, Early Canada; No. 8 was an ear of corn that came from Mr. Guptil of Carroll, and No. 10 was the same as No. 4. That suggests as the next proposition that alongside of our regular field work we make some ear tests. If you remember the work done in Wisconsin a few years ago, where ten ears were taken out of a lot selected for seed in a good field and planted, you will recall that there was a variation in the yield of 12 per cent and that selecting their seed year by year from the row which gave them the best average—not the largest ears but the best average—in five years' time they reduced that variation to less than two per cent, indicating the line of work which may be followed and which will eliminate these misses which I say are the chief cause of lack of profit to the owner at the end of the season. They also raised the yield twelve bushels per acre. There were eleven rows in the plot. I made ten-ear tests and the eleventh row is made up of twenty-two kernels from each of the ten ears.

That field was cultivated thoroughly. The 8th day of July we had a hail storm lasting two hours or more and when I got into the field the corn was lying on the ground and was completely shredded, so that following this there came an enormous development of suckers. Of course that was inevitable. But I want to suggest as another step in this work of seed development the breaking out of all suckers from July 4th on through the season, and the cutting out of all weak or impaired stalks and of course all diseased stalks, and later in the season, the breaking off early of all immature ears. I think these little steps will have a great deal to do with the development of the corn for seed. If you are able to get one ear well developed and of good size, a good step forward has been made in this matter of seed production. It is seed, and seed only, we want from this ten-ear row plat.

After the cultivation and the removal of suckers came the detasseling of one-half of each of the ten rows. The dotted lines show the detasseled portions. Through the center of all the rows, excepting No. 4, there was a slight variation, increasing to quite a per cent in favor of the detasseled portions, indicating that the relief given to the stalk in the development of its pollen gave additional strength and vigor in the development of the ear. There was another fact I noted,—that each detasseled portion gave also a much smaller per cent of immature ears than the remainder. Of course one swallow does not make a summer and this season has been a peculiar one for corn development. I do not care to state anything as clearly indicated, only offer these as suggestions. These were all detasseled before the pollen had become clearly defined. The total yield of the several rows is 879 pounds. This was from an eighth of an acre. I believe that in this simple little way we can not only establish new varieties of seed corn, but without attempting the detasseling, simply by the removal of the immature, weak and puny stalks, also those non-bearing and those which show any signs of disease, we can very materially relieve the field and increase the crop-producing power thereof, adding to the size and adding also to the vigor and vitality of the stalk. How closely we are to breed to types I do not know and will not say. How much is involved in the problem as presented yesterday by Prof. Sanborn is a question to be determined, perhaps, by future experiments; but this much I think is true,—that every man can fix his own type. The susceptibility of corn, the readiness with which it responds, is something remarkable. Among the many varieties of corn grown today in the northern portion of this country is one which has become quite popular in sections of New York, New Hampshire and Vermont, called the Longfellow. It is an eight-rowed corn, with large, long ear and well defined kernels. A gentleman in New Hampshire secured some seed from Mr. Longfellow five years ago last fall. He planted it and got one ear of twelve-rowed corn. That ear he planted on the other side of the woods half a mile from his corn piece, and for the last two years he has not seen an eight-rowed ear in this field. He has today a sixteen-rowed field of corn which is straight Longfellow, no new seed being introduced. It has simply been developed by selection, showing how quickly corn will respond to environment. That corn was changed first from eight to twelve-rowed and then from twelve to sixteen, by selection. That indicates that we can do just about what we like with our corn; we can increase its size, hasten its development, hasten also the maturity, and change it over by taking the freaks and using them as a basis for seed. I have not felt that it was best to press this matter of special type too far. I think there are some possible dangers in attempting to fix a type which shall be adopted by each and every grower, but there is a general type towards which we may well be reaching. The percentage of waste is too large in our ordinary corn. The ears should be very nearly as large at the tip as at the base. In the Early Canada, which is one of our smallest varieties, with the smallest cob, and which has been one of our best varieties, being a ninety-day corn, we are reducing its size year by year, it seems to me, through the failure to appreciate the importance of increasing the type and fixing that type in our work of selection.

These few suggestions I throw out to you today as simply the outcome of my study of the question during the past year in that little plot. I want to say to you who are interested in corn growing that I have never attempted anything in my life that has brought me so much satisfaction and furnished me so many suggestions for thought as has that little piece of corn. It has been brim full of meat for me during the past season. There has been an immense amount of satisfaction in watching its development and studying the conditions which have led up to these results. I do not present them as anything remarkable in the least, but simply as a basis for thought. I want to urge upon every one who is growing corn that you set apart on one side of the field at least enough land for a ten-row test. Take ten ears of corn from your seed, selecting the kernels from the center and leaving an inch on the tip and an inch on the butt and using only the well defined and perfect kernels. Then keep track of it through the season. When harvesting time comes weigh each row by itself and select the seed for the succeeding year from the row which gives you the best average. I found that one of the largest and best ears I grew came from a row which was sadly deficient. I shall take my seed from row six which gave me the least number of waste ears. That row will furnish the basis of my work the coming season. I urge this experimentation along these lines as a source of satisfaction and pleasure, a means of increasing the yield per acre and insuring every man a quality of seed which I think will give him better results than can be obtained in any other way. I know of a seed house doing some business in the State of Maine, which has bought seed from a large number of acres grown in Massachusetts. This is a section where the soil is light and sandy and the conditions ideal for corn growing, and yet if that seed is brought to Maine in 1910 there will be danger of altogether too many failures. I do not think you can transport seed that distance without loss. Better by far choose what has been developed in a latitude as far north as we are, if not a little farther. Better bring it ten miles to the south than ten miles to the north, for I think that even within those ten miles you will get variations that will be marked. Better still, take what you have and improve it. Having no seed for sale, I can speak thus freely without fear of being misunderstood.

Ques. Did you plant your seed in rows or in hills?

Ans. I planted nine inches apart in drills, three and one-half feet in the row. This would give 16,450 stalks to the acre if every one germinated. To secure the maximum germination of good, rugged stalks is the secret of good corn growing.

Ques. Would your experiment indicate that it might be worth our while to detassel our fields of corn?

Ans. I would not detassel except for breeding purposes but I surely would detassel the small and imperfectly shaped or diseased stalks so that they would not fertilize others. If we want to make any crosses in breeding, we detassel that we may make them direct and know just what we are doing. Alongside of every corn field, if not away by itself, there should be a ten-row ear test in 1910 from which to select seed for 1911.

ADJOURNED BUSINESS MEETING.

The business meeting of the Maine Dairymen's Association was called to order at 10.30 A. M., according to adjournment. The treasurer, R. Alden, reported as follows:

Dec. 10, 1908, amount on hand..........	$87 72	
Nov. 23, 1909, received of Leon S. Merrill, secretary	62 00	
		$149 72

Dec. 22, 1908, paid F. S. Adams, expenses attending meeting of Commission on Country Life, at Boston, Dec. 18......	$14 77	
Nov. 23, 1909, paid for printed matter....	2 50	
		17 27
Cash on hand		$132 45

This report was accepted. Officers were elected as follows: President, W. G. Hunton, Readfield; vice president, L. E. McIntire, East Waterford; secretary, Leon S. Merrill, Solon; treasurer, R. Alden, Winthrop; trustee, W. K. Hamlin, South Waterford; member of advisory council of Experment Station, R. Alden.

Voted, That the executive committee be empowered to appoint the corresponding secretaries for the coming year.

The Association expressed its appreciation for the services of the retiring president during the long term of years in which he had acted as its official head, by a rising vote.

The Committee on Resolutions presented the following, which were taken up in detail, discussed and finally adopted by the Association:

In recognition of the splendid work that has been and still is being done by the Maine College of Agriculture, and of the fact that at present the animal industry department is limited in its usefulness by barns and outbuildings that are neither convenient nor of suitable size for carrying on its work educationally or commercially to the greatest advantage to the students or profit to the State; therefore, be it

Resolved, That the Maine Dairymen's Association recommend that the State be asked at the next session of the legislature to make an appropriation sufficient to remove the present barns to a more satisfactory location and to erect an additional barn suitable for the purposes of the College and the State.

Resolved, That the Maine State Dairymen's Association appreciates the needs as set forth in the above resolution and directs a committee of three to be appointed by the incoming president to confer with the trustees of the University and urge the importance of this request, and respectfully ask the trustees to make such removal and addition to the equipment of the department of dairy husbandry from existing funds, and said committee are hereby instructed to present a full and complete report, with recommendations if necessary, to the next meeting of the Association.

Whereas, the herd records of the four great dairy breeds are not on deposit at any public place within the State, and

Whereas, the Maine Agricultural Experiment Station has offered to act as a repository for said records in its library, and agrees to properly shelve, catalogue and keep these records so that they will be available to all members of this Association, be it

Resolved, That a committee of three, of which the Director of the Maine Agricultural Experiment Station shall be the secretary, shall be appointed by the incoming president of the Association, and be it further

Resolved, That this committee is hereby instructed to use every endeavor to obtain these records and deposit them with the Experiment Station, and that if it is found necessary they are hereby empowered to expend not to exceed one hundred dollars from the treasury of the Association for this purpose.

Whereas, the State has purchased for the use of the Maine Agricultural Experiment Station in the town of Monmouth, a farm to be used for carrying out experiments in orcharding and with corn and other farm crops, and

Whereas, it is very desirable that this farm be frequently visited by the citizens of the State in order that they may get the fullest benefit from the experiments which are to be carried out there, be it

Resolved, That the State Dairymen's Association assembled in annual convention at Skowhegan, respectfully ask that the Maine Central Railroad establish a flag station at the crossing where the railroad crosses the highway at Highmoor Farm. The secretary is hereby directed to send a copy of these resolutions to the officials of the Maine Central Railroad.

Resolved, That this Association listened with great interest to the outline of suggested work in breeding as presented by the Director of the Station in his address on Thursday morning, and that a committee consisting of Rutillus Alden, William G. Hunton and Frank S. Adams are hereby instructed to take the whole matter of this address and the recommendation for undertaking breeding and other investigations in dairy husbandry by the Maine Agricultural Experiment Station into consideration and to prepare a report as to providing ways and means for consideration at the next annual meeting of the Association.

Whereas, there seems to be some uncertainty in the minds of the excutive committee of the Association relative to their powers and duties regarding the holding of the annual conference, be it

Resolved, That the executive committee are hereby empowered to call the annual conference at such time and place as may be mutually agreed upon by them and the Commissioner of Agriculture.

Bcause of the increasing importance of this conference and the business that must come before it, be it

Resolved, That the new departure of holding the meeting until Friday noon is approved, and the executive committee are instructed to have the next convention of the same length as the present one, if it shall seem desirable to them when they come to arrange the program. But they are instructed to arrange the program so that the business may be introduced during the sessions and the election of officers shall occur on Thursday.

Whereas, it seems likely that Congress at its next session will have before it amendments to the present law regulating the sale of butter substitutes, be it

Resolved, That the incoming president of this Association is hereby instructed to appoint a committee of three who shall by correspondence or otherwise keep the Maine delegation in Congress informed of the bearing of such proposed legislation upon the dairy interests of this State, and they are hereby instructed to do everything and use every honorable means to aid legislation favorable to and to prevent legislation hostile to the dairy interests of Maine.

The following resolutions from the Maine Creamerymen's Association were presented to the Association and approved:

Whereas, the duty on butter, at six cents per pound, seems to the subscribers a fair and reasonable rate, and whereas the duty on cream at five cents per gallon is utterly inconsistent with the duty on butter, for the reason that four to five pounds of butter may be manufactured from each gallon of cream, thereby practically reducing the duty on butter to one cent or one and one-fourth cents per pound; be it

Resolved, That the tariff on cream should be immediately revised, making it consistent with the present rate on butter.

Resolved, That the Maine Dairymen's Association be requested to act in co-operation with the Maine Creamerymen's Association in an attempt to secure such revision of the tariff on cream as will make it consistent with the present tariff on butter.

E. L. BRADFORD,
E. E. HARRIS,
L. E. BROWN,
Com. on Resolutions, Maine Creamerymen's Association.

This Association is again called to record the death of one of its founders, Lemuel W. Dyer of Cumberland Center. Early in life he identified himself with the agricultural interest of the State and made a success of private dairying. He was the first secretary of this Association and served in that capacity faithfully and effectually for nine years. Be it, therefore,

Resolved, That his memory and good work will ever be remembered by the members of this organization for the results that they have helped to accomplish.

Whereas, the success of this convention has been greatly furthered by the assistance given by the local committee of the board of trade and the grange, the railroads, the Canadian Express Company, the press, and by Mr. E. E. Harris, manager of the Skowhegan Jersey Creamery, be it

Resolved, That the thanks of the Association are hereby tendered to the above named organizations and individuals.

CHAS. D. WOODS,
A. F. TILTON,
L. E. MCINTIRE,
Com. on Resolutions.

The following committee of three, to assist in obtaining legislation favorable to the dairy interests of the State, in accordance with the resolve in relation to this matter, was appointed by the president: F. S. Adams, J. D. McEdwards, R. W. Redman. This committee was also directed to vigorously push the matter of the revision of the tariff on cream as set forth in the resolve presented by the Maine Creamerymen's Association.

A committee to confer with the trustees of the University of Maine in relation to the matter of the removal of the present barns and the erection of an additional one, in accordance with the first two resolutions, was appointed by the president as follows: L. E. McIntire, John Pease, L. S. Merrill.

A committee to obtain the herd records of the four great dairy breeds and deposit them with the Experiment Station, as provided in the third resolution, was appointed by the chair as follows: C. D. Woods, C. L. Jones, P. A. Campbell.

The following recommendation by the committee on arrangements for a corn contest to be held in connection with the Dairy Conference in 1909, was adopted by the Association: "We believe that the work undertaken by the Maine Dairymen's Association in the interest of the corn plant is an important one and would recommend that its efforts should be increased year after year in this direction, and that the amount of premiums offered for 1910 should be somewhat larger than those offered for the present year."

Voted, That the executive committee, if in their wisdom they deem it expedient, shall at the next session of this conference renew the recommendation contained in the report of the secretary in regard to taking action to secure at the next session of the legislature, an appropriation of $1,000 annually for the support of the Maine Dairymen's Association.

Voted, That the matter of providing for a permanent membership of the Association, as presented for consideration by the secretary in his report, with the changes of constitution, the membership fees and everything else that may be involved, be referred to the executive committee to report a definite program of action to this Association at its next annual convention.

Voted, That all officers of the Association and all committees hereafter appointed shall make a written report of their work in detail at the next annual session.

Voted, That the executive committee be instructed to take up the matter of the exhibit of dairy animals and dairy products with the secretaries of the fairs, and insist upon proper recognition at our coming agricultural fairs, both in manner of exhibit and in awarding of prizes.

Voted, That the executive committee be authorized to offer such premiums as in their judgment they deem best for judging contests in all of the products exhibited at our annual meeting.

Voted, That the executive committee be instructed to investigate, between now and the next convention, the question of the affiliation of the various organizations of the State having allied interests with the Maine Dairymen's Association, and see if there is not some method that seems to them practicable whereby this can be accomplished.

Corresponding secretaries were appointed by the executive committee as follows: Androscoggin County, C. E. Millett, West Minot; Aroostook County, Ira J. Porter, Houlton; Cumberland County, John P. Buckley, Stroudwater; Franklin County, Joseph H. Merrill, Farmington Falls; Hancock County, Norris L. Heath, West Penobscot; Kennebec County, Chas. S. Pope, Manchester; Lincoln County, John M. Winslow, Nobleboro; Oxford County, F. H. Morse, South Waterford; Penobscot County, C. L. Jones, Corinna; Piscataquis County, F. W. Leland, East Sangerville; Sagadahoc County, Frank S. Adams, Bowdoinham; Somerset County, A. P. Howes, Palmyra; Waldo County, E. C. Dow, Belfast; York County, John Pease, Cornish.

REPORT OF DAIRY DIVISION.

By Leon S. Merrill, Dairy Instructor.

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

I herewith respectfully submit the report of the Dairy Division for the year 1909.

It has been an exceedingly busy year not only along lines already being carried on, but in the organization and direction of new work authorized by the last legislature, and which by your orders was assigned to this division; the new work referred to being the investigation of dairy products, the enforcement of the dairy laws, gathering of agricultural statistics, and seed and plant improvement. The large number of additional duties devolving upon the Dairy Division necessitated (as was contemplated by the legislature) the immediate employment of assistants in addition to those already connected with the Department, so that the Dairy Division force as at present constituted, in addition to the Dairy Instructor, is as follows:

Mr. P. F. Skofield of Houlton, Assistant Dairy Instructor in charge of field work, investigation of dairy products and enforcement of dairy laws; Mr. R. W. Redman of Corinna, Assistant Dairy Instructor in charge of Cow Test and Breeders' Associations; and Mr. E. W. Johnson, chemist in the State Laboratory of Hygiene. Acting upon your advice the assistants connected with this division have each been assigned to special duties as stated above.

In discussing the work of the Dairy Division the different lines will be taken up under their respective headings and as it appears to the writer of this report, in the order of their importance.

COW TEST ASSOCIATIONS.

It is with pleasure that the Dairy Instructor can report the organization of two new dairy testing associations during the past year and that the ones already organized are still continuing to do splendid service for the members and the communities in which they are located. The members are manifesting great interest in associated effort and we have evidence that they have profited very largely from it. Many of the unprofitable cows have been sold and those put in their places are returning to the owner a reasonable profit. The results coming from the cow test associations are only beginning to be felt, and so most certainly cannot be fully estimated and only time will bring to us the full realization of their value to the dairy interests of the State. The official testers employed by the different associations have been without doubt important factors in making the work popular and profitable to the members.

The meetings held regularly each month still continue to be full of interest and are well attended. Many of those recently held have been attended by members from other associations, and this idea of neighborly visitations is very encouraging to those having the work in charge, as it certainly manifests great interest.

One phase of co-operative action on the part of the associations that should be mentioned in this report, is the co-operative purchasing of feed-stuffs, fertilizers and grass seed. Without question any association which will co-operate fully along these lines can effect a saving in price amounting to several times the total cost of maintaining the association each year.

The September bulletin issued by this Department was devoted to a complete analysis of the work of the Cow Test Association in Maine. It has carried to every part of the State a more complete idea of the plan of organization, the purpose and the results thus far obtained in our State. No bulletin ever issued by the Department has been in greater demand. Many requests are still coming for copies of the bulletin and advice as to the best methods for carrying on the work.

CO-OPERATIVE BREEDERS' ASSOCIATIONS.

In the annual report of the Department of Agriculture made for the year 1908, it was stated that the organization of co-operative breeders' associations would be taken up in the near future, and this has been one of the important moves made by the Dairy Division during the past year. Five such associations have been organized and are located in the principal live stock sections of the State. Among the members of these associations will be found many of the leading dairymen and farmers of Maine.

Meetings are held regularly every three months and it is planned by the association to hold them in so far as it is found practicable, at the home of some member, thus enabling the other members in attendance to compare the animals owned, the methods followed and the results attained with their own.

Reports of breeders' association work will be found in the extracts from the report of the Assistant Dairy Instructor and also from the officers of associations themselves.

The co-operative breeders' associations being closely allied to the cow test associations have been directed at the same time and by the same representative of the Dairy Division. During the months of March and April Mr. P. F. Skofield, acting as Assistant Dairy Instructor, gave his attention to the organization of cow test associations. During that time he was able to very nearly complete the organization of the West Penobscot Dairy Testing Association located at Dexter.

Mr. R. W. Redman of Corinna was appointed Assistant Dairy Instructor in June and was given charge of the organization and direction of cow test associations and co-operative breeders' associations. Since then the Hebron, Minot and Mechanic Falls Dairy Testing Association has been organized with sixty-nine herds, containing more than six hundred cows, this being the largest association in Maine at the present time. The prospects for the extension of cow test and breeders' associations to other sections of the State are very encouraging. Every effort will be made by the Dairy Division to encourage and promote their organization as fast as they can be placed upon a permanent basis.

The report of the Assistant Dairy Instructor in charge of dairy testing and breeders' associations, concerning the work to which he is especially directing his efforts, is herewith made a part of this report at this time as it has special relation to the subject just treated.

REPORT OF MR. R. W. REDMAN, ASSISTANT DAIRY INSTRUCTOR, IN CHARGE OF DAIRY TESTING AND BREEDERS' ASSOCIATIONS.

To Leon S. Merrill, Dairy Instructor:

Sir:—I submit herewith a report of my work from June 21 to Dec. 31, 1909. The greater part of my time has been given to the dairy testing associations and the co-operative breeders' associations. I have tried to get thoroughly acquainted with the problems of the dairymen, especially those who are members of the dairy testing associations, and to this end have spent considerable time in the field so that the Dairy Division may not only be of the greatest possible assistance to the associations already organized, but also that it may anticipate difficulties in new associations.

Dairy Testing Associations.

Waterford and Norway Dairy Testing Association was organized in December, 1907.

President, L. E. McIntire, Waterford.

Secretary, W. K. Hamlin, South Waterford.

Tester, Harold S. Noble.

Number of herds in test December, 1909, 38.

Number of cows in test December, 1909, 295.

Monthly meetings are held alternately at South Waterford and Norway on the second Wednesday in the month.

Kennebec Valley Dairy Testing Association was organized in December, 1907.

President, W. G. Hunton, Readfield.

Secretary, C. F. Kilbreth, Winthrop.

Tester, R. B. Harris.

Number of herds in test December, 1909, 35.

Number of cows in test December, 1909, 268.

Monthly meetings are held at Winthrop on the second Tuesday in the month.

Oxford County Dairy Testing Association was organized on June 16th, 1908.

President, C. T. Bonney, East Sumner.

Secretary, A. H. Adams, Canton Point.

Tester, A. S. Cook.

Number of herds in test December, 1909, 32.

Number of cows in test December, 1909, 263.

Monthly meetings are held alternately at Canton and East Sumner on the first Tuesday in the month.

West Penobscot Dairy Testing Association was organized in June and began active work June 15th, 1909.

President, John Katen, Corinna.

Secretary, George H. Knowles, Corinna.

Tester, Paul J. Fuller.

Number of herds in test December, 1909, 43.

Number of cows in test December, 1909, 259.

This association is composed of members living principally in the towns of Sangerville, Dexter and Corinna.

Monthly meetings are held at Dexter on the first Saturday in each month.

Hebron, Minot and Mechanic Falls Dairy Testing Association was organized in September and began actual field work on December 9th, 1909.

This association is largely the result of the efforts of Mr. Charles R. Millett, of West Minot. Mr. Millett was a member of the Agricultural Committee in the legislature last winter and spent considerable time examining the records sent into the office by the other dairy testing associations. Believing the work to be of particular value to the farmers, he interested his neighbors, and as a result this association has been organized.

This is the largest association in the State, having sixty-nine (69) herds and six hundred and thirty-five (635) cows, with two testers.

President, Charles R. Millett, West Minot.

Secretary, E. K. Holbrook, Mechanic Falls.

Testers, Guy E. MacGown, Walter S. Whitney.

Monthly meetings are held on the second Thursday in each month in different parts of the association.

Members reside principally in the towns of Hebron, Minot, Mechanic Falls, Poland, Turner and Auburn.

Total number of herds in test December, 1909, 217.

Total number of cows in test December, 1909, 1,720.

Wherever the farmers know definitely what each cow in their herds is doing, much greater interest is taken in their work. This means not only better stock, but better crops and even more enjoyable conditions in the farm home.

Co-operative Breeders' Associations.

The question of obtaining better cattle is a large one. Believing that the problem could not be handled as well where every man worked for himself alone, the farmers of several communities acting in co-operation with the Dairy Division of the Department have organized co-operative breeders' associations. At the present time there are five of these dairy cattle breeders' associations, as follows:

Sebasticook Valley Holstein Breeders' Association was organized at Corinna on March 22nd, 1909.

Breeders living in the towns of Corinna, Dexter, Exeter, Newport, Plymouth, Stetson, Ripley, St. Albans, Palmyra, Dover, Foxcroft, Sangerville, Guilford, Atkinson, Garland and Sebec accepted as members.

President, C. L. Jones, Corinna.

Secretary, G. G. Grinnell, Exeter.

Treasurer, E. M. Atkins, Corinna.

Vice President, C. E. Tripp, Ripley.

Vice President, G. G. Grinnell, Exeter.

Vice President, C. H. Brawn, St. Albans.

Vice President, S. P. Ireland, Newport.

Vice President, O. L. Jones, Corinna.

Oxford County Holstein Breeders' Association was organized at Norway on April 27th, 1909.

Breeders living in Oxford County and northern Cumberland County accepted as members.

President, Benjamin Tucker, Norway.

Secretary and Treasurer, Clayton S. McIntire, East Waterford.

Vice President, C. A. Bonney, Sumner.

Vice President, E. L. Porter, Paris.

Vice President, L. E. McIntire, Waterford.

Vice President, E. J. Hobbs, Norway.

Vice President, M. R. Wilbur, Harrison.

Vice President, Fred C. Weston, Otisfield.

Vice President, Ira Harriman, Oxford.

Animals owned by members of the association:

Pure bred and registered	94
High grade	140
Grade	63
Total	297

Sales through association...............	3
Animals for sale through association.....	8
Animals purchased through association...	4

Androscoggin Valley Jersey Breeders' Association was organized at Canton on June 23rd, 1909.

Breeders living in the towns of Buckfield, Canton, Dixfield, East Livermore, Hartford, Hebron, Jay, Livermore, Mexico, Mechanic Falls, Peru, Rumford, Sumner, Turner, Wilton and such other towns as the association may see fit to add from time to time, accepted as members.

President, Arthur J. Foster, Canton Point.
Secretary, A. H. Adams, Canton Point.
Treasurer, P. C. Barker, Hartford.
Vice President, A. L. Stanwood, Rumford.
Vice President, C. E. Richardson, Canton.
Vice President, W. E. Bumpus, Mechanic Falls.
Vice President, B. D. Packard, Peru.
Vice President, P. C. Barker, Hartford.
Vice President, A. S. Robinson, Sumner.
Vice President, F. E. Adkins, Livermore.

Animals owned by members of the association:

Pure bred and registered..............	83
High grade	210
Total	293

Oxford and Cumberland Counties Jersey Breeders' Association was organized at South Waterford on Sept. 2nd, 1909.

Breeders living in Oxford and Cumberland Counties accepted as members.

President, H. W. Evans, North Bridgton.
Secretary and Treasurer, C. S. Hamlin, Harrison.
Vice President, A. L. Sanderson, South Waterford.
Vice President, Wm. Young, Norway.
Vice President, C. W. Farrington, Fryeburg Center.
Vice President, Fred S. Hamlin, North Bridgton.

Census of animals not yet reported.

Androscoggin County Holstein-Friesian Breeders' Association was organized at Lewiston, November 1st, 1909.

Breeders of Holstein-Friesian cattle in this section of the State accepted as members.

Presdent, P. M. Austin, Auburn.
Secretary and Treasurer, Geo. B. Carville, Lewiston.
Vice President, I. H. Waterman, Auburn.
Vice President, W. L. Carville, Lewiston.
Vice President, J. A. MacNaught, North Livermore.
Vice President, J. M. Strout, Webster.
Vice President, Peter Hendrickson, Yarmouth.
Animals owned by members of the association:

Pure bred and registered	64
High grade	32
Total	96

Partial census.

The objects of these associations are practically the same in each. The idea is to promote the interests of the particular breed in the locality where the association is formed by co-operating in the purchase, sale and exchange of desirable animals, and co-operative owning of males.

Men are accepted as members on the recommendation of the executive committee. Usual requirements are that the candidates either own a herd or have one under their immediate charge and will mate their cows with a registered male exclusively, of the breed which the association represents.

One regular and three special meetings are usually held by each association during the year for the discussion of dairy problems pertinent to the association. A representative of the Dairy Division attends all of the meetings.

The Department of Agriculture has furnished each association with a copy of the by-laws for the first year, and a card system for keeping the records so that if every member will do his little part the work of the secretary is greatly reduced, and after the census of live stock is taken in January, 1910, accurate information can be had at all times of the animals owned by members of the association, animals for sale, and animals transferred.

Meetings.

Of the twenty dairy testing association meetings I have attended, thirteen (13) have had two sessions each, forenoon and afternoon. There is a double advantage in having two sessions—more time and a social hour at noon. Many of these meetings have been held at the homes of the members with beneficial results, for they are much more ready to join in the discussions than when the meetings are held in a hall.

The wives and daughters of the members are taking a decided interest in the work, and in connection with the dairy work are even beginning to ask for information concerning household problems. It is possible that in the near future it may be advisable to have a women's division of the meetings for the purpose of bringing out ideas that will make the housework easier and the farm home more attractive. The chief drawback to the plan is the lack of funds to secure an assistant trained in domestic science.

The breeders' association meetings are held for three purposes: (1) to transact necessary business, (2) to arouse enthusiasm in the work, (3) to gain information.

The first two purposes need no comment.

Information concerning problems of feeding, breeding and conformation is sought after. The usual program has a discussion on some subject led by the members; a lecture by an agricultural expert followed by a discussion; and stock judging. Several associations have started classes in stock judging, using the official score card for the breed. Prof. P. A. Campbell, University of Maine, has conducted some of these classes and I have led the others. It is planned to hold three of the four meetings in the year during warm weather and at the farm of some member.

During these six months I have attended thirty-eight (38) meetings as a representative of the Department of Agriculture, having a total attendance of 1713, as follows:

Meetings.	No.	Attendance.
Farmers' Institutes	1	100
Special Institutes	2	153
Special Breeders' meeting	1	31
Grange, Subordinate	5	335
Creamerymen's Association	1	9
Breeders' Association	8	420
Dairy Testing Association	20	665
	38	1713

Twenty-seven (27) of these meetings have been in two sessions, forenoon and afternoon.

It is aimed in all lectures to present the subject in such a way as will lead to a discussion by those present. I am convinced that the best meetings are those where the greater part of the talking is done from the floor instead of the platform.

General.

I am keeping a check system which calls for a monthly report of each cow in each association. Various alterations have been made in the dairy testing association record blanks; new blanks have been devised for various reports on the different lines of work. The Division is prepared to furnish record blanks to farmers who desire to weigh the milk from their cows daily. These blanks may be had upon application and agreement to send in a report at the end of the year of the monthly totals of the milk given by each cow. I have regularly sent notices and reports of meetings to the agricultural newspapers. Correspondence has been considerable. I plan to spend only such time in the office as seems advisable in order to keep the field work in the best condition.

The future for dairying in Maine seems bright. The dry weather the past two seasons has caused a shortage of roughage, and many cows have been sold. However, better cows are being raised and the farmers are giving more thought to the summer silo and green feeds to supplement the pasture, as well as to raising extra roughage, like millet and oats and peas, to cure for winter feeding.

The monthly meetings are of great assistance in the exchange of ideas along all lines of farming, and this serves to keep the community posted on the efficiency of methods used.

Testers.

It has been somewhat difficult to find desirable men for testers. Young men of character, some ability and practical experience, who have had some school training in agriculture, will find positions as testers quite attractive. True the wages are small, not more than thirty dollars per month and board in any association, but the experience will fit a man for positions which he could not fill with school training alone. If an ambitious young man wants to go into dairy work for himself he can find no better school to prepare him for his work. There are quite a number of calls for men who have had experience as testers to take positions as herdsmen and farm superintendents, at satisfactory wages.

The prospects for men trained in agriculture are exceptionally good, and I would encourage the young men especially to take advantage of the courses offered at the University of Maine. The short winter course in dairying is of far greater value than most farmers realize. The two years' and four years' courses in general agriculture and domestic science will give young men and women a training which, applied to the farm, is of very practical value.

Work for 1910.

The dairymen of the State are cordially welcoming the breeders' associations and the dairy testing associations, and are co-operating for the advancement of Maine agriculture. Already men of several communities have asked the Dairy Division to investigate their locality with a view to organizing a breeders' or a testing association. Calls already received for lectures and demonstrations indicate a large number of such meetings for the coming year. Interest manifested in raising swine indicates that it may be desirable to do some special work encouraging hog raising, with an investigation of breeds, care and management.

Anyone desiring assistance in dairy testing association or breeders' association work should communicate with the Dairy Division, which will gladly respond to all requests for lectures and assistance in the organization of associations, in the order in which they are received.

The Dairy Division actively believes in practical co-operation for the general advancement of Maine agriculture and the particular advancement of Maine dairying.

REPORT OF ANDROSCOGGIN VALLEY JERSEY BREEDERS' ASSOCIATION.

Canton Point, Maine, Feb. 4, 1910.

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

This is a partial report of the organization and work of the "Androscoggin Valley Jersey Breeders' Association," from its conception to the present time.

Prior to June, 1909, State Dairy Instructor Merrill had suggested at several meetings that it might be well to organize such a society. This set the advanced breeders to thinking, and a meeting was called at the farm home of C. E. Richardson, in Canton, on June 23, 1909, at which time and place a breeders' association was properly formed.

The purpose of this society is to build up the dairy herd, therefore the foundation on which the association stands is that every member shall use a pure bred sire.

There were eighteen charter members and three have been added since. A census of the stock was taken, which is held by the secretary, and all sales and purchases are reported to him. From time to time he places an advertisement in the Maine Farmer in relation to animals for sale, and I will state here that we have had more orders for stock than we could fill.

It was decided to hold four meetings per year, at which the Department of Agriculture was to be represented by one or more speakers, and this plan has been carried out. The meetings have been highly interesting and instructive. The attendance has been good, and has increased at each meeting.

The opportunities for this association are far reaching in the extreme, and no man can conceive the advantages that will come to the dairymen of the State if this work can be pushed forward all over the State. But I understand that owing to the lack of funds this work has gone about as far as it can at the present time. At the next session of the legislature there should be an appropriation to the Department to extend this work throughout the State.

Some of the members of this society do not fully understand the advantages that will come to them, and so do not keep the secretary as well informed as I could wish, but I trust that in the future they will do better.

I will take this opportunity to thank Instructor Merrill and his able assistant, Mr. Redman, for the many favors they have granted us in carrying forward this work, and I wish to thank the Department beforehand for the space this will take up in case it appears in the annual report.

Yours respectfully,

A. J. FOSTER, *Pres.*
A. H. ADAMS, *Sec'y.*

INVESTIGATION OF DAIRY PRODUCTS AND ENFORCEMENT OF DAIRY LAWS.

The investigation of dairy products and enforcement of dairy laws is a very important work, especially if approached in the constructive as well as the enforcement spirit.

With this idea fully and clearly in mind, the plans for carrying out the provisions of the dairy laws of the State have been made and 2062 milk dealers have registered with the Department to date.

It was found necessary to appoint an assistant who would have immediate charge of the field work, also to employ a chemist who would make analysis of the samples submitted to him, and as stated previously in this report, Mr. P. F. Skofield was appointed assistant in charge of field work, and Mr. E. W. Johnson, chemist. We were very fortunate in securing the co-operation of the State Board of Health, who have given the Department permission to locate their chemist in the State Laboratory of Hygiene under the immediate direction of Director H. D. Evans.

All necessary details preparatory to undertaking the work were attended to at the proper time and during the latter part of September actual work of investigation through the taking of samples of milk and butter was begun.

A large number of samples have been taken and submitted to the chemist for analysis, which can be classified as follows:

Samples taken and analyzed, milk........	160
Samples taken and analyzed, butter......	87
Total samples	247

Results of Analyses.

Violations of milk law..................	13
Violations of oleomargarine laws........	15

A bulletin entitled "Investigation of Dairy Products" will be issued by the Department in February of the present year containing a complete analysis of the milk and butter samples taken up to January 1, 1910. It will also contain a report of the results of all prosecutions thus far made of the above violations. These bulletins will be published once each three months thereafter.

While it is understood that the law authorizing this investigation was designed as a pure food law for the protection of the consumer, yet it is the purpose of the Dairy Division to carry out its provisions in such a manner as will be of material assistance to the producer. Every effort possible will be made to co-operate with local authorities and assist them in the investigation of the conditions under which their milk supply is produced.

It appears to the Dairy Instructor that one of the most important things to be taken up under the investigation of dairy products is personal visitations to dairies producing the milk supply of our towns and cities by practical men well versed in the scientific questions involved in the production of milk. There is every reason to believe that the dairy farmers of this State will welcome visits at any time from an inspector who is thoroughly competent, tactful and reasonable.

To the Dairy Instructor it seems especially important that in connection with the investigation of dairy products and the enforcement of dairy laws, there should be held what might be termed Milk Institutes in the cities and larger towns for the purpose of instructing the consumer as to the care of milk in the home and its value as an article of food. There is no question but that the farmer sometimes, and perhaps often, is criticized for selling poor milk and milk produced under unsanitary conditions, when in reality the fault lies elsewhere,—sometimes with the distributor of milk and sometimes in the home of the consumer. An attempt will be made to hold a series of Milk Institutes during the present year.

A complete investigation of the production, manufacture, transportation, storage and sale of milk as worded in the law adopted by the last legislature, will undoubtedly bring a better understanding as to the conditions necessary for the production, distribution and care of a good quality of milk.

INSPECTION OF DAIRIES.

During the past year so far as the Dairy Division itself is concerned, there has not been very much accomplished in dairy inspection, except in co-operation with creameries and several of our larger towns. Co-operative work has been carried on with as much interest and benefit as during the previous year, a report of each inspection having been forwarded to this Department by the creamery or town making the inspection. A very encouraging feature connected with the inspection of dairies is the improvement in conditions of equipment or methods or both, noted wherever visits have been made to dairies for the second time. Reports sent in from one creamery show an average improved condition amounting to one and a half per cent over the first visit made by the inspector. A disappointing thing, however, about inspection work is the fact that very few of our cities and towns consider it of sufficient importance to undertake. The creameries of the State are manifesting a greater appreciation of the value of its practical application. Most certainly there is no plan more important in its relation to the quality of milk produced than dairy inspection when conducted by a competent inspector.

It is quite possible that for the present, with the limited force at the command of the Dairy Division of the Department, the most practical manner in which this proposition can be handled is to still further encourage local authorities and creameries to act in co-operation with the Department of Agriculture, but the Dairy Instructor is convinced that eventually the most practical method by which the inspection of the production of the State's milk supply can be made will be under the immediate supervision of the Department itself.

INSPECTION OF CITY MILK PLANTS.

The inspection of city milk plants like that of dairies has not been carried on by the Dairy Division to any extent during the past year. It will, however, be an important part of the investigation of dairy products, and will hereafter be reported under that heading. It is a duty which the State and local authorities owe to both producer and consumer.

MEETINGS.

While the duties of the writer of this report as chief of the Dairy Division, especially the duties involved in the organization and direction of new work and the many added responsibilities, have prevented his responding to as many calls for lectures as during the year 1908, yet taken as a whole the work done in this line by the representatives of the Dairy Division has been very important and satisfactory.

The meetings attended by the Dairy Instructor during the past year are as follows.

	Meetings.	Attendance.
Breeders' Association	10	416
Cow Test Association	22	991
Farmers' Week, Orono	2	298
Agricultural Club, Orono	1	51
Demonstrations at farms	2	133
Subordinate Granges	9	772
Pomona Granges	5	588
Grange Field Day	8	3,800
Dairy Conference, Maine	1	148
Dairy Conference, Vermont	1	360
	61	7,557

In addition to the meetings attended by the Dairy Instructor and the two Assistant Dairy Instructors connected with the Deparment the Division has furnished speakers for 29 meetings attended by 1413 people.

Total number of meetings attended by representatives of the Dairy Division:

	Meetings.	Attendance.
Leon S. Merrill, Dairy Instructor	61	7,557
R. W. Redman, Asst. Dairy Instructor	38	1,713
P. F. Skofield, Asst. Dairy Instructor	20	1,119
Speakers furnished by the Department	29	1,413
Total	148	11,802

The opportunity afforded by general meetings such as grange meetings, demonstration meetings, etc., to outline the work of the Department of Agriculture and the many plans it offers for assisting the farmers of the State, is one that all representatives of the Department are glad to take advantage of. Whenever invitations are received from granges for lectures on dairy subjects, the Dairy Division holds itself in readiness to respond unless previous engagements interfere to prevent. It is, however, especially desirable that anyone forwarding requests for lectures to the Division should specify the particular subject they wish discussed.

AGRICULTURAL STATISTICS.

Complete statistics concerning the different farm crops, farm help, opportunities for special farming, available markets, etc., have been collected in all but three counties. These data will be completed in the near future, and when fully tabulated and summarized will furnish very valuable information as to the agricultural possibilities of the State,—information that has not been heretofore available. No one can estimate at this time the immense value to the State the publishing and distribution of this information will prove to be. That definite and positive benefit will accrue, must be apparent to all.

DAIRY CONFERENCE.

The annual meeting of the Dairy Conference was held at Skowhegan beginning Tuesday evening, November 30th, and closing Friday noon, December 3rd. On account of the interest taken in the encouragement of corn growing by the Association, it was deemed advisable to extend the time for holding the meetings an extra day. This plan proved so satisfactory that it was voted by the Association to adopt the same idea for the coming year. The program was full of interest and was in the opinion of the writer one of the most valuable the Association has ever presented to its members. The exhibitions of milk, cream, butter, cheese and corn were considerably larger than ever before and attracted a great deal of attention not only from those present but from the agricultural papers of this and other states.

The special corn work was an innovation for the Maine Dairymen's Association, but proved to be very satisfactory to all concerned. While the milk and cream exhibit of 1908 was the largest ever held in this country up to that time, the exhibition held the past year was very much larger.

It was very gratifying to the Dairy Instructor, who is also secretary of the Association, to note the great interest the farmers of the State take in this particular exhibit. There was also a very largely increased exhibit in butter and cheese.

Plans are already being formulated for the association meeting to be held during the year 1910. While the place of meeting has not been officially decided upon, yet without question it will be held in the city of Augusta, a very cordial invitation having been received from the officials of that city as well as from the local grange and Board of Trade.

GENERAL.

The adoption of a plan for giving publicity through the agricultural, daily and weekly papers of the State, to matters of agricultural interest and especially to such work as the Department may be connected with, has proven beneficial.

The Dairy Division has been treated with unfailing courtesy and liberality by the press of the State and the Dairy Instructor desires at this time to acknowledge the great assistance they have rendered, and to express his appreciation and thanks therefor.

In the early part of the year the Dairy Instructor was fortunate in receiving an invitation to deliver an address before the Vermont Dairymen's Association upon Cow Test Association Work in Maine. At this meeting some new ideas were gained which were put into successful practice at our own Dairymen's Association held late in the year.

On account of the many new duties devolving upon the Dairy Division the past year, it has required the devotion of considerable time and thought to their organization. Every effort is being made to so systematize all lines of work as will not only economize the time at the disposal of the Dairy Division force and give to the Department complete detailed reports of everything accomplished, but will give to the people of the State a maximum amount of results.

An effort is being made to interest the farmers of the State in weighing the milk from each cow in their herds daily, and as a special encouragement, milk record blanks are being furnished free to such farmers as will agree to do so, the only condition imposed being the agreement upon the farmer's part that at the end of the year he will forward to this Department a summary of the yearly milk records by months, of each cow.

A large number of farmers have already availed themselves of the offer and nearly every day brings additional requests for the record blanks.

OUTLINE OF FUTURE WORK.

The efforts of the Dairy Division for the year 1910 will be directed along constructive lines more aggressively than ever before and may be briefly summarized as follows:

Improvement and Protection of Dairy Interests.

Organization and Co-operative Supervision of Cow Test and Breeders' Associations.

Inspection of Creameries.

Lectures and Demonstrations before Granges, Associations and Special Dairy Meetings.

Investigation of Complaints.

Investigation of Dairy Products and Enforcement of Dairy Laws.

Sampling and Analyzing of Dairy Products and Imitations thereof.

Inspection of Dairies and City Milk Plants.

Milk Institutes in Cities and Larger Towns.

Seed and Plant Improvement Work.

Co-operative Assistance to Maine Seed Improvement Association and Members thereof.

From the experience gained in the organization of co-operative associations in the State, the writer believes the time is close at hand, possibly next year, when it will be found ripe for the organization of Co-operative Farm Accounting Associations, in which the members will unite in employing a farm accountant who shall also be able, as a result of a thorough agricultural education coupled with practical experience, to advise them upon the proper solving of farm problems. Already a number of farmers from different sections of the State have informed the writer that they would like to belong to such an association whenever one is organized near them.

In closing I desire to express through the medium of this report my appreciation for the many kindnesses shown me by the farmers of Maine and by everyone with whom I have come in official contact. My work with this Department has always been pleasant, but never more so than during the past year. You, personally, have contributed in no small measure to this end, for which please accept my sincere thanks and the assurance of an unwavering loyalty to the Department and to the agricultural interests of Maine.

Respectfully submitted,

LEON S. MERRILL, *Dairy Instructor.*

REPORT OF STATE ENTOMOLOGIST.

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

I herewith submit my fifth annual report from the bureau of entomology.

My duties during the season of 1909 have been many and varied. The laws in relation to nursery inspection, passed by the last legislature, imposed much extra work. Formerly the inspection was confined to a few nurserymen, but the change made in the inspection law requires that all places where small fruits are grown, the plants of which are offered for sale, shall be inspected for insect pests and fungous diseases. The list of these parties is given on pages 306-308. Undoubtedly many have not yet reported, as it is several years after the passage of a new law before the public in general fully recognizes the intent of the act and falls into line with its provisions.

The small fruit industry in the State is a growing one and the producer in this line has a ready market, as our fruits are at least two weeks later in maturing than those of our nearest competitor. We feel that this industry should be encouraged, as our peculiar soil and climatic conditions produce a finished product that rivals all others in flavor and keeping qualities. As yet many of the insect pests and fungous diseases have not appeared in sufficient numbers to discourage the grower.

INSECTS AFFECTING SMALL FRUITS.

I will mention some of the leading small fruit pests.

Strawberry. The strawberry weevil, crown borer and flea beetle have done some damage in a few localities. Our common "June-bug" is an enemy that has to be reckoned with under certain conditions. Leaf blight can be controlled by spraying. On the whole there has been but little complaint regarding injuries from any of the above agents.

Raspberries and Blackberries. The cane borer and the gall produced by the agrilus beetle have been doing some damage in many sections during the past year, and reports have come in of several severe infestations of this nature. Many complaints have been made regarding the work of hornets and wasps on the ripened fruit. My attention was first called to the matter while inspecting the nursery at Bar Harbor. These insects were so abundant that they had ruined many plots of berries by eating the juicy pulp. They were so annoying that the owners could hardly pick the fruit without danger of being stung. Later we found them very abundant on a patch of blackberries.

Currants and Gooseberries. The leading insect pest of the currant and gooseberry is the saw-fly or currant-worm, so called. This can be easily handled by spraying or sprinkling the bushes with paris green, one teaspoonful to two gallons of water, as soon as the insects appear. The adult fly may be seen early in the season; we have found them in April. The female lays her eggs on the under side of the leaves; these hatch in about two weeks and the young larvæ begin to feed at once, so that if the bushes are sprayed soon after the leaves are developed the young will be destroyed before they can do any damage. A more effective spray would be one ounce of lead arsenate to three gallons of water; this would be retained on the leaves much longer than the paris green and would destroy the young worms as soon as they commenced to feed.

Another currant pest, quite common in some sections, is the currant stem-borer. We captured them by the score around our bushes, while in the adult stage. The perfect insect is a gauzy winged moth, resembling a bee or wasp. The wings expand from one-half to five-eighths of an inch, are partially transparent, and clouded with brownish scales on the tips and border. The body and antennæ are steel blue in color. There are five transverse yellow lines around the abdomen, and at its end is a prominent tuft. The females were seen on June 12th in great numbers, flying around the bushes, evidently depositing their eggs. The larvæ enter the stem and bore along its length until they get their growth. Infested stems were brought into the Insectary and the adult moths secured in this way. When about to hatch, the pupa worked its way out through the bark for one-half its length, and the cast-off skin remained in the opening after the moth had escaped. *Remedy.* Cut off and burn all infested stems.

The span-worm was quite abundant in some sections visited. The moths appear about the time the currants are ripe and may be seen flying about the bushes during picking time. They are light yellow in color, measuring about one and one-fourth inches across the extended wings. There are several brownish spots near the outer margin of each wing. The eggs are laid on the bushes and hatch the following spring. The caterpillar, as its name implies, moves by a looping motion. It has six true legs near the head and two pairs of pro-legs at the other extremity of the body. The caterpillar feeds on the leaves and when mature enters the ground to pupate. Another species, having a similar habit, is *Xanthotype crocataria.* The moth is somewhat larger than that of the span-worm, measuring one and a half inches across the wings. It is darker yellow in color, mottled with blotches, and spotted with dots of reddish-brown. The larvæ of this species have similar habits to those of the other, but when mature, spin a little silk and form their slight cocoons within a leaf of the food plant.

There are several other species of caterpillars that are found feeding upon the leaves of both currant and gooseberry bushes, but the same treatment will answer for all, viz., spraying the bushes with the previously named paris green or lead arsenate.

There are two common fruit pests, the currant fly, which also feeds on the gooseberry, and the gooseberry fruit-worm. These work in the berry and the only way to handle them is by picking off the injured fruit and destroying it.

FRUIT TREE PESTS.

Plum Insects. The plum curculio is the worst pest infesting our plums. The adult insect is so well known that a description is hardly called for. We will simply describe it as a small roughly-marked beetle with a projecting snout. The crescent-shaped mark made by the female when in the act of depositing her eggs is a sure sign of the presence of this destructive pest. The same insect has become quite a pest on the apple as well as the plum. The beetle may be captured by spreading sheets under the trees and, with a padded mallet, giving the trunk and limbs a sudden blow. The nature of the insect is to let go its hold when disturbed. All fallen fruit should be destroyed. It is reported that this pest can be partially controlled by spraying.

During the last two seasons, the plum aphis has been doing lots of damage to the young shoots. This enemy can be handled by the usual kerosene emulsion spray.

There are numerous leaf-eating caterpillars that can be readily destroyed with lead arsenate.

For the fungous diseases of the plum an early spraying with the lime-sulphur solution before the buds start is the only sure remedy.

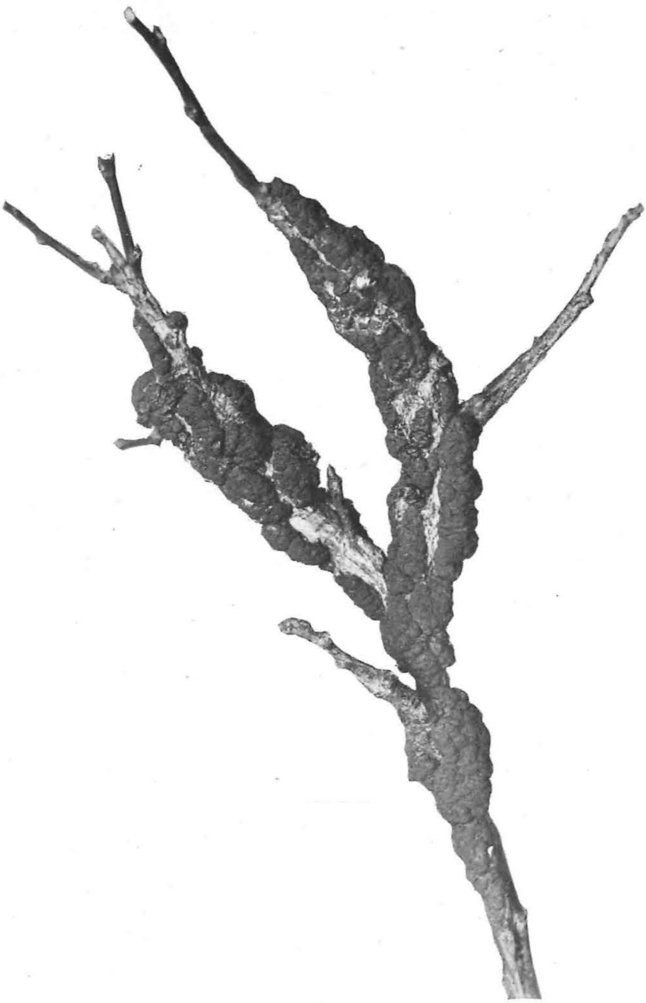
Black Knot. Our cherry and plum trees are badly infested with this fungous disease so common throughout the State. Is it to be wondered at when wherever we go we meet with it along the roadsides on every wild cherry bush and tree? It ought to be the duty of the town or city officials to have all these breeding places cleaned up and the brush burned. We cannot succeed until this is done. Public opinion must be enlisted in the good cause for better fruit before these breeding grounds both for insect pests and fungous diseases are attended to.

The spores of this disease are carried by the wind and find lodgment on the cultivated plum and cherry trees and a new colony is formed. It is a very difficult disease to combat, but if the wild bushes were removed it would save a large per cent of the infestation.

Remedies: Where it has gained a strong foothold and trees are very badly infested it is best to pull out root and branch and start over. In the meantime, be sure that all wild cherry trees and bushes are cleaned up in the vicinity. Watch the new trees carefully through the season and if the bark cracks open at any place and shows a reddish-brown growth cut it out by means of a sharp knife, making a v-shaped cut the length of the diseased portion and removing the bark and wood. Treat the cut with a little kerosene oil applied with a fine brush; not enough to encircle the limb but just to moisten the cut surface.

We shall experiment with the lime-sulphur wash during the coming season, to see if it can be controlled by this fungicide.

Pear Insects. Many of the insects affecting the apple, attack



Black Knot on Plum Tree.

the pear as well, especially the borers, codling moth, oyster-shell bark louse, leaf-eating caterpillars, etc. The remedies spoken of under the apple will apply here.

The pear-tree slug, or pear saw-fly, is quite a common pest; it also feeds on the leaves of cherry and plum trees. The adult insect is a dark colored saw-fly. The slugs or larvæ are soft, flattened insects widened near the head and tapering backwards; they are dark green, slimy to the touch, and adhere firmly to the leaf on which they feed. They work their way over the leaf, eating the green and leaving only the brown skeleton. When mature they descend to the ground and form a cocoon, emerging later as an adult fly. This pest can be easily handled by the usual sprays for leaf-eating insects.

APPLE INSECTS.

Our apple insect pests are so numerous that we will mention only the most noted ones out of several hundred that are known to do more or less damage.

Root Louse or Woolly Aphis. This insect is becoming quite numerous as it has probably been brought into the State every year on more or less of the nursery stock that has been received. The life history of the woolly aphis was given in my Second Annual Report. It is very important that all nursery stock should be thoroughly examined for this pest. If bunches occur on the roots the chances are that they are the work of this insect. Keep watch of all young trees, and if spots occur on the limbs which look like white mould, examine to see if they are not alive. The insect is a louse and is covered with the white, woolly substance that gives it its name.

Apple-tree Aphis. Young trees should be examined in the spring for the eggs of this insect; they are oval, about one-half the size of an ordinary pin head, glossy, black in color, and may be found around the buds and in the crevices of the young twigs. These eggs are laid in the fall by the little green louse that does so much damage to the young trees. The eggs hatch soon after the buds start and the little lice begin their work. Plant lice are sucking insects. They are armed with a beak which they thrust into the buds or young leaves and suck the sap, causing the leaves to curl up, thus protecting the little fellows from harm. These little insects are very prolific, and if unmolested will increase so as to do serious damage, especially to young orchards.

These two species of lice may be handled with the kerosene emulsion spray. An early spraying while the trees are dormant, in March or April, with lime-sulphur solution, will destroy many of the eggs. Washing or spraying with whale-oil soap solution, one pound of soap to five gallons of water, is a good remedy.

The above pests have many enemies among our insect friends, the most common being several species of "lady-birds," so-called, small beetles generally some shade of red in color with black markings; also larvæ of a yellow and black syrphus fly, which was very common during the past season; together with the young of the lace-winged fly—a light green, gauzy-winged insect.

Oyster-shell Bark Louse. The life history of this pest was also given in the Second Annual Report. It is too serious a pest to go unnoticed. It exists all over the State as a menace to our orchards. The lime-sulphur wash or the soap emulsion should be used in early spring. The eggs under the scales hatch about the middle of June into small lice that look to the naked eye like fine dust. While these are crawling they may be destroyed by an application of the kerosene emulsion spray.

Codling Moth. This ranks as the most injurious apple insect for Maine. Its life history has been given so frequently that we will make mention only of some of its characteristics, and touch upon the necessity of its control. The adult moth is rarely seen by the average orchardist for the reason that it is a small insect and remains hidden during the day, flying only by night at the time of egg laying, which occurs about the first of June, while the trees are in bloom. The eggs may be deposited on the small apples, or more commonly, we think, on the leaves of the tree. If unmolested many of the young larvæ crawl into the calyx cup of the fruit and there enter the small apple. If a thorough spraying is given with lead arsenate, three pounds to fifty gallons of water, at the time the petals fall, before the calyx leaves close, the pest can be practically handled. Many of the mature larvæ may be captured by placing bands of burlap around the trees, as used in our gypsy moth work.

A strip of burlap, about eight inches wide, is placed around the trunk and tied in place with a string around the center; the upper half is folded down, thus making a hiding place for many insect pests. We have trapped them in this way.

The rough bark should be scraped from all old trees and the trunks given a wash with the lime-sulphur or soap emulsion as before stated.

Apple Maggot or Railroad Worm. The maggot of this insect is too well known to warrant a description. The adult is a small fly that punctures the skin of the apple and lays her eggs underneath. When the egg hatches the young maggot "railroads" its way through the apple until it reaches its growth; it then works its way out and into the ground to remain through the winter, appearing the following season as an adult fly. They appear in July and we have found them as late as August 17th laying their eggs.

It is very evident that no method of spraying will affect them in the least. The only way to handle them is to keep the fallen fruit picked up and fed out, or keep sheep or hogs in the orchard.

Apple Borers. In the young orchard especially, these two pests, the round-headed and the flat-headed borers, are to be looked after with a great deal of care if one wishes to grow sound trees. Young trees should be examined at least twice during the year,—spring and fall. The adult of the round-headed borer appears the last of June and lays her eggs in the bark near the ground, while the flat-headed borer deposits her eggs near the crotch of the tree, or among the branches.

If the young are discovered the first season it is an easy matter to destroy them, as they work just under the bark, where they can be killed by a thrust of a knife blade. The second season they work deeper into the woody tissue and burrow around the sap wood, sometimes completely girdling the tree. They may be destroyed by running an annealed wire into these burrows, or by injecting a small quantity of carbon bisulphide into the opening and closing it with putty.

Bud and Leaf Moths. There are several different species of small moths, the larvae of which work on the buds and tender leaves of the apple tree. These minute insects are not generally very conspicuous, but their damage in many cases is very great.

The bud moths are very common in some sections but are not recognized by many of our fruit men.

We have had many specimens of the Apple Bucculatrix cocoons sent in for identification. They are elongated silken cocoons about three-eighths of an inch long and one-sixteenth of an inch wide, fastened to the bark with the silken threads. The larvae feed on the young leaves.

The banded leaf-roller is a very common pest and does a great deal of damage to the first leaves that appear. There are several species that have similar habits, some rolling up the edges of the leaves and fastening them with silken threads.

The larvae of most of these species are very active, and when disturbed quickly disappear by dropping to the ground.

All of these minute pests may be easily handled by spraying. Of course in the case of the bud moths the first spray should contain an insecticide to destroy the young larvae when they first begin to feed.

LARGER LEAF-EATING CATERPILLARS.

Tent Caterpillar. The egg cluster of this common pest may be taken at any time during the winter or early spring. It consists of a band of eggs which encircles the small twigs. It is so distinct from other egg clusters and has been so often described that it is generally well known, but not enough care is exercised to secure its removal. It is well, while gathering the nests of the brown-tail moth, to have this in mind, and remove the egg masses at the same time.

Tussock Moth. There are two species of tussock moths that are common in the State and have done much damage in some sections. The egg clusters are found throughout the winter months, often attached to a leaf which has been fastened on to the tree with a little silk, just to hold it in place. The females of both species are wingless. When the caterpillars reach their growth they frequently spin a cocoon within a leaf; this is especially true of the females, and when they emerge from the cocoons as moths, not being able to fly, they deposit their eggs in a cluster on the outside of the cocoon from which they have just emerged. These egg clusters should also be gathered and burned.

Apple Tree in West Baldwin, stripped by Heterocampa guttivitta

Brown-tail Caterpillars. The brown-tail caterpillars have become quite an orchard pest where they are so numerous that the nests occur in the pastures on wild apple trees, thorn bushes, wild cherry and other bushes where they are not removed by the property owners. There is one encouraging feature regarding the work. If the nests are completely removed from an orchard during the winter there will be no caterpillars to molest the trees for the following summer. The moths deposit their eggs during the month of July; the caterpillars hatch from these egg clusters in August, so that if the orchard is sprayed the last of August, or before these caterpillars have constructed their winter nests, they can be easily killed. Two pounds of lead arsenate to fifty gallons of water would be sufficient. This amount would not be harmful to the fruit.

Gypsy Caterpillars. In York County, where the gypsy caterpillars infest the orchards, they can be readily handled by thorough spraying. The young caterpillars hatch about the middle of May, so that the spray that is applied for the codling moth, just after the petals fall, containing two pounds of lead arsenate to fifty gallons of water, will also destroy these pests.

Canker Worms. There are also two species of the so-called canker worm, a fall variety and a spring variety. The eggs of each are laid in clusters on tree trunks, sides of buildings, etc. We have seen them so abundant on the sides of a dwelling house that not a square foot of surface was free from one or more of these egg masses.

It is rather a singular fact that the females of both of these species, like those of the tussocks, are wingless.

As the eggs hatch early in the spring they can also be easily handled with the poison spray above mentioned.

Saddled Prominent. The life history of this insect was given in a special bulletin issued last year, and was also referred to in my last report, but it has proved such an orchard pest during the past season that we feel it our duty to make further mention of its work.

In sections where these caterpillars were so destructive in 1908 they were not so abundant during the past season, although in many places they seemed to prefer the apple tree to the nearby hard wood growth, and as a result more orchards suffered this year than last.

On June 24th quite a number of both male and female moths were taken, some at the electric light and others on the side of the house where they had remained from the night previous. The moth flies by night and lays her eggs singly on the under side of the leaves. On June 30th we found many of these eggs in several orchards in Oxford County. About 50% of the eggs were hatched and the young caterpillars had just commenced to feed. We found a few, perhaps 2%, that had passed to the second stage. Later on these orchards were sprayed and the caterpillars destroyed, but the work was delayed, so it took double the amount of lead arsenate.

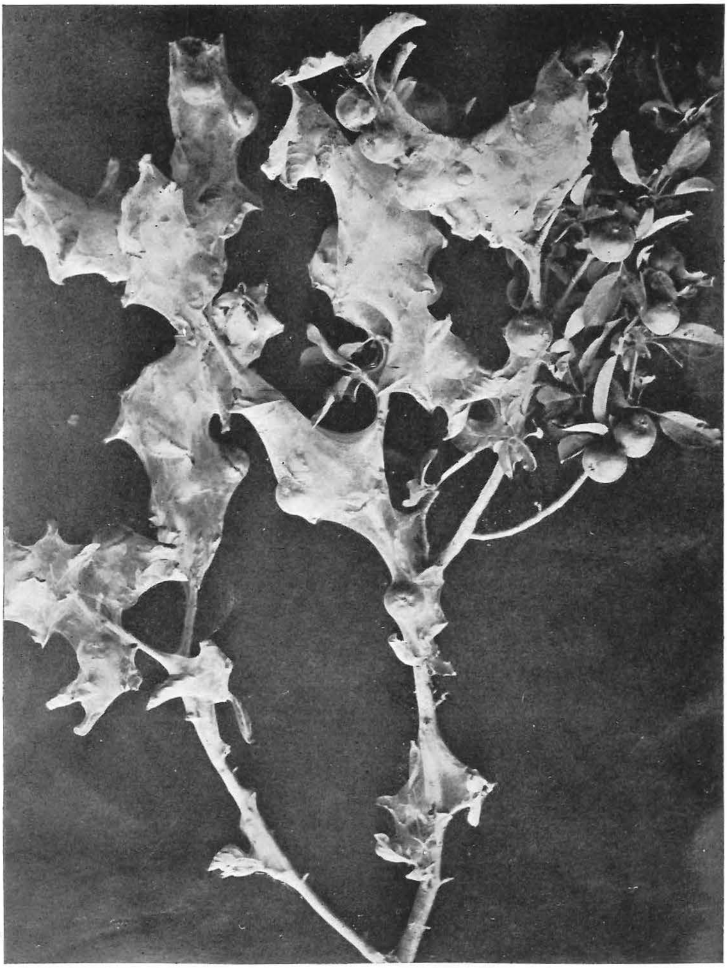
On August 2nd we received word from Bowdoinham that the orchards were being badly stripped and that the woods were suffering about as badly as in 1908.

August 4th we visited one woodlot in Sidney where the trees were completely stripped in 1908 and found the trees in bad shape. About 10% of the old growth beech trees were dead and about 50% injured so that the chances are that they will die before another year. Very few live caterpillars were seen, but many were found that had died of a fungous disease. Saw many apple trees entirely stripped by this pest.

Also visited a sugar orchard that had suffered some in 1907 when the tops of a few trees were stripped. In the spring of 1908 thirteen hundred trees tapped and run for the usual length of time yielded only about one-third of the average amount of syrup.

The caterpillars left many trees bare this season and the chances are that many of them will die. Numerous other reports came in during the month of August from different sections of the State with requests for information as to the handling of the pest.

On August 11th, inspected woods in Oakland where the caterpillars had done so much damage the previous year. Found not so much stripping. Most of the caterpillars were dead of a fungous disease, some were being killed by predaceous bugs, *Podisus modestus,* and we captured two specimens of *Calosoma frigida,* a predaceous beetle, which were feeding on caterpillars in the trees. Larvae of beetles were found under the leaves. Several specimens of *Geotrypes splendidus* were found burrowed under the leaves; they were probably feeding on the



Nest of fall web worm.

decaying caterpillars. *Ichneumon* flies were busy getting in their work, also *Tachnid* flies. There did not seem to be much show for the few remaining caterpillars. A thorough search under the leaves yielded but very few healthy pupæ.

August 19th, I visited an extensive woodlot in Belgrade where quite a per cent of the trees had been defoliated. Found but few live caterpillars, but many dead ones. Only an occasional live pupa was found.

August 20th, received word from Buckfield that many orchards were completely stripped. "Every leaf eaten and the apples standing out bare on the branches." See illustration.

October 1st, an orchard was visited that had been stripped in July and many of the trees were found in full bloom where Nature had endeavored to reinstate herself, although too late in the season.

We are very confident that this pest will be controlled by its many enemies, and that the coming season will see its ravages greatly reduced. There is no question about its control in the orchard if the trees are sprayed during the first week in July.

Fall Web-worm. The cut shows a nest of this noted pest. It was photographed August 4th, 1909. This insect was more abundant all over the State than ever before. Its unsightly nests were found attached to a great variety of trees and shrubs, but its damage was confined more to the fruit and shade trees. Many reports came into the office regarding this pest. By many it was thought to be the brown-tail, and the invasion at Madison of hundreds of moths during the last week in July was reported as being the much dreaded brown-tail. The first appearance of the moths was about the middle of June, and on June 28th we found the first colony of young caterpillars.

The moth very much resembles the brown-tail when at rest. It is of a pure white color but not so robust in appearance, the body being much slimmer and the wings thinner. When extended the distinction is plainly shown, as the body is plain, without the brown tuft which characterizes the brown-tail. The moth is a night flier and deposits her eggs in a flattened patch on the under side of a leaf. These eggs are of a greenish shade, slightly covered with white scales from the body of the moth. As soon as the eggs hatch, the young caterpillars begin to feed on the green portion of the leaf, leaving the entire skeleton; as they feed they spin a web over the leaves and extend this covering backwards until, in many cases, the whole limb is covered as shown in the figure. This silken web protects the caterpillars from their enemies, also from any spray that may be applied. They are gregarious, feeding in colonies until nearly full grown. They then scatter over the tree and wander about with a quick, uneasy movement. The full grown caterpillars are about 1¼ inches in length, thinly covered with silken hairs of varying lengths. They are quite variable in color, from light grey to reddish brown. When fully developed they descend to the ground and hide away, changing to the pupa stage in which they remain all winter, emerging as adult moths the following summer. The trees in the orchard should be inspected every few days and as soon as these webs are seen, they should be cut off and burned.

One orchardist reported that he had kept count of the nests removed from his trees until the number reached 1,495. He got tired when that number was reached, but destroyed many hundreds afterwards, so that it is safe to say that he took at least calculations, 2,000 nests from about 2,000 trees, which meant the destruction of at least 600,000 caterpillars. His method was to have a basket attached to his saddle and as he rode through the orchard he cut off the nests. When the basket was full it was emptied into a large hole in the ground. These nests were burned each night.

Yellow-necked Caterpillar. This caterpillar is quite familiar to many orchardists in Maine, as it was very abundant in 1907 and 1908. It might be classed as a companion piece to the red-humped, as it appears at about the same time and has similar feeding habits. When disturbed the caterpillar throws up both ends of the body, retaining its hold by its pro-legs.

The full grown larva is sparsely covered with fine silken hairs. The head is black and a yellow band just back of the head gives it the common name of "Yellow-Neck." They go into the ground to pupate and remain until the following season. They may be destroyed in the same manner as the red-hump, both of which can easily be controlled by spraying. The July spray for the saddled prominent would answer for all.

Red-humped Caterpillar. But few red-humped caterpillars have been reported this year. The caterpillar is easily recognized by the red hump on the fourth segment, its body being larger at this point and tapering each way.

The eggs are laid in a cluster on the under side of the leaves and when they hatch the young larvae remain side by side and feed in a colony. They consume the entire leaf so that a young tree may be entirely stripped by one brood. When full grown they crawl under leaves or other refuse and spin a thin, somewhat transparent cocoon in which they remain until spring, then change to the pupae stage and hatch into the mature moth about the last of June.

The young larvae may be detected by a careful search while they are confined to one or more leaves and can be easily destroyed.

LIST OF FRUIT PESTS.

Strawberry:

Strawberry weevil, Anthonomus signatus.
Crown borer, Otiorhynchus ovatus.
Flea beetle, Phyllotreta vittata.
June beetle, Lachnosterna fusca.

Raspberry and Blackberry:

Cane borer, Oberea bimaculata.
Gall insect (beetle), Agrilus ruficollis.

Currant and Gooseberry:

Currant worm, Nematus ventricosus.
Currant stem borer, Sesia tipuliformis.
Currant span worm, Cymatophora ribearia.
Currant span worm, Xanthotype crocataria.
Currant fly, Epochra canadensis.
Gooseberry fruit worm, Dakruma convolutella.

FRUIT TREE PESTS.

Plum Insects:

Plum curculio, Conotrachelus nenuphar.

Pear Insects:

Pear tree slug, Selandria cerasi.

Apple Insects:

Wooly aphis, Schizoneura lanigera.
Green aphis, Aphis mali.
Oyster-shell bark-louse, Lepidosaphes ulmi.
Codling moth, Cydia pomonella.
Apple maggot, Rhagoletis pomonella.
Round-headed apple-borer, Saperda candida.
Flat-headed apple-borer, Chrysobothris femorata.
Apple bud moth, Tmetocera ocellana.
Banded leaf-roller, Archips rosaceana.
Apple Bucculatrix, Bucculatrix pomifoliella.
Tent caterpillar, Malacosoma americana.
White-marked tussock, Hemerocampa leucostigma.
Old tussock, Notolophus antiqua.
Brown-tail moth, Euproctis chrysorrhoea.
Gypsy moth, Porthetria dispar.
Fall canker-worm, Anisopteryx pometaria.
Spring canker-worm, Paleacrita vernata.
Saddled prominent, Heterocampa guttivitta.
Fall web-worm, Hyphantria cunea.
Yellow-necked caterpillar, Datana ministra.
Red-humped caterpillar, Schizura concinna.

FUNGOUS DISEASES.

Apple canker, Nectria ditissima.
Black knot, Plowrightia morbosa.

BROWN-TAIL MOTH FOR 1909.

There has been a gradual spread northward of the brown-tail moth, but the infestation is scattering and can be checked to a great extent if thorough work is done by property owners and town authorities. The law passed by the last legislature did not go into effect until the first of July, 1909, but the work of the spring campaign was much more thorough in some sections, than during the preceding year, with the result that but little stripping of trees was noted outside of York County. In badly infested sections where the nests were not removed a great deal of suffering was caused by the so-called brown-tail

Apple Canker; prevalent in Maine since Winter Injury.

Winter Injury wrongly treated; copper wire used in place of string.

rash. Many more cases were reported than ever before, and one man employed in the gypsy field force died from the effect of the disease.

The season was not so favorable for the working of the fungous disease that played such havoc with the caterpillars during the summer of 1908. It is to be regretted that there are yet so many who are seemingly indifferent to the spread of this pest and make no effort to aid in removing the winter nests from trees on their own property. If all such nests are removed there will be no danger of having stripped trees or brown-tail rash.

Early in July a report came to the office that the town of Madison was swarming with brown-tail moths. An investigation revealed the fact that the town was badly infested with the so-called fall web-worm. These moths resemble very closely the brown-tails and appear at the same time, swarming around the street lights. After a thorough search, one male brown-tail was found. A few nests were found at Sangerville in Piscataquis County, in 1908. They were found at Dover and Foxcroft this fall, and a later scout was made with the result that all the intervening towns, from Waterville north, to Dover, were found to be infested. During the summer moths were reported in Bangor as coming on the boats from Boston. This section was inspected and nests were found in all of the towns from Hampden to Old Town. There was a larger flight this year than ever before, which accounts for the more extended infestation. We have the whole sweep from New Hampshire as well as from our own district. Our unusually mild winters for the past two seasons account in a great measure for the added territory. From observations made in the winter of 1906-1907 it would seem that a very severe winter would set back the northern limit again to about the latitude of Augusta.

The following towns have been added to the infested district during the past season:

Andover, Byron, Newry, Roxbury, Alton, Bangor, Bradford, Brewer, Carmel, Charleston, Corinna, Corinth, Dexter, Dixmont, Etna, Exeter, Garland, Glenburn, Hampden, Hermon, Hudson, Kenduskeag, Lagrange, Levant, Newburg, Newport, Old Town, Orono, Plymouth, Stetson, Veazie, Atkinson, Brownville, Dover, Foxcroft, Milo, Orneville, Sebec, Anson, Athens, Bingham, Brighton, Cambridge, Canaan, Concord, Cornville, Detroit, Embden, Harmony, Hartland, Lexington, Madison, New Portland, Norridgewock, Palmyra, Pittsfield, Ripley, St. Albans, Solon, Burnham, Troy, Baileyville, Baring, Meddybemps and Princeton.

GYPSY MOTH SITUATION.

We are facing a critical period in the history of our gypsy moth infestation.

We must have the support and hearty co-operation of all those who are looking for the future interests of our forest conservation and the movement for orchard improvement, and general agricultural uplift. The pest so far has been practically held in York County, but unless a more determined policy is adopted by our next legislature we cannot hope to keep the insect long under restraint, and if once it gets beyond control we will not foretell the result, it is all too evident. The report of the Special Field Agent should be carefully read.

GRASSHOPPERS.

The damage to young apple trees by grasshoppers was quite serious. They were so abundant that whole trees were defoliated, even some ten feet in height. The damage to other farm crops was great; whole fields of grain were ruined; corn and beans were stripped of leaves and much of the feed in many of the pastures was eaten bare.

APPLE CANKER.

This disease has done more to discourage Maine fruit growers than all the other evils combined. Hardly an orchard in the State is free from this trouble. Wherever the winter injury of 1906 and 1907 occurred, this disease followed rapidly in its wake. The worst feature of the situation is the fact that but few recognize the injury and are cognizant of its nature and how to treat it.

We were recently called to an orchard of several hundred trees, almost every one of which was badly infested with tree canker. The cut shows a good illustration of a typical case of this disease as occurring in the crotch of a limb. In most orchards it is noticed first as affecting the ends of the twigs and limbs; the end begins to turn dark, the bark sinks and often cracks open. If the weather conditions are favorable the work of destruction is very rapid, especially if it should be what is called crown canker, occurring just at the surface of the ground and girdling the trunk. It is easily conveyed from tree to tree by the spores of the fungus, which are so minute that they are not visible to the naked eye, and float in the air like so many dust particles. These lodge in crevices in the bark, in fact all over the tree, but are not able to penetrate the healthy bark. It is only when the surface is exposed by the cut of a saw or axe, the puncture of an insect, the cracking of the bark by a sun-scald, the action of the frost in severe winter weather, or some mechanical injury that the disease can cause damage.

We must wake up to the fact that our old orchards are doomed unless the trees are cared for and properly treated.

The mechanical injury due to the severe winter above referred to was followed by this disease, so that now hardly an orchard is free from it. In the affected orchards the trees should be carefully looked over and all diseased limbs and twigs cut out and burned. The sunken, dark colored spots where the bark is dead, either on the limbs or trunk or in the crotch, should be carefully scraped until the live bark is reached. The surface should be saturated with a strong solution of copper sulphate (blue vitriol), two ounces to one gallon of water.

CARE OF INJURED TREES.

The cut shows the trunk of a small tree that has been injured in some way, probably by being knocked off by the whiffle-tree in cultivating. The owners sought to remedy the evil and bound on a piece of burlap, fastening this with a piece of copper wire; the result is very apparent.

Several trees in the orchard were treated in this manner and they were all dead as a result. If these scars had been carefully trimmed of all loose bark, treated with copper sulphate solution and properly painted, nature would soon have healed the wound.

Whenever a band is placed around a tree it should be fastened with a soft string that would easily break or cut away by the time the wound was healed.

NEW ENGLAND FRUIT SHOW.

A conference of New England governors was called to meet in Boston on November 23, 1908.

The writer was sent as a delegate from the Maine Department of Agriculture. As a result of the gathering, a meeting of the New England nursery inspectors was held at the State House on December 4 of the same year, to discuss a plan for better nursery protection for the New England states. At this meeting it was proposed to hold a New England Fruit Show in 1909. This met with the approval of the leading fruit men of the several states.

On March 5, 1909, another conference was held, at which time the following officers were elected:

President, J. Lewis Ellsworth, Boston, Mass.

Vice President, William P. Rich, Boston, Mass.

Secretary, Wilfrid Wheeler, Concord, Mass.

Treasurer, A. Warren Patch, Boston, Mass.

State Vice Presidents—Charles L. Gold, North Cornwall, Conn.; R. M. Bowen, Providence, R. I.; F. C. Sears, Amherst, Mass.; G. L. Perry, South Hero, Vt.; E. D. Sanderson, Durham, N. H.; E. F. Hitchings, Waterville, Maine.

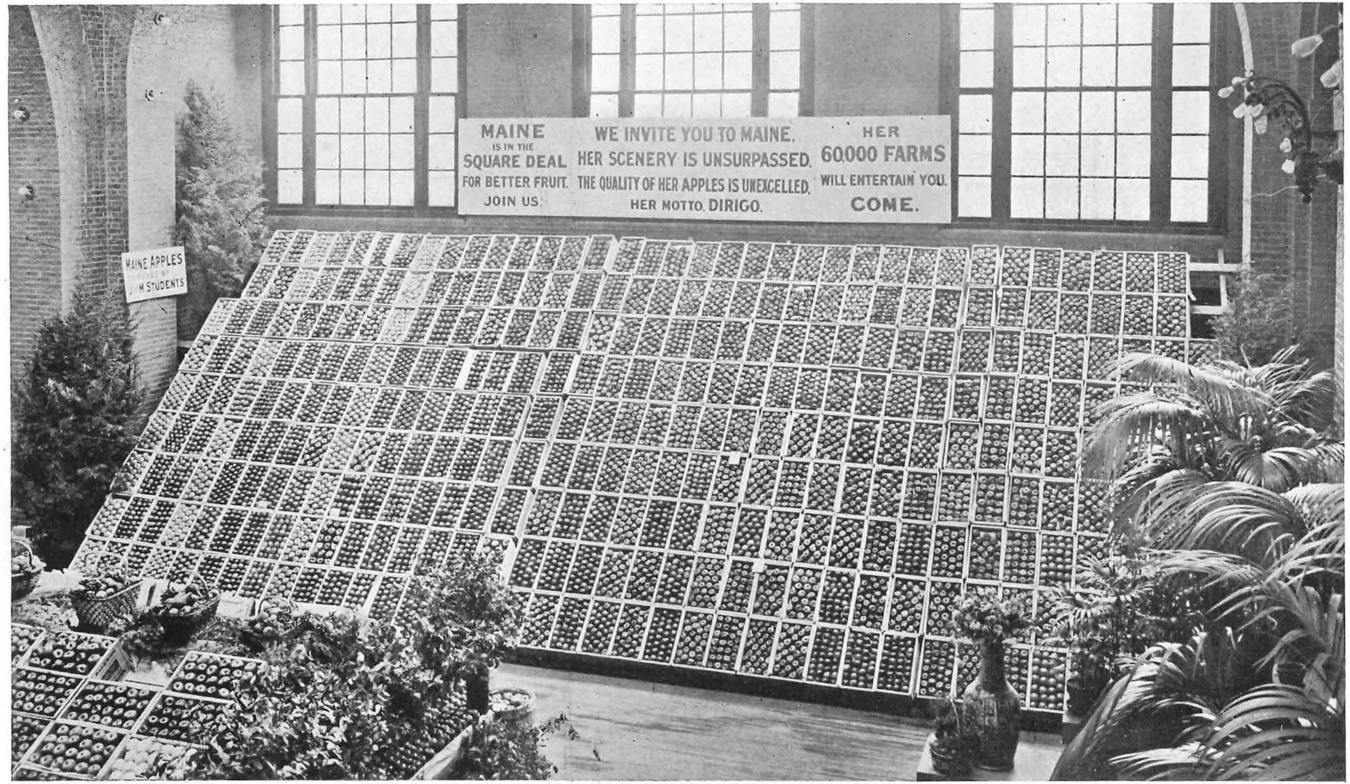
The objects of the exhibition were to demonstrate the superior quality of New England fruit; to encourage better methods of production and marketing; and to call attention to the possibilities of commercial fruit culture in the New England states.

A great deal of work was done in each state towards making this exhibit one of the finest ever held in the East. Maine did her part, although handicapped in many ways. Owing to a severe hail storm in midsummer, much of the fruit in the apple belt was rendered unfit for exhibition. Another drawback was the fact that the show was held too early for Maine fruit, especially winter varieties.

Liberal premiums were offered, open to New England, and each state made out its own list.

MAINE'S POSITION.

The initial movement in Maine was a slow one. There was but little enthusiasm. It was rather up-hill work to secure exhibits of fruit for the show, and still harder to obtain pledges for the amount of the premiums. Private individuals were



Maine exhibit of boxes at the New England Fruit Show, Boston, October 19–24, 1909.

solicited; the Pomona and subordinate granges were called upon, with the result that $329.60 was finally available, aside from special premiums given by the State Grange, Lewiston Journal, and State Master of the Grange. The total amount offered for our State premiums was $412. The full amount was pledged, but owing to a misunderstanding in regard to some of the Grange pledges, only $329.60 was collected, so that but 80 per cent was paid.

Maine entered 28 barrels, 588 boxes and 497 plates.

New Hampshire entered 18 barrels, 54 boxes and 249 plates.

Vermont entered 5 barrels, 16 boxes and 37 plates.

Massachusetts entered 31 barrels, 74 boxes and 455 plates.

Rhode Island entered 24 barrels, 22 boxes and 83 plates.

Connecticut entered 25 barrels, 132 boxes and 199 plates.

For State exhibits, Maine made 10 entries, New Hampshire 9, Vermont 2, Massachusetts 11, Rhode Island 5, Connecticut 6.

In Grange exhibits, Maine made 14 entries, New Hampshire 6, Vermont none, Massachusetts 3, Rhode Island 4, Connecticut 2.

MAINE WINNERS OF PRIZES. STATE EXHIBIT.

In the State exhibit under best collection of five commercial varieties of apples:

First, C. A. Merrill, Auburn. Varieties, Hubbardston, Baldwins, Spy, McIntosh, King.

Second, G. W. Staples, Temple. Varieties, Rolfe, Spy, Baldwin, King, Gravenstein.

Third, I. G. Quimby, Auburn. Varieties, Spy, King, Baldwin, Rhode Island Greening, Ben Davis.

MAINE SPECIAL PRIZES.

Best box of Baldwins—First, R. L. Cummings, West Paris; second, F. H. Morse, Waterford; third, W. L. Warren, West Baldwin.

Best box Ben Davis—First, R. L. Cummings, West Paris; second, H. J. Luce, Hampden Corner; third, J. G. Quimby, Auburn.

Best box Gravenstein—First, A. A. Herrick, Norway; second, G. W. Staples, Temple; third, F. S. Whiting, East Hebron.

Best box King—First, A. A. Herrick, Norway; second, C. A. Merrill, Auburn; third, R. L. Cummings, West Paris.

Best box McIntosh Red—First, C. A. Merrill, Auburn; second, G. W. Staples, Temple; third, none.

Best box Northern Spy—First, A. A. Herrick, Norway; second, R. L. Cummings, West Paris; third, J. G. Quimby, Auburn.

Best box Rhode Island Greenings—First, J. M. Sturgis, Auburn; second, J. Wallingford, Auburn; third, J. G. Quimby, Auburn.

Best box Wealthy—First, G. W. Staples, Temple; second, J. Wallingford, Auburn; third, none.

Best barrel Baldwins—First, F. H. Morse, Waterford; second, R. L. Cummings, West Paris; third, F. G. Whiting, East Hebron.

Best barrel Northern Spy—First, W. H. Keith, North Monmouth; second, Albert J. Pike, Wayne; third, G. W. Staples, Temple.

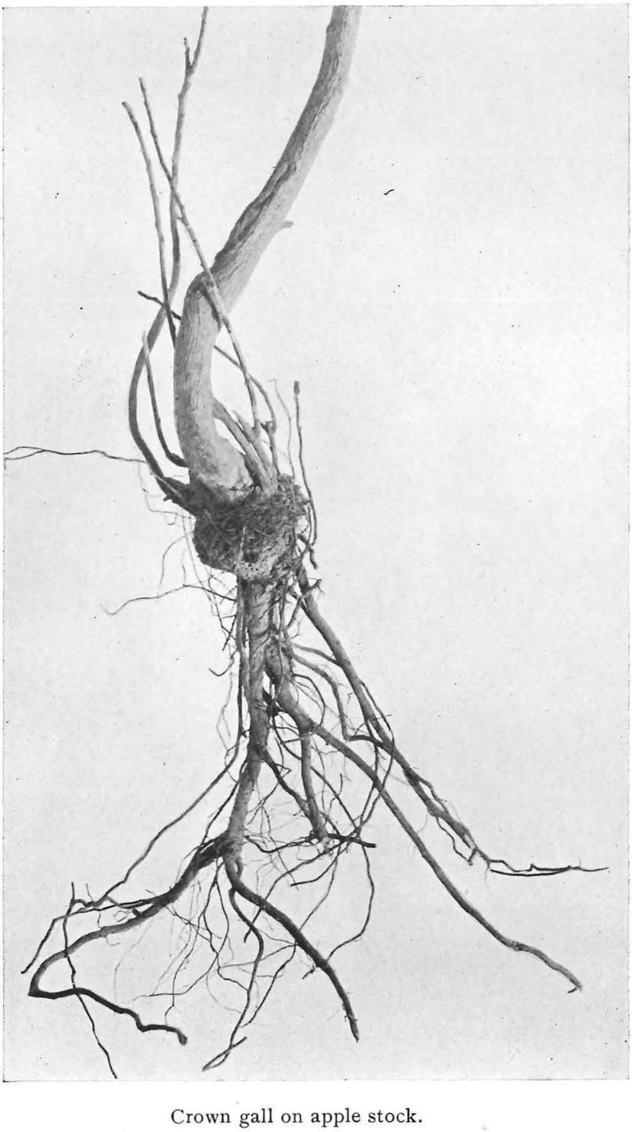
In order to show the leading varieties exhibited from each of the New England states, we will give the list from each as shown by the State exhibit of the best five commercial varieties. Maine, as previously given, had ten entries; in these the following varieties occurred the number of times indicated by the figures following the variety: Baldwin (9), Spy (7), King (6), Rhode Island Greening (5), Ben Davis (4), Gravenstein (3), McIntosh (3), Wealthy (2), Roxbury Russet (2), Nodhead (2).

New Hampshire, nine entries—Spy, Rhode Island Greening, McIntosh, two each, with one each of King, Baldwin, Bellflower and Hubbardston.

Massachusetts, eleven entries—Baldwin (10), King (9), McIntosh (7), Gravenstein (7), Rhode Island Greening (7), Wealthy (5), Spy (4), Hubbardston (3).

Connecticut, six entries—Baldwin (6), Rhode Island Greening (5), Spy (4), King (3), Gravenstein (3), McIntosh (2), Fall Pippin (2).

The fruit show was held at Horticultural Hall, Boston, Oct. 19 to 24. From the beginning it was a great success, and its influence will be felt for years to come, not only in New England, but throughout the apple belt of New York and New Jersey. Maine took her place, and although entering with many odds, came out with her share of honors. The few who pushed the undertaking to success received their reward, as much in



Crown gall on apple stock.

the knowledge gained as in the prizes won. The best feature of the whole exhibit was the perfect harmony and united effort of all who participated in the movement for "Better Fruit for New England."

The large display of boxes in the Maine exhibit prompted a gift from Hon. James J. H. Gregory, to the State of Maine, for the improvement of her fruit interests. A $1,000 bond has been deposited by him with the Maine Department of Agriculture, to encourage the growing of better orchards in the State by awarding the interest, a prize of $200 at each five-year period, on the best acre or more of orchard grown during that time. This offer will give an impetus to Maine fruit raising in the future, and we predict that in a few years orcharding will be one of the leading agricultural industries of the State.

LESSONS FROM THE SHOW.

The first New England Fruit Show has passed into history but its many successes and failures will add impetus to the great movement for "Better Fruit for New England."

Maine in the past has suffered in a great measure from unscrupulous tree agents who wished to unload all the culls of all the tried and untried varieties that an orchard is heir to. The result has brought disaster to many orchards in Maine.

The New England Fruit Show helped to turn this tide to better nursery stock and fewer varieties. A glance over the leading varieties reveals this fact,—that the Baldwin is the most universal variety grown. In Class G, there were 76 plates of five apples each and 36 of 12 each, while in Class F, they entered into almost every state and grange exhibit, giving at least 80 plates more; making a total of about 200 plates of Baldwins out of a total exhibit of 1,520 plates of apples.

The next varieties, as they came in order, were King, Rhode Island Greening, Spy, Roxbury Russet, Hubbardston, Gravenstein, Fameuse, etc.

Maine entered the field to learn her lessons from her more favored sisters, and those who attended the school felt well repaid for the expense of the tuition. We learned a great deal, and what is better, we are going to put that knowledge into practice. The big lesson of spraying was forced home to many as never before. We also learned a few things about scoring fruit, some of which will be put into practice.

In the matter of varieties, there was a good opportunity offered for the exercise of better judgment on the part of many Maine growers.

The whole State is awakened as never before on the subject of fruit growing. The annual exhibit of the State Pomological Society held in Norway, was the finest ever shown in Maine. This came as a result of the New England Fruit Show.

The officials of all the fairs to be held in the State during 1910 have been asked to increase their premium lists for better fruit. Fruit Institutes and field spraying demonstrations will be held during the season; old orchards will be renovated and new ones planted.

There is a general agricultural uplift all over New England and the movement for orchard improvement has turned in the right direction.

Better fruit is in the air,
Better fruit is everywhere.

SOLON CHASE.

In the death of Solon Chase, which occurred on Nov. 23, 1909, the orchard interests of Maine lost a firm friend. We are glad to present the picture of this veteran farmer and orchardist in this report. Mr. Chase was born at Chase's Mills in 1822. When cutting the bushes from around a large boulder in his field, more than forty years ago, he found a small scrub apple tree. This tree he grafted to Northern Spies, and he lived to see it produce $50 worth of apples in one season. At his death he had 600 Northern Spy trees in good condition, the most of them bearing from one to eight barrels of apples. One year ago he had two acres of his rocky pasture land plowed and he helped to remove the stones and fit it for 200 more Spy trees. His plans for this orchard will be carried out by his son.

Mr. Chase manifested a deep interest in the orchard work of the State. He was very anxious to see the recent movement for "Better fruit" materialize, and stated that he thought the future of Maine, so far as orcharding was concerned, was a bright one. We hope that his mantle will fall upon many.

Solon Chase, "Spy" King of Maine.

NURSERY INSPECTION.

Owing to the change in the law, which now requires the inspection of all places where small fruit stock is raised to be placed on the market, the duties of the State Inspector have been greatly increased. The following is a list of the nurseries inspected. The majority sell only small fruit stock, principally strawberry plants.

The nurseries of Maine, with but one exception, are not growing Maine fruit trees. We think this is a great mistake. Years ago there were several parties who grew Maine stock and wherever the orchards are located that were set to this stock we find our most thrifty and long-lived trees. We believe the time has come for a movement in this direction. It is true they could not be raised as cheaply as are the trees from France seedlings, but if we secure hardy stock as a result the price would not count so much as hardiness. Parties have consulted the Department in regard to this matter and we believe a venture will be made in the near future along this line.

One very important factor is in our favor and that is the insect problem. Stock raised in Maine, as far as present conditions are concerned, would be free from San Jose scale, woolly aphis, crown gall, etc. This is very important, to say the least.

LIST OF NURSERIES IN MAINE.

ANDROSCOGGIN COUNTY.

Chapput, Joseph T.......	Auburn,	Small fruit.
Lombard, T. M........	Auburn,	" "
Merrill, A. S............	Auburn,	" "
Merrill, Chas............	Auburn,	" "
Roak, Geo. M...........	Auburn,	Regular stock.
Woodman, H. M........	Auburn,	Small fruit.

CUMBERLAND COUNTY.

Barberi, Chas.	Woodfords,	" "
Benton, Llewellyn.......	Gorham,	" "
Gould, Chas. E..........	Woodfords,	" "
Green, Edward...........	Gorham,	" "
Holmes, H. H...........	Woodfords,	" "
Jackson, H. A..........	Westbrook,	" "
Kemp, A. F..............	Gorham,	" "
Macomber, E. R.........	Woodfords,	" "
Maybury, Walter........	South Windham,	" "
Morse, Mrs. Emma J....	South Windham,	" "
Moulton, Milton S.......	West Scarboro,	" "
Purrington, Chas........	Gorham,	" "
Smith, Chas. W..........	Woodfords,	" "
Webb, Frank............	South Windham,	" "
Webb, Sumner..........	South Windham,	" "
Winslow, Robert........	Gorham,	" "

HANCOCK COUNTY.

Ball, Henry A..........	Hancock Point,	" "
Ball, H. D. & Son.......	Hancock,	" "
Crabtree, W. A..........	Hancock Point,	" "
Hancock Co. Nursery Co..	Surry,	Regular stock.
Moore, Geo. M..........	Hancock Point,	Small Fruit.
Mt. Desert Nursery Co...	Bar Harbor,	Regular stock.
Mt. Desert Nursery Co...	North East Harbor,	Regular stock.
Penny, C. A.............	Hancock Point,	Small fruit.
Phillips, Willard........	Hancock,	" "
Wooster, E. W..........	Hancock Point,	" "

KENNEBEC COUNTY.

		Small	fruit.
Chadwick, Edward C....	So. China,	"	"
Dutton, Chas. E.........	China,	"	"
Ellis, Ruel T............	China,	"	"
Haskell, Wesley.........	Weeks' Mills,	"	"
Jones, Willis E..........	So. China,	"	"
Lawrence, Henry C.....	Chelsea,	"	"
Metcalf, Frank..........	Albion,	"	"
Patterson, Frank M.....	China,	"	"
Perkins, Chas. S........	Vassalboro,	"	"
Perley, Clarence.........	Winthrop,	"	"
Perley, Fred W.........	Vassalboro,	"	"
Pike, Geo. A...........	Winthrop,	"	"
Shaw, Eben.............	Albion,	"	"
Shorey, Asher...........	Albion,	"	"
Ward, Freeman..........	China,	"	"
Ward, O. U. G..........	China,	"	"
Ward, W. F............	China,	"	"

KNOX COUNTY.

Lufkin, W. C............	Rockland,	"	"
Simmons, R. B..........	Appleton,	"	"
Thurston, James........	Rockland,	"	"
Thurston, Philo.........	Union,	"	"

LINCOLN COUNTY.

Chatman, G. H..........	No. Edgecomb,	Regular	stock.
Clifford, Woodbridge....	No. Edgecomb,	Small	fruit.
Hutchings, John E. Jr...	Wiscasset,	"	"
Mason, William.........	Wiscasset,	"	"
Merry, Byron L.........	No. Edgecomb,	"	"

OXFORD COUNTY.

Pike, Dennis............	Norway,	"	"
Lyman, F. L............	West Paris,	"	"

PENOBSCOT COUNTY.

Fogg, A. B..............	Hermon,	"	"
Gould, W. S............	Brewer,	"	"
McCabe Brothers........	Bangor,	"	"
McCabe, John C........	Bangor,		"
McCabe, R. F...........	Bangor,		"
Murphy, Henry.........	Bangor,		"

		Small fruit.
Osborn, William E......	Brewer,	" "
Overlock, Fred..........	Hermon,	" "
Smith, A. C.............	Hermon,	" "
Smith, D. B.............	Bangor, R. 4,	" "
Smith, H. A.............	Newport,	" "
Smith, J. E.............	Newport,	" "
Smith, P. J.............	Hermon,	" "
Wilson, John............	East Newport,	" "

PISCATAQUIS COUNTY.

Bridges, Frank W.......	Dover,	" "
Brockway, C. A.........	Dover,	" "
Bush, James.............	Foxcroft	" "
Cleaves, F. W...........	Sangerville,	" "
Howard, L. D...........	Sangerville,	" "
Knowlton, S.............	Sangerville,	" "
Powers, M. W..........	Dover,	" "
Prentiss, H. C..........	Foxcroft,	" "

SOMERSET COUNTY.

E. T. McCabe & Co.......	Palmyra,	Regular stock.

WALDO COUNTY.

Stantial, A. B...........	Belfast,	Small fruit.
Wilson, M. O...........	Searsmont	" "
Vose, Chas. C...........	Belfast,	" "

WASHINGTON COUNTY.

Wooster, E. W..........	Washington Junction,	" "

YORK COUNTY.

Fernald, W. Linwood...	Eliot,	Regular stock.
Hazelton, F. H..........	Old Orchard,	Small fruit.
Murch, G. A............	Old Orchard,	" "
Whitman, B. M..........	Old Orchard,	" "

LICENSING OF NURSERY AGENTS.

As soon as the new law went into effect, requiring all persons who wished to take orders for nursery stock in the State to take out a license for so doing, there was considerable uneasiness felt among nurserymen outside of the State as to what would be the outcome of this new requirement. It was a movement in the right direction, for it will not only enable the Department to secure data on the business handled in the State along this line, but will bring the fruit interests of the State into closer touch with the great movement for "Better Fruit for New England." It will help to equalize our standard of nursery stock and free the State of much of the inferior material that has found its way into the orchards of the State in the past.

The movement has met with the approval and hearty co-operation of the leading nurserymen who are united for the best interests of the trade. The best is none too good for Maine. Remember our motto!

The greatest lesson now to be learned by our orchardists is that of better selection of stock. Do not for a moment entertain the thought that small and inferior nursery stock should be bought because the first cost is less. We are not at a bargain counter and should bear in mind that cheap stock is dear at any price; even the gift of such should be a criminal offence. Select the best, as you would in purchasing an up-to-date dairy herd. The amount of business done in the State is quite extensive, as will be seen by the number of agents employed. As yet we cannot state the yearly business done, as the data cannot be secured until the season closes next spring. We shall then endeavor to secure as complete a record as possible.

LIST OF NURSERY AGENTS LICENSED BY THE STATE ENTOMOLOGIST FOR THE YEAR 1909.

Abbott, Hiram F.,	Rumford Pt.
Adams, W. P.	Ogunquit.
Ames, Judson,	Foxcroft.
Andrews, Chas L.,	Portland.
Andrews, W. G.,	Prout's Neck.
Archer, Elmer,	Woodville.
Arthur, C. E.,	Farmingdale.
Ayer, Frank W.,	Bangor.
Barlow, L. A.,	East Boothbay.
Bartlett, Frank R.,	Topsham.
Barton, R. S.,	Waterville.
Bean, Chas. E.,	Sanford.
Bean, Emery O.,	Deer Isle.
Bell, Wm. P.,	Westfield.
Bennett, Helen M.,	Scarboro.
Benson, Harden G.,	Kingfield.
Bicknell, L. H.,	Albion.
Billington, H. C.,	Surry.
Bolton, Frank O.,	Portland.
Booker, John F.,	Somerville.
Boothby, Asa,	Westbrook.
Bradeen, A. C.	Lewiston.
Brann, Fred P.,	Palermo.
Bray, Geo. C.,	Hiram.
Bridges, O. W.,	Dexter.
Briggs, Carrie A.,	South Paris.
Briggs, Frank A.,	South Paris.
Briggs, Walter S.,	Littleton.
Brown, I. L.,	Bucksport.
Brown, Nelson W.,	Milo.
Brown, William F.,	Princeton.
Bryant, J. B.,	Buckfield.
Buckman, N. D.,	Yarmouth.
Burleigh, Arthur A.,	Biddeford.
Burleigh, Ray C.,	Biddeford.
Burns, S. L.,	West Eden.
Buswell, Arthur R.,	Norway.
Butters, Levi,	East Stoneham.
Buzzell, F. F.,	Skowhegan.
Campbell, John C.,	Steuben.
Candage, Herbert A.,	S. Bluehill.
Cannon, S. T.,	Augusta.
Carter, Ruel S.,	Bradley.
Cary, C. N.,	Passadumkeag.
Casey, Warren,	Augusta.
Cassidy, M. L.,	Calais.
Chadbourne, E. L.,	Carmel.
Chase, Fred H.,	Clinton.
Chase, Homer N.,	Auburn.
Cheney, Harold E.,	Bowdoinham.
Clarke, Albert W.,	Smithville.
Clough, S. B.,	Lewiston.
Cobb, Willard,	West Paris.
Coffin, G. W.,	Harrington.
Colby, Chas. E.,	Topsham.
Cole, Edward C.,	Sedgwick.
Cole, Edwin B.,	Springfield.
Cole, J. E.,	Union.
Cole, W. D.,	Norway.
Cook, Albert E.,	Windham.
Cook, C. B.,	Troy.
Cookson, G. W. H.,	Newport.
Coulter, Ancil D.,	Vanceboro.
Cowan, George A.,	Tenant's Harbor.
Crockett, Leon O.,	Camden.
Currier, Fred H.,	Houlton.
Curtis, Fred A.,	Ashdale.
Daggett, Chester W.,	Greene.
Daggett, Lee,	Strong.
Daicy, Kilbourn W.,	W. Scarboro.
Dailey, Elon L.,	Canton Point.
Dakin, E. J.,	Wilton.
Davis, E. B.,	Rumford.
Davis, E. E.,	Greene.
Davis, George,	Searsmont.
Davis, Levi T.,	Old Town.
Day, J. D.,	Princeton.

DeLemos, Louis, E. Belfast.
Dennett, Wm. S., Buxton.
Dinsmore, W. E., Fairfield.
DeMarey, Henry N., Lincoln.
Doble, Wm. E., West Paris.
Domansky, R. C., N. Castine.
Douglass, Burton, Belfast.
Dow, Sewall, Riverton.
Downing, Geo. H., York Corner.
Dudley, Frank H., Auburn.
Dudley, O. P., Farmington.
Dunphy, A. J., Lexington.
Duran, James F., Charleston.
Dyer, Alden, Franklin.
Eaton, Samuel H., Oxford.
Eaton, Sidney L., Bath.
Edgecomb, Perley A., Limestone.
Edwards, J. P., Norway.
Ellingwood, Anson P., Monroe.
Ellis, R. T., China.
Evans, Frank J., Berwick.
Evans, I. F. , South Paris.
Fadden, Edgar F., W. Newfield.
Fairbanks, A. E. Monmouth.
Farnham, Mark, Wells.
Fenderson, Wm. P., Dennysville.
Fernald, C. G., Old Town.
Fernald, Fred H., Newport.
Fickett, Miss Minnie, Saco.
Fifield, B. S., Rockland.
Fogg, Isaac H., Portland.
Foss, Clyde, Wellington.
Fox, Alwyn N., So. Berwick.
Fox, Daniel J., Porter.
French, A. B., Lincolnville.
Frizzell, J. N., Mercer.
Gardiner, W. E., Fort Fairfield.
Gay, W. R., Gardiner.
Getchell, Oscar I., Bangor.
Giles, Bennie M., Boothbay Harbor.
Gilman, H. W., South Berwick.
Goodwin, Atwood, Lincoln Ctr.
Gordon, G. A., Livermore Falls.
Gordon, Wilson M., Winn.
Gore, G. W., Dexter.
Gott, J. M., Wayne.
Gould, R. E., South Paris.
Gray, Wm. D., Bowdoinham.
Green, J. C., Lexington.
Grover, John P., Brewer.
Grover, Moses E., Bethel.
Gunnison, Homer E., Kittery Depot.
Hall, Barlow, Ellsworth.
Hall, Chas. H., Mechanic Falls.
Haney, Chr. F., Camden.
Hart, Rodney E., Ellsworth.
Hartford, H. C., Etna.
Harvey, S. M., Lewiston.
Haynes, Henry R., Winn.
Helme, A. G. Y., Dexter.
Hengkins, L. E., Houlton.
Herrin, Forrest, Skowhegan.
Hersey, G. L., Corinth.
Hichborn, F. O., Portland.
Hinckley, A. E., Portland.
Hiscock, Augustus, W. Farmington.
Hocking, Alfred C., St. George.
Hodgdon, Dexter W., Boothbay Harbor.
Hodgdon, Geo. T., Boothbay Harbor.
Holmes, Amos E., Oakland.
Hopkins, John, West Peru.
Howe, Alton L., Norway Lake.
Howell, W. C., Greenville Junction.
Huff, R. D., Danforth.
Hunt, Philip W., Brownfield.
Huntress, Sara L., So. Berwick.
Hussey, J. C., Oakland.
Hutchinson, J. G., Buxton Ctr.
Hysom, Dexter L., Weeks' Mills.
Ingalls, Alfred W., Anson.
Ireland, Clifton, Limestone.
Jackson, Nath. D., Fairfield.
Jackson, Francis A. Detroit.
Jacobson, C. A., New Sweden.
Jones, G. E., Sanford.
Jones, S. L., W. Kennebunk.
Johnson, Roy W., No. Berwick.
Joy, Roger, So. Berwick.
Judkins, Geo. G., No. Woodstock.
Judkins, N. F., Madison.
Keen, Geo. H., Waterford.
Kierstead, Thomas V., Caribou.
Kimball, Geo. E., Woodville.
Kimball, Geo. E., Pittsfield.

Kimball, Samuel L., Patten.
Kinney, Beverly W., Atkinson.
Knowles, F. M., Boyd Lake.
Larrabee, Chas., Milltown.
Lawrence, W. H., Palmyra.
Lawton, John K., Farmington.
Leavitt, H. W., Newport.
Leeman, C. T., Millinocket.
London, G. W., Foxcroft.
Libby, Arthur W., Portland.
Libby, Jesse C., Bridgton.
Libby, Wesley F., Portland.
Little, Joel A., Bristol.
Littlefield, H. E., Bryant's Pond.
Littlefield, S. L., Minot.
Lord, I. H., Gray.
Lothrop, Fred, Rockland.
McAllister, F. A., Livermore Falls.
McCabe, E. T., Palmyra.
McCabe, Geo. L., Bangor.
McClure, Fred R., Athens.
McCormick, Chas., Kingman.
MacFadden, A. S., Bath.
McFarland, W. H., Palmyra.
McGray, Clair L., Burnham.
MacLaughlin, John H., Cooper's Mills.
Macomber, E. R., Portland.
Maloney, Michael A., Houlton.
Mank, Emerson A., Waldoboro.
Manley, Clarence V., Auburn.
Marrow, John H., E. Winthrop.
Marston, F. H., South Portland.
Matson, Joseph, Solon.
May, Harry E., Bangor.
Merrick, F. L., Waterville.
Merrick, W. S., Waterville.
Merrill, Arthur, Bangor.
Merrill, James, Augusta.
Mills, W. H., Norridgewock.
Mitchell, H. R., Waterville.
Mitchell, T. H., Waterville.
Moody, Clement T., Warren.
Moore, E. A., Skowhegan.
Moore, Howard W., Pembroke.
Moore, Leroy, Ellsworth Falls.
Morrell, Hiram, Portland.
Morse, Charles M., Gray.
Morse, F. L., Pittsfield.
Morse, L. H., Kingfield.
Nash, A. D., Damariscotta.
Nash, I. W., Sorrento.
Newcomb, David L., Portland.
Newcomb, F. H., Hampden.
Nichols, Peter, Gloucester, Mass.
Noble, Fred A., Pittsfield.
Norris, Edmund B., Gardiner.
North, F. W., Turner.
Norton, A. D., Farmington.
Norton, Clarence L., Detroit.
Norton, Mrs. M. E., Farmington.
Noyes, Cyrus S., Whitefield.
O'Brien, Horace, Portland.
O'Roak, T. K., Kingman.
Osborne, B. C., Waterville.
Patten, Lester P., Carmel.
Payson, H. H., Hope.
Peaslee, Webster D., Whitefield.
Perkins, Benj. F., Castine.
Perkins, Fred B., Penobscot.
Perkins, H. F., Kennebunkport.
Perry, Asa T., Eliot
Peters, Andrew J. W. Vassalboro.
Phillips, Milton, Madison.
Phillips, Preston S., No. Berwick.
Phillips, Willard H., Hancock Pt.
Pierce, D. S., Bingham.
Pitcher, A. I. H., Lincolnville.
Plummer, M. Gerry, So. Freeport.
Pomroy, Wallace M., Burnham.
Porter, James L., Ctr. Lebanon.
Prescott, Emery, Etna.
Preston, Andrew J., Dennysville.
Pulsifer, Geo. E., West Sumner.
Purington, W. S., Augusta.
Rackliff, Claude E., Cumberland Mills.
Raymond, J. O., Winthrop.
Reynolds, Geo. L., Fort Fairfield.
Ricker, Alvin H., Lebanon.
Ricker, Geo. H., Lebanon.
Roberts, James A., East Waterboro.
Robinson, Delmore, Bridgton.
Robinson, T. R., Brunswick.
Rollins, Dallas V., Unity.
Rowe, Fred E., Auburn.
Rowe, John M., Litchfield.

Russell, A. P., Berwick.
Ryan, Roy G., Calais.
Sabins, G. M., Masardis.
Sanborn, D. S., Norway.
Sands, J. W., Dexter.
Sargent, Solomon, So. Gouldsboro.
Savage, Jewett A., Skowhegan.
Savage, J. Frank, Woolwich.
Sawyer, Charles L., So. Windham.
Seavey, Jedediah, Bucksport.
Shepard, O. A., Presque Isle.
Simmons, Gilbert, Jay
Simpson, Frank A., Winterport.
Sinclair, Geo. L., Columbia Falls.
Small, Fred A., Searsport.
Small, John E., Stonington.
Small, R. H., Harrington.
Smith, Alfred J., Gardiner.
Smith, C. B., Denmark.
Smith, Eugene W., Newport.
Smith, Herbert, So. Paris.
Smith, O. P., Mexico.
Smith, Seth I., Bluehill.
Snow, H. O., Frankport.
Sodergren, John J., Stockholm.
Staples, A. D., Orland.
Staples, Nicholas, W. Kennebunk.
Staples, Wm. D., Fort Fairfield.
Steves, David G., Hallowell.
Stilphen, H. A., Head Tide.
Sullivan, D. Y., Clinton.
Sweetser, A. D., No. Yarmouth.
Task, Geo. W., New Vineyard.
Templeton, Orrin, Greenville.
Thomas, Eugene, Brunswick.
Thomas, H. C., Sumner.
Thomas, John H., Roxbury.
Thomes, Orland J., West Buxton.
Thornton, F. C., Brookton.
Tibbetts, Clara E., Harmony.
Tinkham, L. D., Portland.
Torsey, Alonzo C., Bath.
Tupp, Byron S., Embden.
Tucker, Jas. R., West Paris.
Twombley, Fred S., Buxton.
Wadsworth, W. D., Hiram.
Waldron, Stephen G., Bangor.
Walker, Melvin, Woodfords.
Warren, J. H., Dexter.
Wasson, Loring S., Bucksport.
Watt, A. C., Castle Hill.
Whittemore, F. H., No. Leeds.
Webber, Harrison W., Mt. Vernon.
Weeks, Will S., Parsonsfield.
Wentworth, C. C., Gardiner.
Wentworth, E. J., Sanford.
Wheaton, Enoch W., Medway
Wheeler, C. W., Houlton.
White, Albert K., Portland.
White, James W., Ludlow,
Whiting, Frank O., Belfast.
Whitney, Chas H., Gouldsboro.
Whitney, Fred, Winterport.
Whitney, G. M., Falmouth.
Wiggin, Clarence S., Waterford.
Williams, Fairfield.
Williams, S. T., Athens.
Winn, R. H., York.
Winslow, Chas. V., Webb's Mills.
Wood, Edgar L., Troy.
Woodman, Fred D., Winterport.
Woods, A. L., Cooper's Mills.
Wright, Chas. E., Hartland.
Wright, F. W., Wilton.

LECTURE WORK.

So many requests for lectures, orchard demonstrations and institutes have been received that it has been impossible to comply with them all.

The following is a partial list:

Lectures before State, Pomona and subordinate granges	27
Farmers' Institutes	4
Schools	13
Clubs—on care of city trees	8
Farmers' clubs and Farmers' Week	4
State Board of Trade	1
Fruit Growers' Association and Pomological Society	6
Paper at National meeting	1
	64
Total attendance	6,142

This does not include many other short talks and orchard demonstrations on how to handle apple canker, fruit and orchard pests, etc.

Respectfully submitted,

E. F. HITCHINGS,

State Entomologist.

Gypsy Moth Work. Burning stone wall to kill caterpillars.

REPORT OF SPECIAL FIELD AGENT.

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

SIR:—I have the honor to herewith submit my third annual report as Special Field Agent in Charge of Gypsy Moth Work. As compared with 1908 the infestations of the gypsy moths in open and cultivated lands are now much reduced in numbers in the worst infested sections. On the other hand, the infestations in woodlands occupy more ground than in 1908, and the number of badly infested places is much greater.

This condition of the woodlands is due to the fact that there has not been money enough to provide for a thorough scout of the same, but during the year 1909 special efforts have been made to scout as far as possible under the circumstances, and enough is now known to justify the presumption that colonies of the moth are scattered through the woodlands of at least twelve of the infested towns of York County.

Though many of the colonies found have apparently had their origin within three or four years, many others originated many years since. The woodland which is more or less infested probably covers twenty-five square miles of the southwestern portion of the infested section. The work has demonstrated beyond any possibility of doubt that the gypsy moth situation can be controlled and the forests preserved, if prompt and efficient work is done and sufficient funds are available to carry it out. Parasites have been introduced and the work must continue until these parasites secure the balance of power. Many varieties of these have been cultivated in this country and thus far have survived our severe winters. It will be several years before the parasite will increase sufficiently to obtain control of the situation.

In getting into new territory we find many new and serious infestations, but I am satisfied the situation can be controlled and kept within the limits of the towns now known to be infested.

This season we have expended about $47,200 in the Gypsy-moth work, $20,000 from the State appropriation and $27,200 from the Government. All of the work done in the State is according to U. S. Government standard. After the finish of the winter work which consisted of cleaning, cutting and burning dead wood, scraping, pruning, tin patching, burning over the ground, thinning out the tops of trees, etc., we again took up the scouting and continued same until time for burlapping. Ninety thousand trees were burlapped and carefully attended during the months of June, July and August.

Ten bales of burlap were used during the year in the operation and 192,702 caterpillars were taken from under the burlap bands and destroyed. The spraying operations were carried on more extensively than ever before. Five tons of arsenate of lead were used with excellent results. The summer work finished on August 15th, and owing to lack of funds it was necessary to stop all work until Oct. 1st, when the scouting was again begun and continued until the close of the year. The scouting operations resulted in finding and destroying 47,433 egg clusters. If these eggs were allowed to hatch they would have brought forth at least 10,000,000 caterpillars this coming year.

The following towns have been scouted and found to be infested, viz: Kittery, York, Eliot, Wells, Kennebunkport, Kennebunk, Biddeford, Saco, Scarboro, Gorham, Alfred, Shapleigh, Waterboro, Newfield, Acton, Sanford, Lebanon, Berwick, North Berwick, South Berwick, Dayton and Togus. Total, 22.

The following towns have been scouted and nothing found, viz: Hollis, Buxton, Portland, South Portland, Westbrook, Gardiner, Randolph, Hallowell, Farmingdale and Augusta. Total, 10.

The following table will show the number of men at work in the State during the year (by months).

Month	Govt.	State	Total	Month	Govt.	State	Total
January	61	15	76	February	61	15	76
March	61	15	76	April	00	69	69
May	00	75	75	June	75	37	112
July	78	31	109	August	74	30	104
September	00	7	7	October	62	22	84
November	60	22	82	December	31	27	58

I am very glad at this point to acknowledge the assistance that I have received from Mr. D. M. Rogers, Government Field Agent; for his advice and kindness I am very grateful. I am also glad to acknowledge my obligations to the following inspectors: C. C. Nichols, E. M. Sadler, A. M. G. Soule, A. O. Pike, C. E. Totman and H. L. Spinney. To them in no small degree is due the credit for the success attained during the year.

LUMBER INSPECTION.

Sometime during the month of February there were shipped to this State from South Lawrence, Mass., by the Boston and Maine R. R. two cars loaded with shim wood for the use of section men employed by said road. The contents of these cars was distributed along the tracks between Dover and Scarboro Beach Stations. On Wednesday, March 24th, the crew under charge of A. M. G. Soule, inspector, discovered at Kennebunk Station a pile of this wood badly infested with gypsy moth egg clusters. These were creosoted and destroyed. This discovery led Mr. Soule to think that other stations might be infested and the search was continued along the tracks as far as Portland on the east, and North Berwick on the west of Kennebunk, with the result of finding infestations at North Berwick, Wells, Kennebunk, Biddeford, Pine Point, and Scarboro Station; a total of eighty-five egg clusters. The situation was immediately reported to Mr. Rogers, the Government Field Agent, who took the matter up with the railroad officials and orders were issued from the office of the general superintendent of the road stating that on and after July 9th, 1909, the Boston and Maine Railroad would accept forest products offered for shipment at any of the points mentioned only after such material had been inspected by the proper authorities. Freight agents at these stations were forbidden to accept such material for shipment or allow the same to be placed in any building or upon the grounds of the company, or to permit the loading of any car on the tracks of the company with such products until after inspection of such material had been made and a certificate of inspection issued to the shipper by the proper authority. As soon as these orders were issued by the Boston and Maine Railroad it became necessary to detail a man to act as lumber inspector and Mr. E. M. Sadler was selected for this important duty. This is a work that requires much time and experience in the gypsy moth work. Mr. Sadler has certainly shown his ability to do the work as is required. One thousand and four cars have been inspected and certificates issued for same; these cars were shipped from the following stations: Kittery, York, Eliot, Lebanon, Acton, South Berwick, North Berwick, Wells, Kennebunkport, Kennebunk, Saco, Biddeford, Sanford, Lyman, Scarboro and Alfred. The destinations of these cars were to towns in Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania and Illinois. These inspections have been of the greatest good and have without any doubt stayed the spread of the moth to the states to which the forest products were consigned. These inspections will be continued during the year 1910 in this State under the direct supervision of Mr. Sadler.

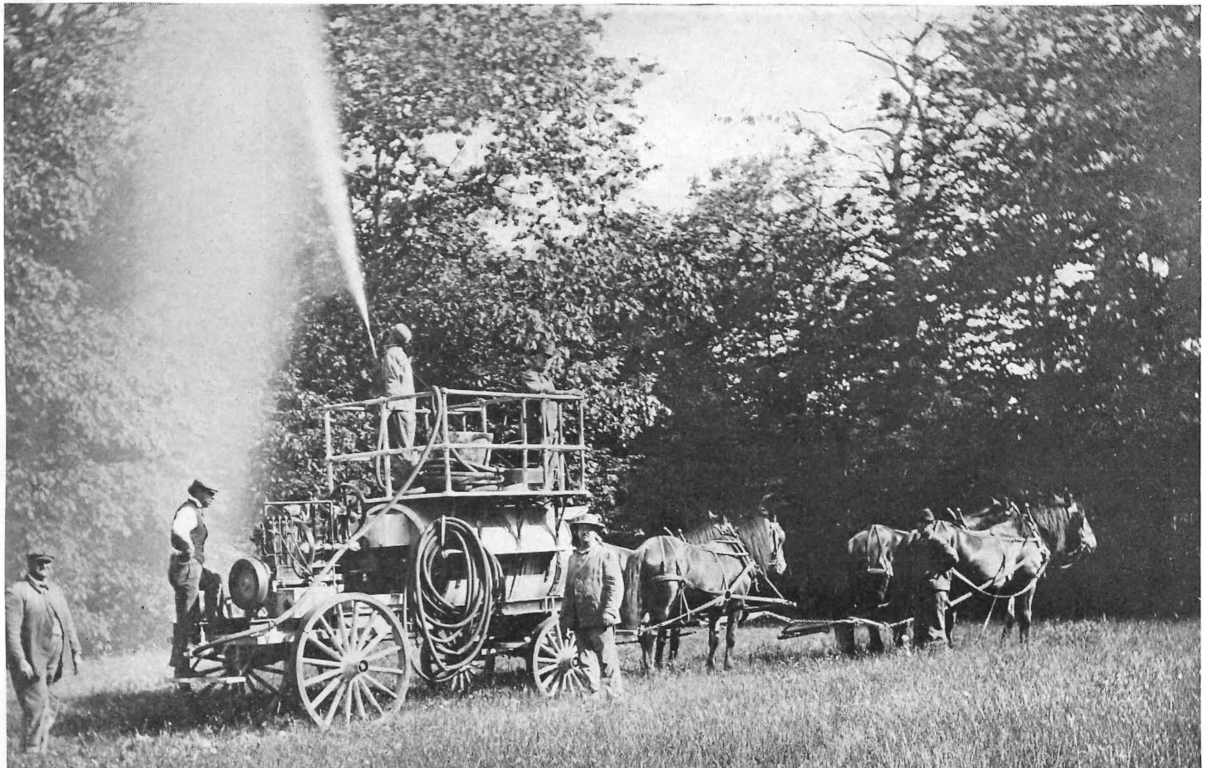
ANNUAL FIELD DAY.

The second annual field day of the force was held at the Elmwood Hotel, Wells Beach, on the 16th of August, 1909.

The occasion was made complimentary to Hon. A. W. Gilman, Commissioner of Agriculture. An old fashioned New England clam bake was served at noon by the members of the force and was enjoyed by all. After dinner Mr. A. M. G. Soule read a brief history of the Gilman family, who formerly made their home in the town of Wells. Short speeches were made by D. M. Rogers, Special Field Agent, United States Department of Agriculture, L. Howard Worthley, in charge of the Massachusetts moth work, Col. Frederick Hale of Portland, Dr. L. S. Merrill, Maine State Dairy Instructor, A. F. Burgess, United States Department of Agriculture, and many others. Many visitors were present from Maine, New Hampshire and Massachusetts, and it was voted the best time ever held by the Department.

I regret at this time to report the death of George H. Wilson, Kittery, from brown-tail poisoning. He was employed in the gypsy moth work in the town of Kittery and while attending to the work of turning burlaps was so badly poisoned with the hair of the brown-tail caterpillar that it struck into his stomach, causing blood poison from which he died on July 3rd, 1909. The death of Wilson caused much trouble with the men of the force who became frightened and it was with the greatest effort on the part of the inspectors and myself that we were able to keep the forces at work during the caterpillar season.

The following is a list of the towns infested and the conditions of such as far as we are able to learn at this time:



Spraying woodland for gypsy moth. York, Maine.

KITTERY.

The work in this town has progressed satisfactorily during the past year under the efficient direction of O. T. Clark, foreman.

During the caterpillar season the trees were burlapped and attended to, with the result of finding under the burlap bands, 20,273 caterpillars, which were destroyed.

There are many old orchards in this town containing trees with hollow trunks and branches, which offer ideal hiding places for the gypsy moth. Many of these have been scraped, pruned and tin-patched, and much progress has been made towards exterminating these orchard colonies.

Kittery is peculiarly exposed to continued infestation of the gypsy moth, owing to its close proximity to Portsmouth, N. H., which is badly infested, and from the fact that most of the trading is done in said city by the Kittery people.

The scouting was carefully done by the crew in the spring and fall and 4,686 egg clusters were found and destroyed. In the woodland colonies underbrush and worthless trees have been removed and thinning operations have been carried on to quite an extent. During the caterpillar season spraying was done quite extensively with excellent results.

While the infested localities show improvement over the year 1908, there still remains a great deal to be done in way of scouting and cleaning.

YORK VILLAGE.

I am glad to be able to report the excellent condition of the village with reference to the gypsy moths, and to comment most favorably on the quality of the work done here.

The condition of the trees in this village is a striking illustration of the wisdom of spraying. With the power spraying machine much spraying was done on the street trees and in the woodlands with the most satisfactory results.

In the many orchards that have been treated for the extermination of the gypsy moth the owners have this year gathered some of the finest fruit ever grown in York County.

After closing up the winter work of cleaning and burning, the scouting was taken up and continued until time for burlapping. Trees were burlapped and the same carefully attended during the caterpillar season and 41,347 caterpillars were destroyed. In addition to these, millions were killed by fire and spray.

The scouting operations were again carried on during the fall season with the result of finding 1,146 egg clusters during the year.

The excellent public spirit shown by the officials, citizens and summer visitors of this village is worthy of the highest commendation. Mr. C. C. Nichols has had direct charge of the work in this village and has been ably assisted by foremen, B. E. Grant and S. W. Moulton. A great deal of credit is due these gentlemen for the manner in which the work has been handled.

YORK.

Brixham, Scotland and Agamenticus Sections.

Previous to this fall most of the work in this district had been confined to the Brixham and Scotland sections. Large tracts of woodland had been cleared of underbrush, the dead wood taken from the trees and spraying and burlapping done each year with excellent results. The scouting this fall showed a decrease in these sections of the number of egg clusters found. Knowing that portable saw mills which had operated in infested sections of other states had been at work in the Agamenticus section, it was deemed advisable to scout the woodlands of this section. Headquarters were established in a house near Agamenticus Mountain and in close proximity to the work. Here the men live and are able to get to and from the work with ease. The scouting commenced on the 20th of October, 1909, under the direct charge of Inspector A. M. G. Soule with a crew of fourteen men. The scouting thus far has revealed a startling condition. Large tracts of woodland have been found infested, the egg clusters evidently scattered by lumbering operations, covering an area of 700 acres, and it is hard to estimate how many egg clusters will be found in this section, but it is safe to say at least 100,000. Two days' scouting covering less than 1¾ acres showed a count of over 4,000. Thirty-eight different colonies have thus far been found and no doubt many more will be discovered before spring. This is by far the worst section we have ever had to handle, comprising as it does about 9,600 acres, of which three-fourths is heavily wooded, most of the growth being oak, beech, gray and black birch and scattering white oaks. While the gypsy moth will feed upon anything, the oak seems to be a special favorite. This section is particularly bad to handle owing to the rough character of the ground and the fact of water not being accessible, which makes it almost impossible to employ the most effective method of spraying the trees where the caterpillars are feeding.

Inspector Soule is well qualified to handle the situation and if the weather permits and conditions for scouting are favorable I hope by next summer the situation now so bad here will be much improved, to the great benefit and safety of the nearby towns and woodlands.

The number of egg clusters found in the district for the year 1909 was 32,718. The number of caterpillars taken and destroyed was 96,758. A great many more were killed by fire and spray.

ELIOT.

It has been impossible at this time of writing to make a thorough scout of the town owing to lack of funds. In the early part of the year many cleaning and thinning operations were carried on, with excellent results, after which the scouting was done until time for the burlapping. Trees were burlapped and carefully attended during the caterpillar season. Considerable spraying was done in this town with the usual good results.

The number of egg clusters found during the year was 2,191, and the number of caterpillars taken from under the burlaps was 12,873. Many were also killed by fire and spray.

The work done in this town by the foreman, F. E. Pratt, and crew, is entitled to the highest praise, and I am sure that with suitable funds to carry on the work in the future he will continue to secure the same good results.

WELLS.

A general inspection and scout of this town showed that many orchards as well as many woodland colonies in the northern part of the town were infested. A great many of the woodland colonies were cleaned and the ground burned over. The orchards were cleaned, pruned, scraped and tin-patched. Spraying was extensively done through the town with good results.

The trees were burlapped and attended during the summer months. Fifteen thousand nine hundred and six caterpillars were found and destroyed. During the scouting 2,250 egg clusters were found and creosoted. The town is in fairly good condition as far as orchard infestations are concerned, but the woodland colonies in the northern part of the town will give us more or less trouble for quite a few years. The work has been well handled and Foreman E. J. Platts deserves much credit for the manner in which he has performed the same.

KENNEBUNKPORT.

The work here has been under the direct charge of Inspector Sadler and has been carefully attended to. Trees were burlapped and attended in caterpillar season. The town has been thoroughly scouted and is in good condition. Seventeen egg clusters and 101 caterpillars were killed during the summer months. The moth has made no gain in this town in the last three years.

KENNEBUNK.

The situation in this town remains about the same, except for a woodland colony found this fall along the banks of the Mousam River which will be handled in the usual way. The trees were burlapped and attended during the summer. Sixty-eight caterpillars were taken from under the burlap bands and destroyed. The town has been scouted thoroughly and 98 egg clusters found. The infestation found on the shim wood at the Kennebunk Station developed some caterpillars in the woods nearby. Foreman M. J. Shorey had charge of the crew in this town and handled them in good shape.

BIDDEFORD.

After being scouted four times previous there was found one infestation this fall with 33 egg clusters. The usual methods will be employed in handling the same next year. Scouting in charge of Foreman M. J. Shorey.

SCARBORO.

The infestation here was on the shim wood shipped over the Boston and Maine from South Lawrence. This infestation was carefully attended during the summer months but no caterpillars

Rocks at summit of Mt. Agamenticus, infested with gypsy moth. 1600 egg clusters found in pile of rocks.

were found. While scouting the town of Gorham this fall the crew under charge of H. L. Spinney, inspector, found on the northern edge of Scarboro another infestation with one egg cluster. This was about three-fourths of a mile from the infestation found on the Day Road in Gorham, consisting of thirty-two egg clusters.

BERWICK.

A general scouting of the orchards in the spring months showed the moth to be present in notable numbers in all sections of the town. The woods were also found to be generally infested. The work of scouting was finished in May and the burlapping of trees began. Upwards of 1,200 trees were burlapped and 1,054 caterpillars were taken and destroyed. Up to the present time the town is but one-third scouted, but will be finished as soon as the weather permits. Three hundred and thirty-six egg clusters were found and destroyed. The work next year should include, aside from the customary operations, a great deal of spraying in the infested orchards. Foreman G. J. Galvin deserves much credit for the manner in which the work has been carried on and the success achieved.

NORTH BERWICK.

Owing to lack of funds we were unable to do much work in this town until April. Scouting was carried on until time for burlapping. The trees were burlapped and attended during the caterpillar season. Seventy-six caterpillars were taken from under the burlaps. In the early part of September, Mr. Chandler, the local foreman, resigned to accept another position, and the fall scouting was done under the direct charge of Inspector Totman with Foreman Galvin from Berwick. Eight hundred and sixty-eight egg clusters were found during the year. It will be necessary to thoroughly scout this town as soon as possible, as it seems probable that infestations must occur in various places in the woodlands.

SOUTH BERWICK.

In this town very little work was done in the early part of the year outside the central part of the town. The orchard and street trees were burlapped and sprayed with the usual good results. Three thousand and seventy-seven caterpillars were taken from under the burlap bands and destroyed. Many more were killed by spraying and fire. At the present time the street trees and those on private property which were found to be infested are in a most satisfactory condition, but on the outskirts in the woodlands a great deal of work will be necessary to control same. The scouting resulted in finding 2,429 egg clusters. Owing to shortage of funds I was obliged to stop work on Dec. 15th. The work here has been well handled and much credit is due the foreman, W. H. Anderson, for the same.

LEBANON.

The gypsy moth colonies in this town were carefully burlapped in the early season, the burlaps were attended and 489 caterpillars found. No scouting was done here in the spring, but this fall the town has been very carefully scouted and 542 egg clusters found. The greater number of infestations are in orchards and can be handled with ease. There are several woodland colonies which with proper care can be exterminated. No spraying has ever been done by the State force in this town. There should be a general spraying of the orchards. Much credit is due to Inspector Totman for the very efficient manner in which he has handled the work in his district, and with proper support I am certain that the towns of Berwick, North Berwick, South Berwick and Lebanon will show great gain in the next year.

ACTON.

The infestations in this town were found at the finish of the year 1908, and no scouting was done until fall, 1909. Three egg clusters were found. The trees were burlapped and attended with the result of finding 278 caterpillars which were destroyed. The old infestations found in 1908 were completely eliminated.

NEWFIELD.

The situation in this town is very encouraging. Of the infestations which were found in 1908, none showed any caterpillars this season. The fall scout failed to reveal any new egg clusters, and I am in hopes at the end of 1910 to report a complete extermination.

WATERBORO.

A careful inspection of this town this fall failed to show any egg clusters. During the spring scout four egg clusters were destroyed. During the summer season the burlaps were carefully attended and three caterpillars were destroyed. The situation looks very hopeful and I am in hopes that nothing more will be found.

SANFORD.

Scouting was carried on here in the spring months and the sum of 92 egg clusters were found and destroyed. During the summer the burlaps were carefully attended and 311 caterpillars were taken and destroyed. Many more were killed by spraying. No scouting has been done here this fall, so it is impossible to give the conditions.

ALFRED.

This town has been very carefully scouted twice and but one egg cluster was found. The town will be carefully watched for further developments.

SHAPLEIGH.

This fall we were able for the first time to scout this town and found 59 egg clusters. This is a bad town to handle from the fact that it is almost impossible to get boarded in the town and the men have to live in Sanford and go to and from their work.

This district has been in charge of Inspector A. O. Pike and he has been ably assisted by E. L. Newdick as foreman. The work has been hard and trying on the men but it has been done to the best advantage and reflects great credit on the ability of the inspector and foreman.

DAYTON.

The scouting this fall revealed the first egg cluster ever found in this town. This is the second time the town has been scouted.

GORHAM.

This fall scouting revealed for the first time in this town one egg cluster. It was found in an orchard on the Day Road and near a clearing on which had been a portable saw mill. As near as could be ascertained the mill had come from New Hampshire.

SACO.

During the spring scouting a very bad colony was found on the estate of the late Governor Fairfield. Twenty-three egg clusters were found and destroyed. During the summer months 454 caterpillars were found and destroyed. This was an orchard infestation and the trees were in bad shape. Just before finding this infestation the trees had been trimmed by some person living in the city who had hauled the wood some distance from the orchard. We certainly expected to find many eggs scattered but have failed to as yet. During the fall scout another egg cluster was found in an elm tree a short distance away from the old infestation, making in all 24 egg clusters found in the city.

TOGUS.

Previous to burlapping the trees at Togus the grounds around the Home were thoroughly scouted as well as the towns of Chelsea, Randolph and Farmingdale and the cities of Augusta, Gardiner and Hallowell, and no egg clusters were found. On the 15th of May the burlapping of the trees on the reservation began, 940 trees were burlapped and the same carefully attended during the months of June, July and August. No caterpillars were found and it is with the greatest satisfaction that I am able to report that this infestation which was found in the winter of 1906 has been, so far as I am able to tell, entirely wiped out. This is of the greatest importance, for if the moth had worked from this point farther north, it would have been impossible to keep it from the great forests of the State.

The work done by Inspector Spinney at this point as well as at the different points at which he has been stationed during the year is deserving of the greatest credit. He has performed the duties assigned him with a great deal of ability.

During the year I have been called upon to deliver lectures upon the gypsy moth and on all occasions I have complied with the requests.

I have now 70 lantern slides dealing with the work of extermination of the moth, showing the work as carried on in the field, the methods used in the work such as scouting, spraying, burlapping, pruning orchards and in fact everything pertaining to the work.

E. E. PHILBROOK,
Special Field Agent.

REPORT OF CATTLE COMMISSIONERS.

To His Excellency, the Governor of Maine:

We herewith submit the report of the State of Maine Cattle Commission for the year commencing December 1, 1908, and ending December 1, 1909.

BALANCE SHEET OF JOHN M. DEERING, SECRETARY, STATE OF MAINE CATTLE COMMISSION.

Cash on hand, Dec. 1, 1908........	$142 97	
Rec'd from State Treasurer, (1908 deficiency)	21,823 18	
Rec'd from State Treasurer (1909 appropriation)	50,000 00	
Rec'd from sale of hides..........	1,236 29	
		$73,202 44
Paid 1908 deficiency..............	$21,823 18	
Paid State Treasurer, the cash on hand, Dec. 1, 1907, at the request of the State Auditor............	54 41	
Paid out the 1909 appropriation, on vouchers as approved by State Auditor	50,000 00	
		71,877 59
Cash on hand, Dec. 1, 1909....		$1,324 85

The regular appropriation of $50,000.00 has been expended and in addition $14,998.57 has been contracted for, to be paid out of the appropriation for the year 1910, making a total of $64,998.57.

There have been destroyed during the year 1909 as follows:

Grade Cattle.	Pure Bloods.	Horses.	Sheep.	Total.
1,303	138	77	5	1,523

Total amount for grade cattle,	$38,061.65	or	$29.21 each
Total amount for pure bloods,	5,574.00	or	40.40 each
Total amount for horses,	1,853.50	or	24.07 each
Total amount for sheep,	20.00	or	4.00 each
Total,	$45,509.15		

There have been destroyed since the new law of July 3, 1909:

Grade Cattle.	Pure Bloods.	Horses.	Sheep.	Total.
754	26	38	5	823

The 754 grade cattle destroyed since July 3, amount to $25,720.40 or an average of $34.11 each.

The 549 grade cattle destroyed previous to July 3, amounted to $12,341.25 or an average of $22.46 each.

The Commissioners have rendered bills as follows:

F. O. Beal,	
Services, $1,670.00; expenses, $696.63; total,	$2,366.63
F. S. Adams,	
Services, $1,262.50; expenses, $814.68; total,	2,077.18
J. M. Deering,	
Services, $1,300.00; expenses, $563.71; total,	1,863.71
	$6,307.52

For veterinarians, disinfecting and all other assistance:

Services, $9,299.58; expenses, $2,082.64; total,	$11,382.22
For disinfectants, tuberculin, and all other supplies,	818.53
For postage, stationery and printing,	786.47
	$12,987.22

It has not been our custom to give a detailed report for the year following the session of the Legislature, but on account of the new law passed by the last Legislature, we thought it best to give an account of how the law was working, as compared with the old law.

You will notice that more cattle have been condemned and destroyed and more money has been expended during the year 1909, than in any previous year.

One part of the new law that has caused an increase in expenditures is the rise in the valuation of cattle from one-half, under the old law, to a full market value, under the new law, at the time of condemnation.

This has caused dairymen all over the state to call upon the Commissioners, to have their herds investigated. The increase in the compensation for diseased cattle has caused the owners to look more closely after the health of their animals and where there is a suspicion of disease the services of the Commissioners have been more freely sought for, for the purposes of investigation, and this has brought the Commission into new sections of the state, sections where tuberculin had never been used.

This has raised the percentage of diseased cattle, over what it would have been had we confined ourselves to the old law and only worked in sections where the dairymen were more acquainted with the use of tuberculin and where cattle had to quite an extent been tested for a number of years and the disease practically cleaned out.

It was shown in the last report, that the city of Portland milk and cream supply had been greatly improved by the testing of the herds furnishing the same for three years running.

The first test showed 6% diseased and the third test showed about 2%, and in the testing of the Turner Center Creamery herds, we give Mr. Bradford's statement as follows:

"Three hundred and fifty-four of our patrons have had their herds tested—3,185 cows in all, of which number 101 reacted under the test and were destroyed.

"This is about 3%, or in other words, an average of one diseased cow for every three herds of 11 cows each.

"A few of these herds have been tested annually for the second and some for the third time and no diseased animals have been reported in such cases.

"This speaks well for the tuberculin test and for the efficiency with which it had been administered by the Cattle Commissioners and their authorized veterinarians."

This seems to me to be fairly conclusive evidence that bovine tuberculosis can be practically stamped out of our dairy herds, by faithful and persistent work.

To show how the matter stands in sections where no testing has been done, we call your attention to the town of Sanford.

It has a population of about 11,000 and it requires about 550 cows to furnish its milk and cream supply. These cattle have practically all been tested within the last three months. There had never been more than one herd tested in the town to our knowledge, up to the time the testing commenced last October, and that herd was practically all condemned.

The result of the work recently done will show the difference in percentage of diseased animals between sections where no work has been done, and sections where more or less work has been done by the Commissioners, within the last few years.

There have been 455 cattle tested and 130 condemned, or in other words 28½%. We do not say that all sections where no work has been done would be as bad as Sanford; but we do say that wherever disease is located and no effort has been made up to the present to suppress it, there will be a very much larger percentage than in sections where the owners of cattle have been trying for years to get rid of it.

In the southern part of York County there has not been much testing done.

Aroostook County is another section where practically no work had been done previous to 1909. During the year 1908 several carloads of dairy cattle were shipped in there from central Maine, and the people reading and hearing so much about what was being done in the western part of the state, became suspicious that they were having disease brought into their county and there was a demand made upon the Commission to have some of these cattle tested, and the result has been that 471 cattle have been tested and 71 found to be diseased, or 15 per cent, which shows that the Aroostook farmer did not commence any too soon.

During the last year there has been very little work done in Knox, Lincoln, Hancock and Washington counties. The other counties have had more or less done, some more than others.

There have been 21,000 grade cattle tested during the last year and 1,303 condemned, or 6 per cent. This includes all bad sections and also some of the cleanest sections (barring the Portland milk supply where the work has but just started) and indicates the average of the work done for the year 1909.

There have been about 3,900 pure blood cattle tested during the year and 138 condemned, or an average of 3½ per cent.

This is a decrease in per cent over the previous year of 1½.

The new law requires the testing of all animals that are to be shown at the State Fairs. Also many herds containing part grades and part pure bloods were tested this year for the first time, owing to the more favorable aspect of the new law as regards compensation for diseased animals and the free test by the State where disease is found. The old law only required a test where the animal was to be transferred.

The law provides that the State shall pay for the testing of cattle where the evidence of disease is such as to satisfy the Commissioners that a test is necessary.

Our rule is, that whenever a case is found in a herd, it is necessary to test the balance of the herd; that when a herd is found badly diseased and a number condemned it is necessary to test the herd again in six months or within one year.

In the testing of herds if no disease is found the owner must pay for the test to the extent of $10.00, which usually pays the bill; if the cost exceeds this amount the State will pay the balance.

The law provides for a free test where disease exists.

Dairymen cannot afford to carry disease in their herds when the State pays a fair market value for the animal, if diseased, pays for the test and pays for disinfecting and making the premises safe for the sound animals.

Some may say that the Commissioners are condemning too many cattle, and it is a fact that the Commissioners sometimes feel that way themselves; but when we consider that they make no effort to locate or hunt for diseased herds; that the business is absolutely upon the application of the owners of the cattle themselves; that it takes the entire time of the Commissioners to keep up with the work; that it requires the services of a large number of inspectors to do the work of testing and disinfection of premises, and under the law the Commission has no way or excuse to curtail the business, it becomes evident that it is the policy of the State under the present law, backed up by public sentiment, that tuberculosis among our dairy herds must be eradicated as nearly as is possible and that the Commissioners are not responsible for the amount of money being expended, further than the efficiency of the work done and an economical method of doing the business.

It would be well to note that under the old law, the Commissioners expended $72,178.58 during the years 1907-1908. The object of the new law was to authorize the payment of a higher price for a first-class cow that reacted to the tuberculin test.

The new law as first drafted carried an appropriation of $65,000 per year for two years, or $130,000, and this amount was considered by the Commissioners as low as they could possibly get along with, and not have a deficit at the end of 1910.

They expressed themselves to the Committee that they had rather have $70,000 for the two years under the old law, than $130,000 under the new law; but the Committee in their wisdom saw fit to cut off $30,000 from the appropriation of the new law and pass it and the result is that the business after seven months of the new law has settled down to about $6,000 per month.

This will cause the department to be short of funds during the latter part of 1910. Notwithstanding this, if the business is not curtailed, at least one-fourth of the cows in the State will be tested within the two years. This would cause a deficiency and cause people to be obliged to wait for their pay. Yet it would be a good showing.

The cow population of the State has been reduced during the last two years on account of the short hay crops. Dairymen have been weeding out the unprofitable ones and while our numbers are less the quality was never better and what we now have are as a rule young and good producers.

The high prices of our dairy products make a good young cow worth from $40.00 to $60.00, an average much higher than for some years, so that the values on condemned cows must be higher in the coming year.

Farmers are struggling to carry through the winter what they now have in order to receive the benefits of better prices when better hay crops return.

Under the old law cattle were appraised for what they were worth upon a basis of health, or disregarding the fact of their being diseased, not to exceed $50.00 and the owner received one-half of such appraisal. Under the new law the owner receives a fair market value, not to exceed $50.00, and receives the full amount.

The following circular was issued to the breeders of the State:

"Dear Sir:

"Our work in the suppression of bovine tuberculosis embraces the most advanced methods. It had for some time been our hope and expectation that a method of prevention of the disease would come to our aid. About three years ago Prof. Von Behring's method of vaccination was brought to our notice and put into practice in some of the worst infected herds in the State. The results have been most gratifying, and we felt it our duty at the last session of the Legislature to ask for authority to continue this work on a larger scale. This authority was granted and we are now in a position to present to our breeders a proposition whereby immune herds may be built up throughout the State. Breeders having calves under three months of age may apply to the Cattle Commission for vaccine, provided they will arrange with their veterinarians for the application of the same. Animals over three months and under one year of age which have passed a satisfactory tuberculin test, are also eligible for treatment. The vaccine will be furnished free, the owners paying the veterinarians' charges."

Since July 3, 1909, quite a number of breeders have applied for the vaccine and there have been some 56 calves immunized with it or in process of immunization at the present time, at a cost to the State of $2.00 per head.

All of which is respectfully submitted.

STATISTICS OF AGRICULTURAL SOCIETIES.

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	T. F. Callahan	Lewiston.
Eastern Maine Fair Association	F. O. Beal	Bangor	Albert S. Field	Bangor	Albert S. Field	Bangor.
Central Maine Fair Association	Martin F. Bartlett	Waterville	George R. Fuller	Waterville	Geo. R. Fuller	Waterville.
Maine State Pomological	G. M. Twitchell	Auburn	E. L. White	Bowdoinham	E. L. Lincoln	Wayne.
Maine State Poultry and Pet Stock Association	Silas Bartlett	Lewiston.	A. L. Merrill	Auburn	T. H. Sclater	Auburn.
Androscoggin County	Alonzo M. Bumpus	Livermore Falls	W. N. Gilbert	Livermore Falls	H. A. Morison	Livermore Falls.
Aroostook, Northern Maine Fair Association	O. B. Griffin	Caribou, R. F. D. 5	Ernest T. McGlauflin	Presque Isle	A. E. Irving	Presque Isle
Cumberland County	Jos. L. Robinson	So. Windham	C. H. Leighton	Cumberland Mills	F. D. Scamman.	Gorham
Cumberland Farmers' Club	Fred E. Burnell	Cumberland, Center, R. F. D. 1	E. W. Winslow	Woodfords, R. F. D. 2	Willard Wilson	Cumberland Center, R. F. D. 2.
Cumberland, Bridgton Farmers' and Mechanics' Club	Fred P. Emery	Bridgton	C. Lester Ames	Bridgton	John S. Ames	Bridgton.
Cumberland, New Gloucester and Danville	Manley F. Burnham	Auburn, R. F. D. 7	Charles H. Nelson	New Gloucester	George W. Haskell	New Gloucester.
Cumberland, Lake View Park	Arthur Dyer	Sebago	A. L. Brackett	E. Sebago	P. P. Larrabee	Naples, R. F. D. 1
Cumberland, Freeport Agricultural	Harry Merrill	Freeport	Willis Snow	Freeport	S. H. Fitts	Freeport.
Cumberland, Freeport Poultry Association	V. C. Morton	Freeport	Geo. P. Coffin	Freeport	L. E. Curtis	Freeport.
Franklin Country	C. F. Blanchard	Notch	C. F. Smith	Farmington	G. M. Currier	Farmington.
Franklin, North	Elbridge Dill	Phillips	Fremont Scamman	Phillips	J. N. Brackett	Phillips.
Hancock County	F. P. Merrill	Bluehill	C. S. Snowman	Bluehill	M. R. Hinckley	Bluehill
Hancock, North	A. D. Archer	Clifton	H. M. Kenniston	Amherst	J. J. Dunham	Amherst.
Hancock, Eden	A. S. Bunker	West Eden	H. M. Jellison	Eden	Wm. S. Alley	Eden
Hancock, North Ellsworth Farmers' Club	Alvin E. Maddocks	Nicolin	Carl M. Maddocks	Nicolin	Vincent M. Carter	Nicolin.
Kennebec County	L. C. Berry	No. Monmouth	Ellsworth E. Peacock	Readfield	Chas. H. Stevens	Readfield.
Kennebec, South	Frank Trask*	Windsorville	L. H. Ford	Whitefield	J. S. Gray	Windsorville.
Knox, North	E. E. Barnes	Union	H. L. Grinnell	Union	Geo. C, Hawes	So. Union.
Lincoln County	C. E. Peaslee	Alna	G. W. Singer	Damariscotta	E. F. Metcalf	Damariscotta.
Lincoln, Bristol	Artell Russell	Bristol	J. Wilbur Hunter	Damariscotta	Chas. B. Woodward	Damariscotta.
Oxford County	W. J. Wheeler	So. Paris	W. O. Frothingham	So. Paris	W. O. Frothingham	So. Paris.
Oxford, Androscoggin Valley	W. W. Rose	Canton	O. M. Richardson	Canton	W. S. Marble	Dixfield, R. F. D.

* Acting President.

Oxford, North	Y. A. Thurston	Andover	J. F. Talbot	Andover	R. A. Grover	Andover.
Oxford, West	Wm. Gordon	Fryeburg	B. Walker McKeen	Fryeburg	A. D. Merrill	Fryeburg.
Penobscot, North	S. T. Mallett	Springfield	B. D. Averill	Prentiss	C. M. Lombard	Springfield.
Penobscot, West	A. M. Atkins	Dexter, R. F. D. 3	E. E. Colbath	Exeter	F. C. Barker	Exeter.
Penobscot, Orrington	Rawson Lufkin	So. Brewer	F. E. King	So. Brewer, R. F. D. 1.	F. E. King,	So. Brewer. R. F. D. I.
Penobscot, Bangor Poultry and Pet Stock Association	Prof. W. A. Brown	Orono	Harry E. Farnham	Bangor	Harry E. Farnham	Bangor.
Piscataquis County	C W. Hayes	Foxcroft	E. C. McKechnie	Foxcroft	A. J. McNaughton	Foxcroft.
Sagadahoc County	I. R. Morrell	Brunswick	John F. Buker	Bowdoinham	Lyman E. Smith	Brunswick.
Sagadahoc, Richmond Farmers' and Mechanics' Club	Geo. M. Curtis	Richmond	N. H. Skelton	Richmond	N. H. Skelton	Richmond.
Somerset County	Ernest Hilton	Anson	J. F. Withee	Madison	E. H. Athearn	Anson.
Somerset, Central	C. D. Miller	Skowhegan	S. H. Bradbury	Skowhegan	Roland T. Patten	Skowhegan.
Somerset, East	Lewis Fish	Hartland	E. A. Webber	Hartland	R. C. Hamilton	Hartland.
Somerset, Embden	John W. Morin	No. Anson, R. F. D. 1	Grant Witham	No. Anson, R. F. D. 1.	Geo. O. Moulton	No. Anson, R. F. D. 1.
Waldo County	John B. Darling	Belfast	Orrin J. Dickey	Belfast	Orrin J. Dickey	Belfast.
Waldo and Penobscot	W. B. F. Twombly	Monroe	Edwin Jenkins	Monroe	John B. Nealley	Monroe.
Waldo, Unity Park Association	Wm. H. Kimball	Burnham	Edwin T. Reynolds	Unity	Edwin T. Reynolds	Unity.
Washington County	T. W. Pomeroy	Pembroke	J. M. Morgan	Pembroke	A. E. Lincoln	Dennysville
Washington, West	A. H. Chandler	Columbia Falls	S. H. Allen	Columbia Falls	W. H. Allen	Columbia Falls.
Washington, Machias Fair Association	E. I. White	Machias	W. H. Phinney	Machias	W. H. Phinney	Machias.
York, Shapleigh and Acton	W. P. Ferguson	Springvale	Fred K. Bodwell	Acton	Geo. T. Crediford	Shapleigh.
York, Cornish Agricultural Assn	Wm. H. Pendexter	Cornish	Wm. R. Copp	Cornish	Edwin C. Small	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 Agricultural	120	65	218	62	316	33	–	694	249	48	461
Eastern Maine Fair Association	62	44	124	–	276	30	167	474	103	16	592
Central Maine Fair Association	128	57	182	23	94	86	135	356	116	16	1600
Maine State Poultry and Pet Stock Association	–	–	–	–	–	–	–	–	–	–	1920
Androscoggin County	82	12	39	56	50	15	24	196	30	–	60
Aroostook, Northern Maine Fair Association	87	34	88	13	6	–	54	141	57	17	379
Cumberland County	101	51	70	25	198	10	84	438	18	29	130
Cumberland Farmers' Club	26	3	9	21	18	7	20	78	–	7	210
Cumberland, Bridgton Farmers' and Mechanics' Club	38	17	28	25	50	16	26	162	19	10	75
Cumberland, New Gloucester and Danville	37	2	9	21	12	2	–	46	–	–	–
Cumberland, Lake View Park	–	–	–	2	3	–	–	5	–	–	8
Cumberland, Freeport Agricultural	37	8	24	–	6	–	12	50	6	8	79
Cumberland, Freeport Poultry Association	–	–	–	–	–	–	–	–	–	–	730
Franklin County	102	45	151	153	378	34	121	882	180	9	76
Franklin, North	71	4	12	29	158	13	17	233	80	12	6
Hancock County	15	5	7	25	50	10	–	97	25	10	20
Hancock, North	14	2	4	22	4	–	–	32	16	6	15
Hancock, Eden	4	2	5	10	–	–	5	22	15	6	9
Hancock, North Ellsworth Farmers' Club	–	–	–	–	–	–	–	–	–	–	–
Kennebec County	131	42	74	55	106	48	36	361	41	37	224
Kennebec, South	31	6	7	11	132	10	–	166	5	–	8

Knox, North	42	2	13	14	92	9	12	142	13	–	19
Lincoln County	39	2	8	6	35	8	6	65	9	–	28
Lincoln, Bristol	5	–	–	2	16	–	–	18	5	–	7
Oxford County	54	39	77	99	128	22	48	413	112	21	168
Oxford, Androscoggin Valley	80	21	38	63	64	6	48	240	15	7	44
Oxford, North	8	2	2	2	20	2	–	28	30	4	15
Oxford, West	97	19	50	60	124	30	50	320	32	10	75
Penobscot, North	25	4	20	15	4	6	–	49	12	4	6
Penobscot, West	49	7	20	35	26	–	24	112	25	5	27
Penobscot, Orrington	8	1	1	3	–	–	8	13	–	2	2
Penobscot, Bangor Poultry and Pet Stock Association	–	–	–	–	–	–	–	–	–	–	270
Piscataquis County	35	7	32	30	10	–	66	145	19	1	24
Sagadahoc County	20	49	150	92	56	8	70	306	65	55	602
Sagadahoc, Richmond Farmers' and Mechanics' Club	13	1	8	3	1	2	–	15	–	1	6
Somerset County	47	4	23	54	48	15	10	154	102	–	40
Somerset, Central	48	5	16	23	24	–	–	73	88	40	205
Somerset, East	41	4	11	52	12	3	25	107	27	8	28
Somerset, Embden	20	2	9	19	6	10	25	71	12	–	1
Waldo County	63	8	46	32	64	–	62	98	18	12	70
Waldo and Penobscot	75	16	42	26	78	14	12	188	50	6	73
Waldo, Unity Park Association	77	3	8	20	40	17	16	104	37	19	23
Washington County	26	3	9	29	4	–	18	45	32	24	15
Washington, West	43	5	18	36	28	–	6	93	51	9	15
Washington, Machias Fair Association	18	8	10	9	18	–	–	45	15	16	37
York, Shapleigh and Acton	11	1	–	3	90	8	–	102	8	–	15
York, Cornish Agricultural Association	28	12	19	26	80	6	12	155	6	14	49
	2058	624	1681	1311	2925	480	1219	7534	1743	489	8466

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.
Maine State Agricultural	$103 00	$50 00	$51 00	-	-	$50 00	$40 00	$66 00	$165 00
Eastern Maine Fair Association	69 00	12 00	122 00	$10 00	$15 00	18 00	16 00	31 00	-
Central Maine Fair Association	77 50	30 00	48 00	8 00	100 00	30 00	25 00	94 00	59 10
Androscoggin County	25 00	15 00	12 00	15 00	10 00	25 00	12 00	60 00	25 00
Aroostook, Northern Maine Fair Association	42 00	-	68 00	39 00	51 00	15 00	-	162 00	90 00
Cumberland County	45 00	29 00	21 00	15 00	15 00	25 00	-	-	76 00
Cumberland Farmers' Club	3 00	3 00	3 00	2 00	-	-	-	18 00	16 00
Cumberland, Bridgton Farmers' and Mechanics' Club	8 00	8 00	-	-	8 00	-	20 00	39 00	35 00
Cumberland, New Gloucester and Danville	-	3 00	2 00	-	3 00	8 00	-	18 00	12 00
Cumberland, Lake View Park	-	-	-	-	-	-	-	-	-
Cumberland, Freeport Agricultural	-	6 00	-	3 00	3 00	8 00	5 00	38 00	10 00
Cumberland, Freeport Poultry Association	-	-	-	-	-	-	-	-	-
Franklin County	17 00	12 00	23 00	12 00	18 00	20 00	21 00	33 50	37 00
Franklin, North	2 00	4 00	4 50	4 50	-	3 00	-	19 50	13 00
Hancock County	15 00	12 00	5 00	4 00	-	3 00	-	15 00	-
Hancock, North	-	-	-	-	-	1 50	2 00	1 25	15 00
Hancock, Eden	-	-	-	-	-	-	-	1 50	-
Hancock, North Ellsworth Farmers' Club	-	-	-	-	-	-	-	1 00	-
Kennebec County	25 00	18 00	10 00	6 00	9 00	6 00	12 00	31 50	30 00
Kennebec, South	4 50	3 75	-	-	1 50	4 75	5 00	19 50	14 00
Knox, North	5 00	2 00	-	2 00	3 00	2 50	2 50	33 50	30 75

Lincoln County	5 00	5 00	–	–	3 00	8 00	8 00	13 75	10 00
Lincoln, Bristol	–	–	–	–	–	–	–	–	–
Oxford County	47 00	27 00	10 00	–	–	43 00	–	67 00	51 00
Oxford, Androscoggin Valley	27 00	10 00	5 00	–	–	10 00	10 00	21 00	72 00
Oxford, North	–	–	–	2 00	–	–	–	7 00	49 00
Oxford, West	35 00	23 00	10 00	–	–	–	15 00	22 50	60 00
Penobscot, North	2 50	2 50	2 50	2 50	3 50	2 50	–	12 00	3 25
Penobscot, West	5 00	7 00	10 00	–	–	6 00	–	25 50	109 00
Penobscot, Orrington	–	–	–	–	–	4 50	–	7 00	–
Penobscot. Bangor Poultry and Pet Stock Association	–	–	–	–	–	–	–	–	–
Piscataquis County	7 00	6 00	5 00	6 00	6 00	6 00	–	9 00	53 00
Sagadahoc County	24 00	2 00	11 00	5 00	–	–	–	30 00	100 00
Sagadahoc, Richmond Farmers' and Mechanics' Club	1 00	1 00	1 00	1 50	–	–	–	3 35	2 25
Somerset County	11 00	4 50	3 50	2 00	6 00	6 00	5 00	21 00	18 00
Somerset, Central	13 00	5 00	9 00	5 00	–	13 00	8 00	18 25	50 00
Somerset, East	15 50	8 50	4 00	2 50	–	6 50	3 75	9 75	103 75
Somerset, Embden	–	–	–	–	–	–	–	13 00	10 00
Waldo County	11 00	9 00	9 00	3 00	17 00	10 00	8 00	9 00	17 00
Waldo and Penobscot	26 00	9 00	43 00	12 00	10 00	12 00	8 00	48 00	86 00
Waldo, Unity Park Association	12 50	6 00	10 00	6 00	14 00	8 00	8 00	21 25	20 00
Washington County	3 00	9 00	3 00	–	–	–	–	28 00	9 00
Washington, West	54 00	–	25 00	–	–	100 00	–	185 50	40 00
Washington, Machias Fair Association	11 00	–	16 00	–	–	2 00	–	20 00	3 00
York, Shapleigh and Acton	–	–	–	–	3 00	3 50	6 00	–	6 00
York, Cornish Agricultural Association	20 00	–	–	–	6 00	7 00	4 00	16 00	50 00
	$771 50	$342 25	$546 50	$168 00	$305 00	$467 75	$244 25	$1290 10	$1550 10

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.
Maine State Agricultural	$314 00	$520 00	$104 00	$278 00	$68 00	$120 00	$20 00	$146 00	$160 00	$378 00
Eastern Maine Fair Association	180 00	470 00	–	171 00	353 00	–	–	–	45 00	18 00
Central Maine Fair Association	267 00	401 50	69 00	289 00	111 00	53 00	10 00	183 00	90 00	196 65
Androscoggin County	25 00	40 00	50 00	10 00	35 00	40 00	10 00	20 00	75 00	75 00
Aroostook, Northern Maine Fair Association	270 00	575 00	57 00	88 00	22 00	–	–	–	–	–
Cumberland County	115 00	75 00	43 00	35 00	53 00	27 00	8 00	22 00	16 00	183 00
Cumberland Farmers' Club	6 00	13 00	36 00	27 00	13 00	15 00	–	9 00	27 00	57 00
Cumberland, Bridgton Farmers' and Mechanics' Club	48 00	80 00	105 00	20 00	14 00	35 00	–	9 00	36 00	59 00
Cumberland, New Gloucester and Danville	4 00	14 50	26 25	–	–	2 00	8 00	2 00	5 00	9 00
Cumberland, Lake View Park	–	–	3 00	–	5 00	–	–	–	–	–
Cumberland, Freeport Agricultural	10 75	14 50	–	8 00	5 00	–	2 00	–	–	5 00
Cumberland, Freeport Poultry Assn.	–	–	–	–	–	–	–	–	–	–
Franklin County	107 50	276 50	78 50	108 00	69 50	43 50	8 00	23 50	134 80	80 00
Franklin, North	2 50	11 00	14 75	12 00	5 25	8 20	–	4 50	30 80	20 00
Hancock County	20 00	8 00	28 00	–	25 00	10 00	–	8 00	–	28 00
Hancock, North	75	2 75	11 25	–	3 00	–	–	–	–	–
Hancock, Eden	5 00	18 00	–	–	–	–	–	–	–	–
Hancock, North Ellsworth Farmers' Club	10 00	14 00	12 00	–	–	–	–	–	–	–
Kennebec County	31 50	74 50	49 00	24 00	28 00	16 00	11 00	28 00	69 00	20 00

Kennebec, South	15 00	15 00	14 00	–	26 75	29 00	11 90	13 25	44 00	45 75
Knox, North	6 00	24 50	7 00	9 00	7 00	9 00	–	5 00	47 00	22 75
Lincoln County	5 00	13 75	3 25	5 00	6 00	15 50	–	6 00	20 00	34 00
Lincoln, Bristol	–	–	1 00	–	6 00	–	–	–	–	–
Oxford County	173 00	181 00	180 00	70 00	101 00	42 00	–	12 00	73 00	174 00
Oxford, Androscoggin Valley	38 00	54 00	75 00	33 00	23 00	23 00	3 00	9 00	12 00	39 00
Oxford, North	6 00	1 75	–	–	18 00	3 75	2 50	2 50	–	18 00
Oxford, West	90 00	135 00	136 00	50 00	35 00	30 00	10 00	30 00	136 00	80 00
Penobscot, North	5 00	4 50	5 00	–	–	–	2 00	–	–	–
Penobscot, West	28 50	50 00	42 25	24 00	13 00	25 00	9 00	5 00	–	–
Penobscot, Orrington	3 00	–	3 50	6 00	–	–	–	–	–	–
Penobscot, Bangor Poultry and Pet Stock Association	–	–	–	–	–	–	–	–	–	–
Piscataquis County	24 00	101 95	–	40 00	4 50	5 50	–	–	–	–
Sagadahoc County	249 00	542 00	131 00	127 00	96 00	25 00	7 00	17 00	47 00	165 00
Sagadahoc, Richmond Farmers' and Mechanics' Club	1 00	3 25	1 25	–	60	25	60	–	–	–
Somerset County	3 75	16 25	34 75	6 00	11 00	14 50	–	11 50	28 00	24 00
Somerset, Central	12 00	30 00	38 50	–	10 00	11 00	5 00	–	–	50 00
Somerset, East	15 50	20 00	46 50	12 00	11 00	–	–	4 50	–	–
Somerset, Embden	4 00	–	–	6 00	2 00	4 00	–	–	–	–
Waldo County	33 00	62 50	15 00	30 00	84 00	8 00	12 00	–	35 00	69 00
Waldo and Penobscot	61 00	109 00	42 00	66 00	20 00	16 00	5 00	46 00	45 00	68 00
Waldo, Unity Park Association	9 00	12 00	26 25	20 00	13 50	11 50	5 50	17 75	10 00	20 00
Washington County	9 00	9 50	25 00	24 00	7 00	–	–	–	–	–
Washington, West	31 00	90 00	138 00	12 00	28 00	–	–	–	–	22 00
Washington, Machias Fair Assn.	16 00	46 00	15 50	–	26 00	–	–	–	–	17 00
York, Shapleigh and Acton	1 00	–	3 25	–	6 00	30 00	–	6 00	45 00	12 00
York, Cornish Agricultural Assn.	46 00	81 00	66 00	23 00	130 00	67 00	6 00	18 00	56 00	57 00
	$2,301 75	$4,211 20	$1,736 75	$1,633 00	$1,495 10	$739 70	$151 50	$658 50	$1,286 60	$2,046 15

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 Agricultural	$625 00	$87 00	$186 00	$106 00	$160 00	$211 50	$52 00	-	$337 00	$303 00	$4,700 50
Eastern Maine Fair Association	284 00	27 00	212 50	387 75	-	507 80	18 00	-	735 00	-	3,702 05
Central Maine Fair Association	557 50	30 00	675 75	241 50	258 40	172 05	33 75	-	306 05	152 00	4,568 75
Maine State Poultry and Pet Stock Association	-	-	2,532 78	-	-	-	-	-	-	-	2,532 78
Androscoggin County	50 00	-	45 00	85 00	75 75	40 50	20 25	-	85 00	225 00	1,205 50
Aroostook, Northern Maine Fair Association	191 00	45 00	325 75	87 30	111 90	41 25	20 50	-	190 85	334 80	2,827 35
Cumberland County	21 00	15 00	215 15	42 50	38 75	36 00	15 00	-	75 50	116 00	1,377 90
Cumberland Farmers' Club	-	2 00	94 00	50 50	29 95	6 75	-	-	36 90	10 00	478 10
Cumberland, Bridgton Farmers' and Mechanics' Club	18 00	14 00	49 70	25 00	-	15 50	-	5 00	33 75	48 00	732 95
Cumberland, New Gloucester and Danville	5 00	8 00	23 75	23 35	19 35	9 75	1 00	-	25 70	30 00	257 65
Cumberland, Lake View Park	-	-	3 50	-	11 40	-	-	-	9 70	10 00	42 60
Cumberland, Freeport Agri'l	2 50	2 00	20 00	10 00	23 00	8 00	2 00	-	28 00	61 00	274 75
Cumberland, Freeport Poultry Association	-	-	349 79	-	-	-	-	-	-	27 50	377 29
Franklin County	116 00	20 50	61 75	44 55	62 90	76 85	-	-	64 00	-	1,569 85
Franklin, North	43 50	1 00	2 85	10 45	6 80	4 55	5 70	-	16 20	2 70	253 25
Hancock County	15 00	8 00	25 00	79 55	20 00	10 00	7 00	-	18 00	12 00	375 55
Hancock, North	4 45	1 00	5 25	14 60	13 65	50	-	-	38 45	3 00	118 40
Hancock, Eden	8 00	5 00	3 40	42 60	19 65	-	-	-	9 95	-	113 10
Hancock, North Ellsworth Farmers' Club	1 00	1 00	7 00	97 00	-	-	-	-	15 40	8 00	166 40

Kennebec County	28 00	15 00	123 50	50 25	87 50	37 75	15 00	–	39 75	108 75	1,004 00
Kennebec, South	2 00	–	8 00	7 10	21 20	3 70	1 25	–	39 25	45 00	395 15
Knox, North	5 50	–	17 50	25 50	33 95	8 00	8 60	–	21 55	77 81	416 91
Lincoln County	3 00	–	18 50	22 25	26 80	3 00	6 00	–	22 45	25 35	288 60
Lincoln, Bristol	2 50	–	4 25	9 50	7 75	1 50	–	–	13 55	12 00	58 05
Oxford County	73 00	18 50	126 60	64 75	296 50	34 20	20 75	15 00	118 90	460 00	2,479 20
Oxford, Androscoggin Valley	13 00	3 00	33 50	18 75	23 25	11 00	3 50	5 00	24 40	98 50	697 90
Oxford, North	12 00	5 00	10 50	12 00	23 20	4 50	6 65	–	25 00	27 00	236 35
Oxford, West	25 00	10 00	12 00	25 00	16 00	15 00	15 00	–	10 34	149 50	1,175 34
Penobscot, North	6 00	2 00	2 00	25 00	40 18	10 00	5 00	–	82 37	–	220 30
Penobscot, West	13 00	11 00	18 00	38 35	75 05	6 30	6 50	–	81 25	33 14	641 84
Penobscot, Orrington	–	4 00	1 00	16 85	26 40	65	1 00	–	25 75	10 25	109 90
Penobscot, Bangor Poultry and Pet Stock Association	–	–	122 00	–	–	–	–	–	–	–	122 00
Piscataquis County	7 50	2 00	13 00	–	1 50	44 25	–	–	18 50	3 00	363 70
Sagadahoc County	27 00	60 00	254 15	152 00	159 00	100 00	7 00	–	141 00	251 69	2,729 84
Sagadahoc, Richmond Farmers' and Mechanics' Club	–	75	1 25	16 25	12 05	2 35	1 25	–	7 90	1 20	60 05
Somerset County	39 50	–	14 75	9 25	7 10	2 15	–	–	34 65	4 65	338 80
Somerset, Central	87 50	10 00	99 40	24 35	28 50	11 00	3 00	–	16 50	24 75	582 75
Somerset, East	17 75	4 00	17 50	13 50	13 00	4 70	85	–	11 60	49 95	396 60
Somerset, Embdem	2 00	–	–	–	–	–	–	–	–	10 00	51 00
Waldo County	36 00	13 00	77 00	38 25	22 50	6 00	–	–	89 50	3 00	726 75
Waldo and Penobscot	76 00	34 00	32 75	72 00	67 40	32 50	1 50	–	140 85	5 00	1,194 00
Waldo, Unity Park Association	22 50	6 50	14 25	32 00	13 50	10 50	3 25	6 00	36 80	58 25	454 80
Washington County	19 00	10 00	13 25	38 00	11 75	13 75	–	–	49 25	–	281 50
Washington, West	52 00	58 00	16 50	107 75	74 25	9 25	22 00	–	217 40	55 65	1,338 30
Washington, Machias Fair Assn.	15 00	13 00	42 25	60 40	39 90	19 35	75	–	59 95	12 15	435 25
York, Shapleigh and Acton	4 50	–	10 50	69 25	44 75	7 50	–	–	45 00	99 50	402 75
York, Cornish Agricultural Assn.	4 00	18 00	84 00	30 00	29 75	7 50	2 00	–	30 40	9 35	868 00
	$2,535 20	$564 25	$6,026 82	$2,325 95	$2,054 23	$1,547 40	$306 05	$31 00	$3,429 31	$2,978 44	$43,744 35

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 Agricultural	$2,437 00	$60 00	$3,825 00	$1,488 25	$18,876 22	$26,686 47
Eastern Maine Fair Association	-	-	-	-	-	-
Central Maine Fair Association	2.068 75	20 00	500 00	1,452 00	11,187 22	15,227 97
Maine State Poultry and Pet Stock Association	1,197 44	34 00	-	-	1,523 55	2,754 99
Androscoggin County	518 80	40 00	600 00	325 00	1,416 20	2,900 00
Aroostook, Northern Maine Fair Association	1,335 01	31 00	-	869 00	7,308 56	9,543 57
Cumberland County	560 20	-	1,375 00	232 50	4,477 21	6,644 91
Cumberland Farmers' Club	221 43	62 00	-	167 50	1.150 61	1,601 54
Cumberland, Bridgton Farmers' and Mechanics' Club	319 89	-	-	90 00	579 50	989 39
Cumberland, New Gloucester and Danville	133 79	-	-	146 00	664 69	944 48
Cumberland, Lake View Park	18 07	-	-	-	54 28	72 35
Cumberland, Freeport Agricultural	81 84	-	100 00	118 75	577 22	877 81
Cumberland, Freeport Poultry Association	244 93	20 00	-	304 00	83 95	652 88
Franklin County	601 77	734 00	-	600 00	3,272 77	5.208 54
Franklin, North	94 07	273 00	-	28 75	760 26	1.156 08
Hancock County	201 05	-	-	85 75	1,829 34	2,116 14
Hancock, North	76 98	8 00	29 20	-	32 58	146 76
Hancock, Eden	56 85	-	-	-	770 24	827 09

Hancock, North Ellsworth Farmers' Club	83 91	–	–	–	373 35	457 26
Kennebec County	461 46	20 00	650 00	–	1,245 58	2,377 04
Kennebec, South	176 18	10 00	500 87	49 50	797 05	1,533 60
Knox, North	176 75	4 00	–	27 50	1,886 99	2,095 24
Lincoln County	160 52	12 00	–	160 00	1,260 83	1,593 35
Lincoln, Bristol	30 82	25	–	–	127 30	158 37
Oxford County	933 90	44 00	425 00	602 50	5,954 15	7,959 55
Oxford, Androscoggin Valley	353 39	10 00	300 00	183 00	2,090 92	2,937 31
Oxford, North	119 46	–	–	15 00	587 86	722 32
Oxford, West	560 15	20 00	–	118 50	2,767 33	3,465 98
Penobscot, North	121 37	2 00	–	–	376 63	500 00
Penobscot, West	287 21	32 00	–	227 50	1,179 95	1,726 66
Penobscot, Orrington	54 04	–	–	68 00	513 27	635 31
Penobscot, Bangor Poultry and Pet Stock Association	–	50 00	–	–	353 85	403 85
Piscataquis County	–	–	–	–	–	–
Sagadahoc County	–	532 00	3,600 00	945 00	6,335 53	11,412 53
Sagadahoc, Richmond Farmers' and Mechanics' Club	29 26	–	–	–	100 00	129 26
Somerset County	144 94	–	300 00	–	685 25	1,130 19
Somerset, Central	258 77	120 00	–	310 00	1,747 61	2,436 38
Somerset, East	132 58	69 00	10 00	280 00	1,099 90	1,591 48
Somerset, Embden	20 47	–	30 00	3 00	–	53 47
Waldo County	227 88	140 00	–	542 50	1,674 87	2,585 25
Waldo and Penobscot	519 62	–	1,000 00	72 50	2,300 95	3,893 07
Waldo, Unity Park Association	192 50	–	–	212 50	700 50	1,105 50
Washington County	67 72	23 00	150 00	78 00	1,092 52	1,411 24
Washington, West	687 87	–	1,400 00	332 50	4,670 59	7,090 96
Washington, Machias Fair Association	–	14 00	–	80 00	2,201 86	2,295 86
York, Shapleigh and Acton	175 99	200 00	60 00	–	82 43	518 42
York, Cornish Agricultural Association	410 67	–	–	442 50	2,288 31	3,141 48
	$16,555 30	$2,584 25	$14,855 07	$10,657 50	$99,059 78	$143,711 90

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 Agricultural	$1,381 00	$4,300 00	$2,419 09	$15,805 07	$28,605 66	$63,059 00	$20,500 00
Eastern Maine Fair Association	-	-		250 80	-	-	-
Central Maine Fair Association	216 60	3,215 00	6,638 93	-	14,890 08	250 00	3,500 00
Maine State Poultry and Pet Stock Association	-	-	-	-	-	1,690 00	-
Androscoggin County	400 00	855 00	375 00	650 00	3,485 50	2,000 00	1,000 00
Aroostook, Northern Maine Fair Association	2,834 78	1,970 00	1,179 50	850 00	9,661 63	25,000 00	700 00
Cumberland County	2,540 00	895 00	1,767 01	-	6,579 91	7,500 00	1,675 00
Cumberland Farmers' Club	24 98	437 50	446 83	132 50	1,519 91	3,000 00	-
Cumberland, Bridgton Farmers' and Mechanics' Club	75 00	450 00	125 00	32 85	1,415 80	4,000 00	2,251 41
Cumberland, New Gloucester and Danville	78 42	506 00	131 49	-	973 56	2,500 00	50 00
Cumberland, Lake View Park	-	-	17 69	-	60 29	600 00	-
Cumberland, Freeport Agricultural	30 00	500 00	100 00	-	904 75	2,000 00	850 00
Cumberland, Freeport Poultry Association	20 00	-	275 19	30 00	702 48	-	-
Franklin County	1,188 99	1,500 00	1,221 34	461 76	5,941 94	10,000 00	-
Franklin, North	89 59	310 33	208 75	273 16	1,135 08	2,400 00	2,325 00
Hancock County	200 00	700 50	789 84	-	2,065 89	5,000 00	-
Hancock, North	30 00	-	450 43	-	598 83	150 00	29 20
Hancock, Eden	392 00	158 25	210 16	-	873 51	2,200 00	1,500 00
Hancock, North Ellsworth Farmers' Club	-	-	-	-	-	-	-
Kennebec County	-	387 50	240 00	715 49	2,346 99	1,500 00	1,505 00

Kennebec, South	–	353 50	445 32	–	1,193 97	–	629 14
Knox, North	600 00	800 00	532 96	91 53	2,441 40	1,500 00	400 00
Lincoln County	–	490 00	450 00	204 21	1,432 81	2,000 00	300 25
Lincoln, Bristol	6 50	–	35 43	32 83	132 81	1,000 00	104 29
Oxford County	1,471 51	1,580 00	1,460 08	946 76	7,937 55	12,000 00	425 00
Oxford, Androscoggin Valley	500 88	793 50	115 25	1,389 75	3,497 28	5,000 00	3,122 50
Oxford, North	–	90 00	76 00	54 35	456 70	1,500 00	30 00
Oxford, West	215 00	799 75	250 40	1,310 60	3,751 09	10,000 00	1,695 00
Penobscot, North	20 00	–	75 00	20 00	335 30	475 00	–
Penobscot, West	300 00	575 00	284 50	230 70	2,032 04	5,800 00	4,900 00
Penobscot, Orrington	–	235 00	219 77	23 63	588 30	–	–
Penobscot, Bangor Poultry and Pet Stock Association	–	–	313 07	35 88	470 95	–	98 00
Piscataquis County	–	–	–	–	–	–	–
Sagadahoc County	900 00	1,750 00	5,233 84	2,647 48	13,261 16	881 21	1,845 00
Sagadahoc, Richmond Farmers' and Mechanics' Club	–	–	52 70	–	112 75	–	–
Somerset County	163 99	267 50	224 40	125 00	1,119 69	1,000 00	440 00
Somerset, Central	200 00	802 75	100 00	155 18	1,840 68	5,000 00	2,788 43
Somerset, East	10 00	700 00	278 69	161 28	1,546 57	2,000 00	665 00
Somerset, Embden	–	–	4 62	–	55 62	–	32 15
Waldo County	300 00	1,312 50	860 00	–	3,199 25	10,000 00	277 73
Waldo and Penobscot	267 70	938 00	2,100 00	602 42	5,102 12	10,000 00	1,140 00
Waldo, Unity Park Association	125 00	504 00	211 10	–	1,294 90	–	189 40
Washington County	206 75	326 85	408 82	180 75	1,404 67	–	150 00
Washington, West	587 87	750 00	2,245 38	2,113 44	7,034 99	1,961 00	1,093 12
Washington, Machias Fair Association	–	735 60	1,100 00	–	2,270 85	–	–
York, Shapleigh and Acton	–	–	26 00	19 70	448 45	2,000 00	–
York, Cornish Agricultural Association	204 65	885 00	730 99	714 73	3,403 37	4,000 00	–
	$15,581 21	$30,874 03	$34,430 57	$30,261 85	$148,127 08	$208,966 21	$56,210 62

BULLETINS

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Maine Agricultural Experiment Station

IN

1909

Bulletins 166 and 168 on Egg Production, Bulletin 170 on two Fungous Diseases of the Apple, Bulletin 172 on the Fungus Gnats of North America, and Bulletin 173 on Chermes of Maine Conifers, are not here included.

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NOTES ON PLANT DISEASES IN 1908.

W. J. MORSE.

In connection with the regular lines of investigation undertaken by the Plant Pathologists of this Station certain minor problems are encountered and studied which of themselves are not of sufficient importance to merit treatment in a separate bulletin. It also seems desirable to record observations upon the yearly prevalence and distribution of the more important plant diseases and any new or unknown troubles which appear, particularly with reference to the apple and potato, around which the major part of the work in this department now centers. This bulletin has to do with certain subjects of this nature, based largely upon the work of the current year. The following topics are considered.

POTATO DISEASES OF THE YEAR.

Leaf Blights. Late blight, *Phytophthora infestans,* did practically no damage in Maine, even on unsprayed fields, during the summer of 1908. This was due to the fact that dry weather conditions prevailed over much of the State during the summer. However, in the portions of the State where potatoes are the main commercial crop this lack of rain was not enough to reduce the crop, but just sufficient to hold the late blight in check. Early blight, *Alternaria solani,* on the contrary found ideal conditions for development upon the plants already weakened by dry weather, and consequently did much damage on all but the most thoroughly sprayed fields. This was particularly the case in the central and western parts of the State where the drouth was more severe and spraying is less generally practiced.

Stem and Tuber Diseases. Last year the occurrence of a stem and tuber disease new to Maine was noted and the appearance of the affected plants described under the name of Black-leg.*

It was stated that the evidence so far obtained indicates that the disease is of a bacterial nature. During the past summer, cultures of bacteria have been isolated from stems of potatoes attacked by black-leg, which are able to cause a rapid and complete decay of potato tubers and, on inoculation, have produced the characteristic black-leg disease of the stem, thus confirming the diagnosis. The organisms thus secured are now being studied.

Another disease of the stem and tuber which is usually designated as the Fusarium dry rot caused by the fungus *Fusarium oxysporium,* Schlecht. has been found for the first time in Maine during the past summer. It is well known that this disease, and it is probable that black-leg as well, is disseminated by means of seed tubers from infected fields, therefore, tubers from fields showing either of these diseases should not be used for seed. Fortunately neither disease is very widely distributed in Maine, and prompt measures taken at this time will restrict their spread and possibly lead to their eradication.

Both the Fusarium dry rot and black-leg are fully described in a circular issued by the Station, entitled How to Fight Potato Enemies. This circular can be obtained by any potato grower or dealer on request addressed to the Experiment Station.

Maine seed potatoes are probably as free from such diseases as any which are shipped South for planting and the writer believes that for many reasons they are much cleaner in this respect than those raised for like purposes in many other parts of the country. However, in order to have these conditions prevail growers and shippers of seed potatoes should at once

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*Me Exp. Sta. Bul. 149, p. 323.

learn to recognize both of these diseases and not knowingly ship potatoes intended for seed purposes from any fields showing either disease. If any doubt should arise as to whether either disease exists on a given field, specimens of the affected plants should be at once sent to the station.

ORCHARD DISEASES OF THE YEAR.

On account of the appointment of Dr. Charles E. Lewis as associate pathologist, beginning July 1, it has been possible to commence certain lines of work on orchard diseases which have been under consideration since the Department of Plant Pathology was established two years ago. Comparatively little was known as to the nature and extent of Maine orchard diseases, and preliminary to opening up studies of a more fundamental nature upon the fungi associated with certain apple diseases Doctor Lewis has isolated many cultures from spots on apple leaves, collected by himself and the writer, and representing nearly every part of the State where the apple is grown to any extent. From an equally representative territory cultures have been obtained from decaying apples either on the tree or in storage. The more important results in connection with this work will be given by Doctor Lewis is a later publication.

It is sufficient at this time to say that Maine appears to have in varying degree a relatively large number of the fruit rots which have been described as occurring on the apple in different parts of the United States. Among them may be mentioned those caused by the following fungi:—*Sphaeropsis malorum* Pk. (black rot), *Glomerella rufomaculans* (Berk.) Sp. & von Schr. (bitter rot), *Sclerotinia fructigena* (Pers.) Schrt. (brown rot), *Cepholothecium roseum* Corda. (pink rot), and species of *Penicellium, Botrytis, Rhizopus* and *Alternaria,* In addition at least 4 other apple rots have been ecountered, a part of which are caused either by what are apparently undescribed species of fungi or fungi which are not listed as causing apple decay.

Only preliminary work has been done in testing by inoculation of fruit with fungi isolated from leaf spots, but at least 3 of these including *Spaeropsis malorum,* have been found to produce decay of the fruit.

On account of the general lack of spraying, apple scab, caused by *Venturia inaequalis* (Cke.) Alderh., probably does more to reduce the profits from Maine orcharding than any other disease. During the winter of 1907-08 hundreds of barrels of Maine apples which were quite free from scab when placed in storage were found to be in the condition represented by Fig. 1 when taken out after six or eight weeks—quite thoroughly covered with small black specks, usually smaller than those shown in the photograph. This condition was new to the writer and none of the orchardists consulted had experienced a like trouble before.* Microscopic examination and cultures from the diseased spots invariably showed the apple scab fungus and nothing else. This abnormal development of scab was doubtless due to several factors, the principal one being that the entire growing and harvesting season was very wet, and the vegetative development of the fungus continued up to and during the harvest time. The moist apples, covered with spores, were then placed in rather warm cellars, resulting in the infection of the fruit and the formation of the small scab spots in storage.

In view of all that has been written and published on the common diseases of the apple, here mentioned, it hardly seems necessary to remind Maine orchardists that much of the loss resulting from fungi is unnecessary and can be avoided by proper and comparatively inexpensive treatment. To any who request, the Station will send a circular on How to Fight Apple Enemies.

The Development of Scab Upon Limed Potato Soils.

In Bulletin No. 149 attention was called to the fact that while liming had proven very beneficial to the clover and grass crops in Aroostook County, it should be applied with caution to potato soils in short rotations on account of its liability to largely increase the amount of potato scab.† The following is a brief summary of an experiment therein reported.

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*Prof. F. C. Sears of the Mass. Agricultural College has lately told the writer that this development of scab in storage is not uncommon on stored apples in Nova Scotia.

†Me. Agr. Exp. Sta., Bul. 149, p. 316 (1907).

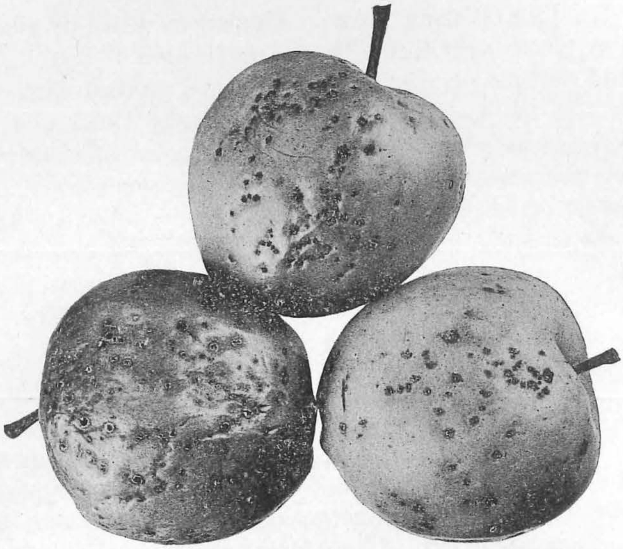

FIG. 1. Apple Scab Produced in Storage.

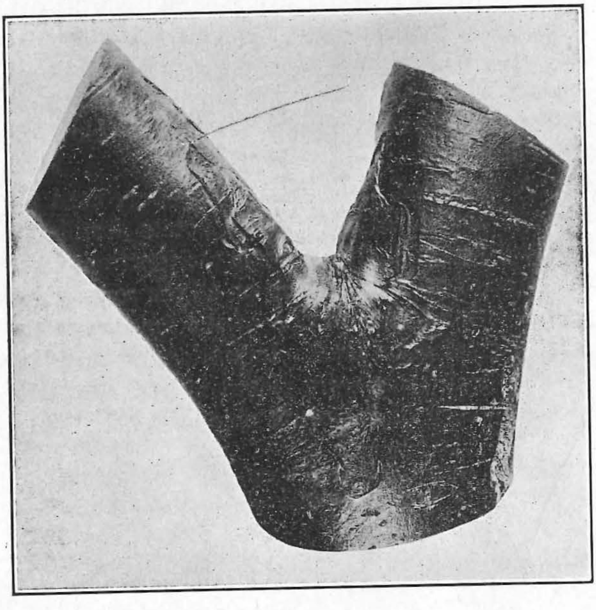

FIG. 2. Crotch Injury of Apple Trees.

On the John Watson farm in Houlton a series of alternate half-acre plots* were treated by the application of 1000 lbs., 500 lbs., and no lime per plot respectively, and stocked with clover and oats in the spring of 1905, an untreated check plot lying between each two limed plots. In 1907 a strip sufficiently wide to allow the planting of 5 rows of potatoes was plowed across the middle of these plots and at right angles to them. At maturity the potato crop on these plots was harvested and carefully sorted for scab, care being taken to avoid as far as possible any cross infection or mixing of soil in the different plots. The results obtained were as follows:

Treatment	1000 lbs. lime	500 lbs lime	no lime
Per cent of scab on crop........	49	27	11

The above results were so striking that it seemed worth while to continue the experiment for another year by replanting the same and also planting another equal strip, along side, which was in grass last season. Therefore, one series of potato rows running across the lime plots at right angles was on land which since the application of lime had been one year in oats, one year in grass and clover, and one year in potatoes fertilized with 1200 pounds of commercial fertilizer per acre and will be designated as the second year potato crop. The other given below as first year potato crop was on land adjoining and parallel to the first, like it in every way as to soil and treatment except that it had been one year in oats and two years in grass and clover since the lime was applied.

As in 1907, untreated, clean seed tubers were used for planting, and 1,200 pounds of high grade potato fertilizer applied per acre. On digging, the two rows at the junction of the potato plots were rejected as was the crop on all the rows for about 15 feet on either side of the junction of the limed with the check plots in the original grass land. In sorting, all tubers showing plainly marked scab spots were placed in that class. The following is a summary of the result obtained.

*In the previous report the plots were given, through error, as acre plots, this making the amount of lime per acre one-half what it really was.

SECOND YEAR POTATO CROP.

Treatment	1000 lbs. lime	500 lbs. lime	no lime
Per cent of scab on crop........	90	48	13.6

FIRST YEAR POTATO CROP.

Treatment	1000 lbs. lime	500 lbs. lime	no lime
Per cent of scab on crop........	52	37	6

DISCUSSION OF RESULTS.

As in the previous year the results were quite uniform as well as clean cut and conclusive on the different plots, there being very little variation in plots receiving the same treatment. Taken together the figures obtained during both seasons seem to point to the following definite conclusions with regard to the development of scab on heavily limed Aroostook potato soils.

First, that the effect of the lime on the amount of scab is fully as great at the end of three years in grass as at the end of two years. In fact the amount of scab on the plots receiving 1000 pounds per acre was 10 per cent greater on the land laid down for three years compared with the results obtained in 1907 on similar adjoining land laid down for two years. Adjoining plots receiving 2000 pounds of lime per acre, however, have practically the same results, 49 per cent and 52 per cent of scab the first year in potatoes, at the end of two and three years respectively after liming.

Second, that, on limed soils, scab is largely increased by planting two successive crops of potatoes. In the present instance where a ton of lime per acre was used the per cent of scab increased from 49 per cent in 1907 to 90 per cent or almost double, in 1908, and where one-half ton of lime was used the per cent of scab increased from 27 per cent the first year to 48 per cent the second year on the same ground.

In this connection it is interesting to note that on the unlimed plots there was only a slight increase in the amount of scab the second year in potatoes, and this fully within the limits of experimental error. However, this should not be accepted as conclusive evidence, for it is a matter of common observation that the second crop in succession on infected ground is as a rule more scabby than the first crop.

The first year unlimed plots showed quite a marked falling off in the amount of scab as a result of the extra year in grass. The average for these plots was 6 per cent of scabby tubers as compared with 11 per cent in 1907 and 13.6 per cent in 1908 on the adjoining second year plots.

For a discussion as to the methods of handling soil or seed to prevent the introduction of scab and the treatment of land already infested the reader is referred to the following publications of this Station: Bulletins 141 and 149 and the special circular entitled How to Fight Potato Enemies. The former bulletin is now out of print but the two latter publications will be sent on request.

Another matter was noted in connection with the yields on the two portions of the field which is of practical importance to the potato grower. There was a marked falling off in the yields on the same land growing the second crop of potatoes in succession as compared with that growing the first crop of potatoes, although 1200 pounds of high grade potato fertilizer had been applied for each crop. The former gave slightly less than 83 per cent of a full crop as compared with the latter, or 90 and 109 barrels per acre respectively.

Self-Boiled Lime-Sulphur as a Substitute for Bordeaux Mixture for Apple Scab.

Bordeaux mixture has been found to be the most effective agent as a treatment for and as a preventative of the common leaf and fruit diseases of the apple, but unfortunately it occasionally causes injury to fruit and foliage. This matter of Bordeaux injury, or "spray injury" to apple trees as it is commonly called, has been made the subject of quite exhaustive inquiry by Hedrick.* The reader is referred to his report on the subject for a detailed discussion of the nature, causes and prevalence of spray injury. With regard to the continued use of Bordeaux mixture on apple trees he summarizes his conclusions as follows:—

"Bordeaux mixture is the best fungicide known to the apple grower. Its use cannot be given up in fighting the apple scab;

*Hedrick, U. P. Bordeaux Injury, Bulletin 287, N. Y. Agr. Exp. Sta., 1907.

even though it causes some injury, apple scab causes a far greater loss than Bordeaux injury."

At the same time there is need for a fungicide which will protect fruit trees from fungous diseases and yet never injure the fruit and foliage. From the published results of preliminary experiments made by Scott of the U. S. Department of Agriculture, self-boiled lime-sulphur appears to have considerable merit in this respect.* In experiments conducted at Bentonville, Arkansas, the self-boiled lime-sulphur was found to be equally as effective as Bordeaux mixture in treating the bitter rot of apple caused by *Glomerella rufomoculans* (Berk.) Sp. and von Schr. It also appeared to be effective in controlling leaf-spot caused by *Sphaeropsis malorum* Pk., and caused no injury to the leaves. Its use on the more tender foliage of the peach at Koshkonong, Missouri, produced no injury and at the same time was very much more effective in controlling peach rot and scab. Bordeaux mixture, applied at the same time, was so injurious to the peach foliage that most of the leaves dropped off after the second application.

In view of the promising results recorded above it seemed advisable to at once make tests of this new fungicide as a preventative of apple scab,—*Venturia inaequalis* (Cke.) Aderh.

Accordingly in 1908 a small orchard, consisting of about an acre, planted to four or five varieties of apples on land in Orono owned by Director Woods was very kindly set apart for these tests. As originally planned one-half of the orchard was to be sprayed with Bordeaux mixture (3-3-50 formula) and one-half with self-boiled lime-sulphur mixture using hot water in preparation. However, after the first application, a letter was received from Mr. Scott advising the comparison of hot and cold water in making the latter preparation.† Therefore, one-half of the lime-sulphur plot on the second and third application was sprayed with a mixture prepared with hot water and one-half with a mixture prepared with cold water.

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*Scott, W. M. Address before the American Pomological Society, Sept., 1907. Circular No. 1. Bureau of Plant Industry, U. S. D. A., April, 1908.

†This, on account of the fact that he had found that where the lime is exceptionally good, enough sulphur can be brought into solution with hot water to slightly burn the foliage.

The lime-sulphur mixture was prepared as follows:—

Fifteen pounds of fresh stone lime was placed in a 50-gallon barrel and a 3-gallon bucket of boiling water poured over it with constant stirring. As soon as the lime began to slake 10 pounds of sulphur was poured over it and then another bucket of water added with continual stirring with a hoe, being careful not to allow the lime to burn. When the lime appeared to be nearly all slaked but while the mixture was still boiling violently the barrel was covered with several thicknesses of burlap and then with boards, and allowed to remain closed for one hour. The mixture was then diluted, strained* the same as Bordeaux mixture, made up to 50 gallons and at once sprayed on the trees. In the letter already referred to Mr. Scott stated that later experiments showed that 10 pounds of lime to 10 pounds of sulphur served the purpose as well as 15 pounds, therefore the smaller amount was used in making the mixture for the two latter sprayings.

The trees were sprayed three times,—May 14, just as the leaves were unfolding, June 10, shortly after the blossoms had fallen, and again on July 6. A part of one row of trees in the center of the orchard was left unsprayed for a check. Neither spray produced any visible injury to foliage or fruit. Both adhered well to the trees, the Bordeaux somewhat the best. Some of the spray in both cases could be seen on the limbs and leaves when the apples were picked, and with the Bordeaux on some trees it showed so plainly that it was necessary to wipe the fruit.

Unfortunately many of the trees of the varieties susceptible to scab failed to set fruit so that it was impossible to secure apples from several trees illustrating each treatment as was intended. The best that could be done was to select four Fameuse trees, one from each lot, bearing on an average somewhat less than a barrel apiece. The fruit was picked and very carefully sorted by a class of University students under the direction of Professor V. R. Gardner. The per cent of fruit free from scab was as follows:—

*A strainer with the bottom placed at an acute angle was found particularly well adapted for this purpose.

Treatment	3-3-50 Bordeaux	Self-boiled lime-sulphur, hot water	Self-boiled lime-sulphur, cold water	Unsprayed check
Per cent of fruit free from scab	50	33	16	1

DISCUSSION OF RESULTS.

Obviously it would be unwise to draw very definite conclusions from the limited data provided above. However, taken in connection with the results obtained by Scott in treating bitter rot and leaf spot of the apple, it seems safe to conclude that self-boiled lime-sulphur mixture has considerable value as a preventive of apple scab. It is at least promising enough so that any orchardist who has trouble with Bordeaux injury would do well to give the lime-sulphur treatment a thorough trial.* From the comparison of single trees the lime-sulphur mixture prepared with hot water was twice as effective as that prepared with cold water, the former approaching Bordeaux mixture in efficiency. Attention should be called to the fact that the percentage of scab free apples was low in all cases—even with the Bordeaux mixture much below the average. In that respect the experiment was disappointing. Doubtless a 5-5-50 Bordeaux would have produced better results. The large amount of scabby apples, 99% on the unsprayed trees, indicates that the fungus was very prevalent in the orchard. If the trees had been given two extra sprayings—one early in the spring before the buds started and another about June 20—much better results might have been obtained.

Weather Records in Relation to Winter Injury of Fruit Trees.

It is well known that there is a wide variation in the ability of various plants to withstand low temperatures. Certain tropical plants have been known to die of cold at temperatures of from +35° F. to + 45° F., while some arctic plants have been

*Sulphur can be purchased of wholesale druggists in Bangor for 5c. per pound in 25 pound lots and 4c. per pound in 100 pound lots, therefore aside from the extra labor involved in preparation self-boiled lime sulphur mixture should cost but little more if any than Bordeaux mixture.

known to withstand cold to the extent of —76° F. With fruit trees, particularly apples, we know that there is also considerable variation in hardiness in different varieties of the same species. It is admitted that such factors as the condition of the soil, whether moist or dry, frozen or thawed, the amount of water in the tissues at the time low temperatures occur, the abruptness of temperature changes, the rapidity of thawing, the direction and character of prevailing winds, e. g. as influencing the rate of evaporation and consequent drying of the tissues, all enter into the question of winter-killing. It is true that these factors along with the intense cold doubtless more often cause the death of trees through stoppage of the upward water current and through its removal from the cells, or cell walls, thus bringing about conditions simulating those of drouth in summer, yet we cannot get away from the fact that: "The capacity of withstanding intense cold is a specific property of the protoplasm of certain plants * * * *."* There is then a certain minimum temperature below which a given variety of apples, pears, or plums, cannot be expected to endure. Therefore it is a matter of fundamental importance to the fruit grower, first to know as closely as possible the approximate zero point of a certain variety and, secondly, the probable lowest range of temperature of the region in which he wishes to plant, based upon recorded observations extending over as many years as possible. Unfortunately very little data of this nature is available, therefore it is hoped that the following article will be of some value in this respect.

Maine being on the northern limit of commercial apple growing, not infrequently the orchards suffer from severe low temperatures and abrupt changes of winter weather. Prof. W. M. Munson notes that in the winters of 1903-04 and 1904-05 the orchards of the State experienced greater injury from conditions of this kind than during the twenty years immediately preceding.† With only one year for recovery this was followed by the most disastrous winter in the history of Maine orcharding, that of 1906-07. The amount of this injury is indicated by the following, quoted from a report of a census of the injured

*Schimper, Dr. A. F. W., Plant-Geography upon a Physiological Basis, English Translation, p. 41. Clarendon Press, Oxford. (1903).

†Me. Agr. Exp. Sta., Bul. 128, p. 73, 1906.

orchards carried out under the direction of Prof. E. F. Hitchings, State Entomologist, and undertaken at the instance of Hon. A. W. Gilman, Commissioner of Agriculture:—

" * * * * * * there were 950 orchards inspected with a total of 443,184 trees. The number killed outright was 24,613 or about 5.5 per cent. A safe estimate of the number injured would be at least 25,000 more. So that 11 per cent of the whole number of trees were killed or injured in 950 orchards."* Farther than this many of the trees which were injured did not recover sufficiently, partly on account of a heavy bearing year, following, so that they were able to withstand the following winter of 1907-08, therefore, it is probable that if the census had been taken again in the summer of 1908 the percentage of trees killed directly or indirectly by the winter of 1906-07 would have been found to be much greater than above quoted.

The writer has elsewhere discussed in some detail the causes which led to the large amount of winter killing in a single season.† It is sufficient for our present purpose to state that after a careful inspection of the weather records at Orono throughout the fall, winter and spring of 1906-7 it seemed that conditions which prevailed for a single week near the middle of January were responsible for the injury, although it was doubtless increased by the low temperature of —28° F. and —25° F. recorded on Feb'y. 24, and March 1, respectively. Figure 3 shows graphically the daily maximum and minimum fluctuations in temperature in degrees Fahrenheit during the last 23 days of this month. The observations were made at 2 P. M., using official instruments. As a rule the minimum record is the temperature of the early morning and the maximum that at or about or a little earlier than the hour of observation.

Particular attention should be called to the fact that the two lowest records of the season, —40° F. and —35° F., are only 7 days apart and midway between them come two consecutive days with records of +45° F. and +47° F. Moreover these changes were quite abrupt, particularly on the 21st when from 2 P. M. to sometime before sunrise the next morning there was a fall in temperature of 60° F., or in other words a change from

*Sixth Annual Report of the Commissioner of Agriculture, p. 282, (Augusta, 1907).

†Procceedings of the Maine Pomological Society. pp. 36-46. 1907-8.

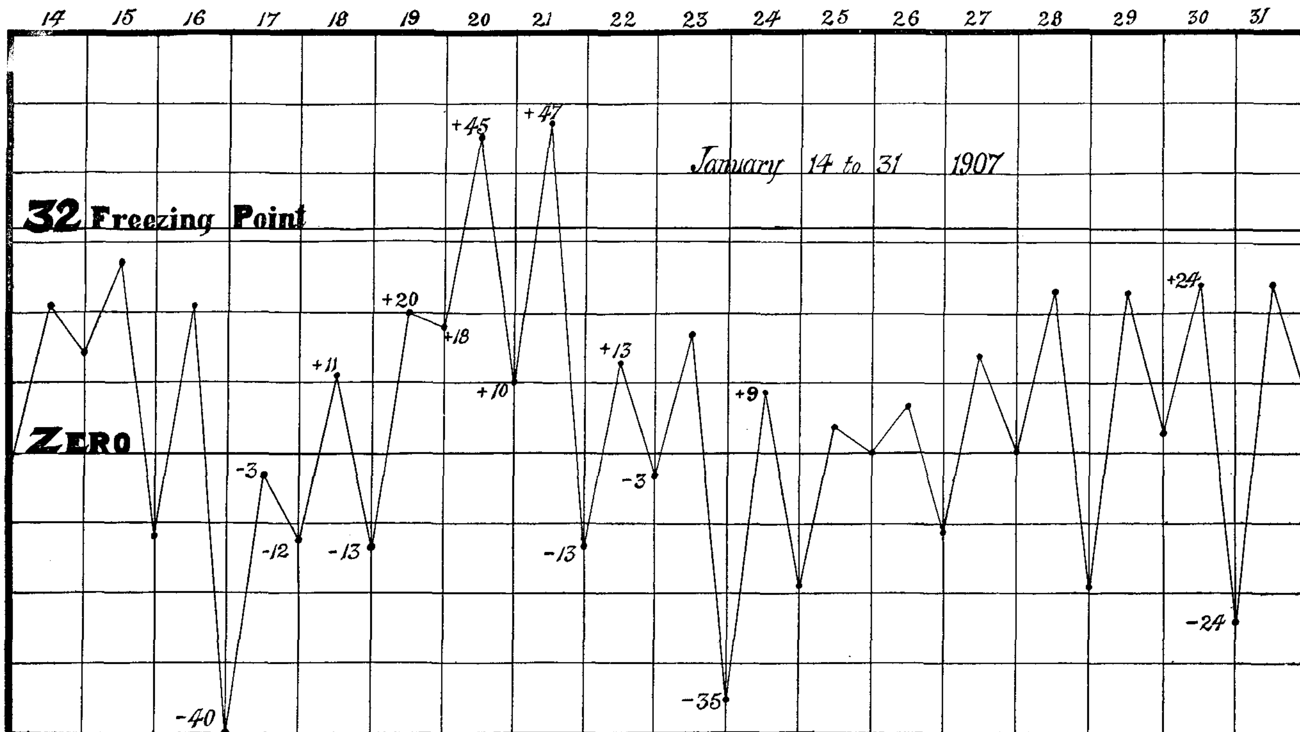

FIG. 3. Maximum and minimum temperatures in degrees F., Orono, Me., Jan. 14-31, 1907.

15° F. *above* the freezing point to 45° F. *below* the freezing point in 12 or 15 hours. Following this in 48 hours is the second lowest record of the season, —35° F., another drop of 52° F. between observations. During the ten days following it will be seen from the figure the temperature ranged quite low, the mean for this period being only slightly above zero F. Except on the 25th these ten days were clear and the prevailing wind was northwest, although not excessive.

The weather records at Orono for nearly 40 years, 1869 to December 1, 1908, inclusive, give 23 months with a minimum record of —25° or lower, these occurring in 15 different years. Only eight are —30° F. below. January, 1878, with a minimum of —35° F., and December, 1890, with —36.3° F., are the only records through the period which in any way equal those of January, 1907, in severity. It is unfortunate that there are no authoritative records for winter-killing at hand aside from the winters of 1903-4, 1904-5, 1906-7 and 1907-8. We have the statement already quoted that the injury during the two first mentioned winters was greater than for 20 years previous. It is quite suggestive, however, to compare the records for these two winters with others in which no injury is reported. Twenty-six degrees below zero F. is given as the minimum for both January and February, 1904. Similar conditions, —27° F. for December, 1904, and —30° F. for January, 1905, are recorded for the next winter. For six years previous there had been no monthly minimum below —23° F. and for 35 years previous to this only four years, 1873, 1887, 1894 and 1898, showed two consecutive months with a minimum of —25° F. or lower, although a number of instances during the period are recorded where the minimum temperature for a single month was as low or lower than this. As has been said there are no available data for the amount of winter-killing during these years.

During the winter of 1906-07 in Maine the Baldwin and Ben Davis winter-killed much more than any other varieties, although Northern Spy, Greening and several other varieties suffered more or less severely, according to the location, slope, and drainage of the orchard. At Orono, where the weather records were taken, and at several other places, not even the hardy Russian varieties escaped without considerable injury.

It should be recognized that the above data are valuable simply as a matter of record, and any attempt to draw general conclusions from them would be fallacious. However, taken in connection with common experience it seems safe to say that it in attempting to grow any but the most hardy varieties of apples would be a matter of considerable hazard to invest much money in those portions of the State where the lowest winter temperature frequently reaches or approximately reaches —30° F. Again it may be said that the grower who confines himself to Baldwins, and possibly Ben Davis, except in the mildest parts of the State, e. g., where the minimum winter temperature, repeated at frequent intervals, seldom reaches below —20° F., or at the utmost —25° F., must expect greater losses than his neighbor who plants almost any of the other commercial varieties grown in Maine.

It is admitted that other states farther south frequently suffer nearly as much from winter-killing of apples, but it should also be remembered that this is probably due to frequent and abrupt changes from severe cold to mild weather, these changes being more common than is the case with the climate of Maine.

Crotch Injury of Apple Trees, Caused by Weather Conditions.

In the spring of 1907 the writer was called to Dover, Maine, to examine an orchard of about 1200-1500 trees from 8 to 12 years old. On the lower portions of this orchard many of the trees were plainly winter-killed, including 5 to 10 per cent of the whole orchard. Quite frequently trees could be found with "frost patches" or portions of the bark killed and loose on the more exposed parts of the larger limbs and trunk, but the most characteristic thing about this orchard was the constant occurrence of the crotch injury illustrated by Fig. 2. This occurred to a greater or less degree on probably 75 per cent of the trees in the orchard, the varieties being largely Ben Davis, and Stark. The bark showed every appearance of recent death, with no invasion of fungi, neither were there any scars, cankers, or other evidence of past injuries of this kind. The dead bark was drying down and cracking away from the healthy portion—it was too early in the season to see evidences of attempts to heal the wounds. The owner, an intelligent and careful observer—a business man who for the sake of out-of-door work had spent all of his spare time for several years in giving this orchard his personal attention and care—was confident that nothing of this kind had appeared on *any* of the trees before.

Whetzel has shown* that not only can injuries to the bark and cambium which are usually called "sun scald" and "winter injury" be caused by the pear blight organism *Bacillus amylovorus* Burrill, but a crotch injury as well, which very closely resembles that which is here figured and discussed. It was thought at first that this was possibly the same trouble as he described, but careful observation followed up for two seasons leads to the conclusion that it is an entirely different trouble—simply an unusual form of "winter injury" or "frost patch." In this connection it should be remarked that the thousands of apple trees in Maine which in the summer and fall of 1906 appeared perfectly healthy gave ample evidence in the spring and summer of 1907 that winter-injury or frost patches are very real things and can occur independently of bacteria or fungi.†

In addition to the reasons already given the following may be cited as showing that probably adverse weather conditions and not fungi or bacteria are the cause of the crotch injury in this instance. Examination showed that crotch injury was almost universally found in previously healthy orchards which in the spring and summer following the severe winter of 1906-07 showed a large percentage of dead or dying trees. It was very common in hundreds of orchards where the injury was present largely in the form of frost patches on the limbs or trunks, but where there was every reason to believe the trees were perfectly healthy the season before. Orchards owned by the University and by Director Woods of the Station furnished excellent opportunity for personal observation upon this point. These had been given the best of care and attention. Both were in very healthy condition up to this time. There is positive evidence that there were no cankers, or dead areas on the limbs or in the crotches of these trees, previous to the winter of 1906-7. Both orchards had a large per cent of trees killed outright and nearly all which were not killed were badly injured in the crotches and showed conspicuous dead areas on the limbs and smaller portions of the trunks. In the Woods orchard a solid acre of Spys about 8 years old which were perfectly

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*Whetzel, H. H. Cornell Exp. Station, Bul. 236, 1906.

†See pages 353-358.

healthy in the fall showed in the spring every tree, either killed or so badly injured that they put forth a few leaves and then died. Crotch injury and frost patches were a very constant occurrence on these trees. An adjoining acre of trees 15 or more years old, largely Mildings with some Russian varieties and a few pear trees, lost only a comparatively small number, but here again the crotch injury was very prevalent, more so than frost patches on the limbs. A very noticeable fact was that in this part of the orchard whole limbs or parts of the tree were killed only on the northwest side of the trees where most exposed to the cold winds. The bark on the northwest side of the trunks on nearly all of the trees in the northern row was entirely killed, while only a few like instances could be found in the remainder of this block of trees.

Repeated attempts to isolate *B. amylovorus* from the injured crotches or limb patches only resulted in failure. Neither was there any constant association of a fungus with the patches, although various fungi, largely sapophytes, began to appear in the injured areas as the season progressed. The writer is perfectly familiar with the appearance of bacterial blight of the pear, but after spending two and one-half years in Maine, has yet to see a case of pear blight in the State, and no specimens of this disease have been sent in to the Station during that time. This indicates that while the disease without doubt occurs in the State it is by no means common.

At Orono all pear trees were killed by the winter but at Dover there were several living pear trees growing along side of the crotch-injured trees. These showed no bacterial blight during the past two seasons, which would not have been the case had the organism been present in sufficient quantities to cause the amount of crotch injury which appeared in the apple orchard.

Since the crotch injury was coincident and almost invariably associated with the winter-killing resulting from the severe winter of 1906-07 and since it would seem that all other probable causes are eliminated, it is fair to assume that it was in some way brought about by the same adverse weather conditions. As a possible suggestion let us again refer to the weather records. We find a snow storm complicating matters just at the time of the thaw between the two low temperature records of the season. See Fig. 3, p. 15. On January 19 the maximum thermometer read $+20°$ F. and dropped off to only $+2°$

F. toward night, when the weather changed and by 2 P. M. the next day the temperature was +45° F. Four inches of snow fell in the afternoon and night of the 19th, but with the rising temperature this was probably of such a consistency as to load up and adhere to the trees, particularly in the crotches. The storm stopped before morning, ending with a trace of rain but not enough to dispose of the snow. The thermometer dropped to +10 on the night of the 20th following the record of +45° F. On the day following it rose again to +47° F. only to fall 60 degrees F. during the night to —13° F. It seems then that the loading up of the trees with soft snow which later thawed some and suddenly froze again two days in succession, the second a very severe drop in temperature, gives conditions which may account for the crotch injury. The crotches would be filled with greater or less deposits of ice which radiated heat with more rapidity than the parts of the trunk not so covered and caused the injury described.

Correspondence with Prof. W. T. Macoun of the Central Experimental Farms, Ottawa, showed that he had observed the same trouble in various parts of the adjoining Provinces of Canada coincident with its occurrence in Maine. Without knowing that the crotch injury was being studied by the other, both Prof. Macoun and the writer arrived at practically the same conclusion as to the cause, as will be seen from the following quotations kindly furnished by Professor Macoun from the forthcoming report of his Department for the year 1907.

"*Crotch Injury.*—The effects of crotch injury have been very serious in the Province of Quebec and in some parts of Ontario in recent years. On examination it is found that in the center of the crotch and on the branches diverging from it, but close to it, the bark is dead. As a result of this killing in the crotch the tree loses its strength there, rot sets in and eventually the tree is destroyed by the loss of one limb after another at the crotch. This crotch injury is probably due to ice lodging in the crotch. There are several theories as to why the ice should cause the bark to die. One is, that it acts as a lens and concentrates the rays of the sun, causing a scalding of the bark. The position of the injured limbs alone would seem to be sufficient to show that this theory is not a good one. It seems more likely that the injury is caused by the softening of the bark by the melted snow or water before freezing, and that after freezing the bark which is, even before this probably tenderer than at any other part, owing to its being most shaded there in summer, is subjected to a severe frost and it and the cambium are both destroyed. One of the best means of preventing crotch injury is to grow trees with as little crotch as possible, training with a central leader."

Winter Injury of the White Pine in 1908.

Coincident with the large amount of winter-killing of fruit trees in Maine there has also appeared a diseased condition of the white pine, particularly of those young trees which are springing up over waste lands and abandoned pastures and which are leading to a natural reforestation of these areas. The matter has received considerable attention from the public and agricultural press of the State. This naturally led to widespread and general alarm among owners of such young pine growth, and has influenced many who were contemplating planting of pines on waste lands, to either give up the project or put it off indefinitely. This trouble has been known *popularly* as "pine blight" and apparently the term has been used to cover every condition of the tree which the observer considered to be abnormal from the normal, yearly death and shedding of the oldest set of needles on the twigs to the troubles herein described.

The general notion exists that the so-called pine blight is due to some parasitic agency, although the cause attributed is as varied as the number of writers on the subject. Fungi, various insects, gases from the sulphite mills, etc., are some of the causes assigned by different individuals in articles, correspondence or in conversation.

There appeared to be a lack of definite information on the subject, based upon careful observation of the trees in the field over any considerable portion of white pine area of the State. Therefore, the writer has made it a point to investigate the conditions with regard to the white pine in every part of the State to which his duties called him during the past season. Many acres of pine growth were examined, distributed over and giving a pretty fair representation of that part of the State lying south of the Canadian Pacific Railroad except Franklin and Washington counties. The data thus gathered led to the following conclusions, namely: There are two well marked leaf troubles of the white pine in Maine. One, which constituted nearly all of the so-called "pine blight" of the State in 1908, is plainly due to adverse weather conditions and while it may occur again at any time is only temporary and need not be feared like a contagious parasitic disease. The other the writer has found only in a few scattered localities, and, so far as observed during two seasons, it is not spreading, at least not to an appreciable extent, and no single fungous parasite could be found constantly associated with the diseased needles. The reasons for these conclusions will be given somewhat briefly. The reader is also referred to the report for the current year (1908) of the Hon. E. E. Ring, Forest Commissioner, State of Maine.*

The discussion which follows should be distinctly understood to be confined to what has popularly been called "pine blight" in Maine and is not based on observations elsewhere in New England, although correspondence and other available information indicates that some of the trouble elsewhere may be due to similar causes†

The common, or practically universal leaf and twig blight of the pine in Maine observed by the writer in the spring and summer of 1908 was characterized by the sudden withering and death of tufts of entire needles early in the spring, which needles soon turned a deep, rich, reddish brown., In cases of severe injury where entire trees were killed it was impossible at a distance to distinguish from scorching by fire. Young trees were invariably more severely affected than old trees. In fact, all other things being equal, the younger the tree the more severe the injury. Large trees only showed scattering tufts of dead needles and these usually only on the more exposed sides. In severe cases the twigs themselves were killed back several inches. In fact acres of young trees in some parts of the State which were apparently healthy in the fall of 1907 were entirely dead by the last of May, 1908. *The most characteristic thing about the trouble was that the injury was usually confined almost wholly to the north and northwest sides of young trees growing in the open or somewhat scattered.* As a rule young trees occurring in clumps or otherwise pro-

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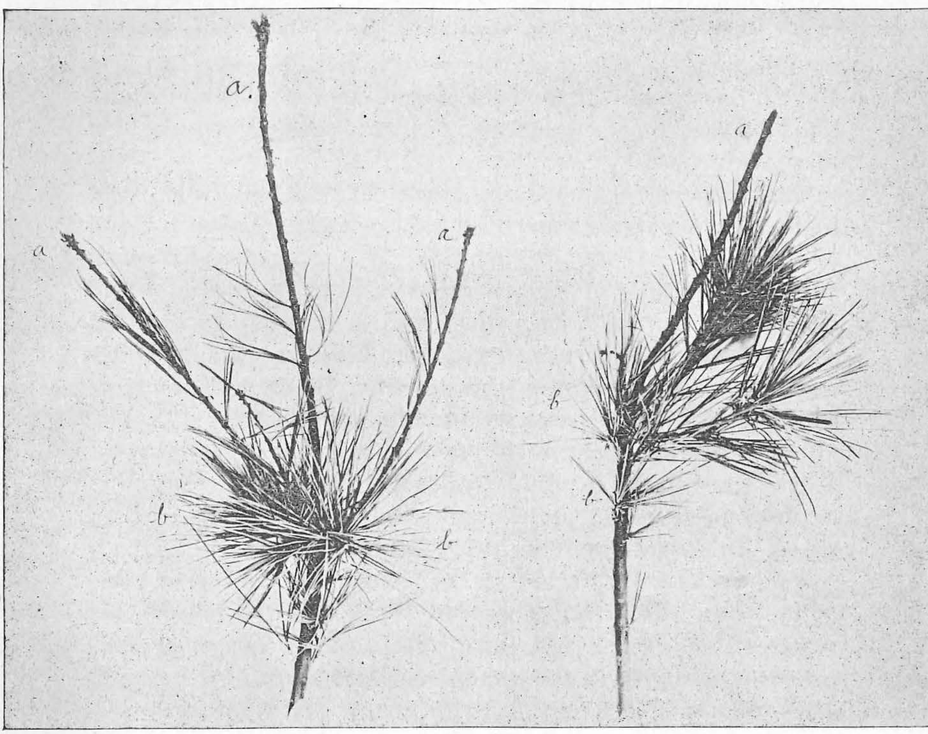
*Morse, W. J. White Pine Blight in Maine. Rept of Forest Commissioner for 1907-08, p. 20, Augusta, 1908.

†Clinton, G. P. Rept. 14. Conn. Exp. Sta. p. 353, 1907; Stone, G. E. Rept. 20, Mass. Exp. Sta. p. 125, 1907.

tected were injured only on the more exposed parts. Young pines—2 to 4 feet high—were frequently observed early in May on exposed hillsides with the branches on the north and west sides of the tree and the entire top dead while the lower, more protected branches on the south side were still green and apparently uninjured.

Young pines which were badly injured when first seen in the spring were kept under observation during the summer and except in the few cases described later in this article *where the trees, like those at Brunswick, were plainly affected with an*



WINTER INJURY OF WHITE PINE.

Small branches photographed October 7, 1908. a-a Injured tips of the twigs from which the dead needles have fallen. b-b Tufts of young needles which started out late in the season at the base of the injury.

entirely different trouble, there was no sign of disease on the needles formed the present year. The old needles and injured twigs gradually dropped off, and many trees by the first of September had the appearance of being severely pruned off on one side. About July first it was noted that in almost every case adventitious buds were showing and little tufts of new needles were forming near the base of the injury on each twig. This is shown by the accompanying photograph (Fig. 4) taken October 7. The new needles are not so long as those put forth in the spring but they are now (November, 1908) entirely healthy, with no signs of disease.

Nor was this injury confined to the pines alone, for spruces and firs and some other conifers showed the same trouble and in the same manner. It was especially severe in the case of the arbor vitæ. Hedges of this tree were practically exterminated in some localities.

Microscopic examination by means of sections of the needles of affected pines and other conifers failed to show any parasitic fungus constantly associated with the disease. In fact dead needles collected from the trees early in the season usually showed no signs of fungi of any kind.* An opportunity came to examine the roots of trees dug up out of an arbor vitæ hedge early in May. The hedge was apparently healthy in the fall before but now the foliage appeared practically dead. The roots appeared perfectly healthy when dug up and the leaves showed no sign of fungi upon them.

It seems to the writer only a logical inference to attribute the injury above described to adverse weather conditions particularly when we summarize the observations. "Pine blight" in 1907-1908 was coincident with the most destructive winter injury of fruit trees in the history of Maine orcharding. A similar trouble appeared to a greater or less extent on other conifers. The disease which constituted the major part of the trouble did not begin in particular centers and gradually spread outward from them, but appeared simultaneously in all parts of the State wherever the pine thrives. It did not appear on the young needles during the summer but came on suddenly in the early spring. Only the young and actively growing trees were badly attacked and these very much more severely on the sides exposed to the prevailing cold dry winds of winter.

While it is possible for frost coming late in the spring to cause the death of young needles,† it is very improbable that low temperatures alone were responsible for the injury in this instance. The fact that the injury recorded in 1908, the milder of the two winters, was by far the most severe and widespread is entirely against this interpretation. It is more probable that the trouble may be accounted for as the result of excessive transpiration bringing about a condition in the plant tissues comparable to drouth in summer. Leaves on conifers remaining on throughout the year remove more or less water from the tissues all winter by transpiration. In the case of young, shallow-rooted trees the ground may be frozen to the depth and often below where the roots extend, thus effectually cutting off the upward current of water to the branches. Now if the tree is exposed to severe and long continued dry winds, particularly if accompanied by bright sunlight during a part of the day, the tissues may become sufficiently dried out in this manner as to injure them beyond recovery. The fact that the larger trees are deeper rooted, and their trunks much better protected against the radiation of heat and the consequent stoppage of the upward current in them doubtless explains in a measure why the large pines suffered only slightly as compared with younger trees.

As has already been stated there is another well marked pine leaf trouble in Maine. The writer has seen a few trees showing this disease in Brunswick, Winthrop and Orono, and has received specimens of the same thing from Lewiston. The Orono trees have been under observation for two years. The disease appeared on the young needles the second year much the same as when first observed, and in this respect as well as the general aspect of the diseased trees the trouble is decidedly different from the winter injury. At Orono branches of healthy

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*Pine needles lying on the ground were usually quite thoroughly infested with saprophytic fungi. Late in the season these fungi were found in some cases to have spread to the dead needles still adhering to the trees. Examination of needles on the same trees earlier in the season failed to show any pustules on them and no mycelium within the tissues, except in an occasional instance. Spots on the needles of pines in the State due to fungous attacks can be found quite frequently but these were by no means constantly associated with the trouble here described.

†Hartig, R. Text-book of the Diseases of Trees. English translation, by Somerville and Ward. p. III (London, 1894).

trees, interlocking with those of affected trees did not develop the disease either season. This disease is very well described in a circular issued in May, 1908, by the United States Forest Service and entitled "Extent and Importance of White Pine Blight."

"Trees affected by the blight may readily be recognized from the characteristic reddish-brown color assumed by the newest needles. The tip of the needle is always affected first and needles with the base or middle turned brown but the tip green are practically never seen. The extent of the decoloration varies greatly in the different needles, and in different trees; sometimes only the tip is affected, sometimes the whole needle. Attacked trees look as if they had been scorched by fire, or as if the tips of the needles had been dipped in reddish-brown dye. * * * * * A tree which is attacked one year appears rarely to escape the next."

"Trees of all ages and sizes whether growing in the open or in closed stands seem to be almost equally affected, with two apparent exceptions: (1) Large full crowned trees with a diameter of 18 inches or more, standing in the open, seem to be rarely affected; and (2) trees in the interior of a dense stand seem to be more rarely affected than those near the edge. Otherwise the blight seems indifferent to the health or to the situation of the tree or to the character or moisture of the soil in which the tree is growing."

In the summary we find the following:—

"So far the disease has done but little damage, but it has now obtained such a foothold that if it proves to be infectious it may have serious results. The cause of the trouble is still unknown. The situation is not one which calls for alarm, but simply for watchfulness and investigation."

In the above discussion nothing has been said with regard to the relation of insects to the present trouble affecting the pines. Fortunately the Station Entomologist, Miss Edith M. Patch, was making the study of certain forest insects one of her important lines of investigation during the past summer. Consequently she had the opportunity and did make quite careful observations on the insects of the pine, particularly those found on diseased trees scattered over extensive and widely separated areas in the State.

In Bulletin 162, p. 366, Miss Patch after discussing various insects found upon the pine, makes the following statement: "On account of the precarious condition of white pine in certain parts of the State considerable alarm has been aroused by various insects found upon the pine this season and indeed it has seemed as though an unusual number of species had taken advantage of the pines this year.

Besides the standard borers to be continually reckoned with, the pine sawflies and pine leaf eating caterpillars have made noticeable inroads, while spittle insects and plant lice (*Lachmus strobi* and *Chermes pinicorticis*) have been unusually prevalent.

None of these insects, however, have been the cause of the 'white pine blight,' though several of them, *Chermes pinicorticis* and spittle insects, *Aprophora parallela,* for instance, have been in some cases conspicuously associated with the ailing trees."

POULTRY NOTES—1908.

RAYMOND PEARL AND FRANK M. SURFACE.

The purpose of this bulletin is to present a brief report of the progress of the work of the Station with poultry during the year 1908. In this year a number of changes were made in the material equipment of the poultry plant, and in methods. It is desirable that a record of these changes be made, as well as the results of certain specific experiments carried on during the year. In this account there will be no discussion of topics which are to appear in other Station bulletins.

TECHNICAL STUDIES ON POULTRY ALREADY PUBLISHED.

A considerable portion of the more technical scientific work of the department of biology of the Station, which has in charge the work with poultry, is published in current biological journals, not readily accessible to the agricultural public. During the past year two papers of this sort directly relating to poultry have been published. One of these papers* is the first install-

*Resection and End-to-End Anastomosis of the Oviduct in the Hen, without Loss of Function. Amer. Journ. of Physiology. Vol. 22. pp. 357-361.

ment of the results of an investigation which is being made into the special physiology of egg production. The laying of an egg is a very complicated physiological process of which only the most general features are known. The attempt is being made to determine the exact part in the process played by the ovary and each portion of the oviduct or egg tube. In the paper under discussion it is shown that a hen may lay a perfectly normal egg after the removal of a considerable portion of that part of the oviduct which secretes the white of the egg.

The second paper† referred to deals with a related question regarding the physiology of the oviduct or egg tube. In this tube the egg shell is deposited and given its shape. Hens are often found which lay misshapen or malformed eggs. This paper deals with the result of an analytical study of a case in which a pullet began by laying a very abnormal egg, and gradually came to lay a normal egg. This change from an abnormal shape of the egg to a normal shape was found to follow a definite mathematical rule. Studies are now in progress to find out whether the change in size of pullets' eggs with continued laying follows the same rule. The character of the eggs laid by the pullet under discussion is shown in Fig. 5.

Fig. 5. Showing the change in the shape of the successively laid eggs of bird No. 183. All the eggs shown were laid by this same bird. The numerical order of arrangement on the plate is: Top row (beginning at left) eggs 1, 2, 3, 4. Second row: Eggs 5, 6, 7, 8. Third row: Eggs, 9, 10, 11, 12. Fourth row: Eggs 18, 30, 42, 54. The eggs of this bird were saved until nearly 90 had been laid but as there was no essential deviation from the normal shape in the later ones they are not figured. The figures given show clearly the gradual change in the shape of the eggs from the very abnormal No. 1 to the normal No. 54.

Changes in Equipment and Plant.

The changes which have occurred during the last year in the material equipment of the poultry plant will be noted under three heads, viz: 1. New buildings. 2. Modification of brooder houses. 3. A new trap nest.

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†Studies on the Physiology of Reproduction in the Domestic Fowl. I. Regulation in the Morphogenetic Activity of the Oviduct. Journ. Exper. Zool.

NEW BUILDINGS.

In the summer of 1908 it became necessary to make some provision for the storage of the surplus supplies of grain which had to be carried at the poultry plant for feeding purposes. The needs of the plant had outgrown the space available. To meet this demand for storage space a two-story building was erected between House No. 2 and House No. 3.* This new

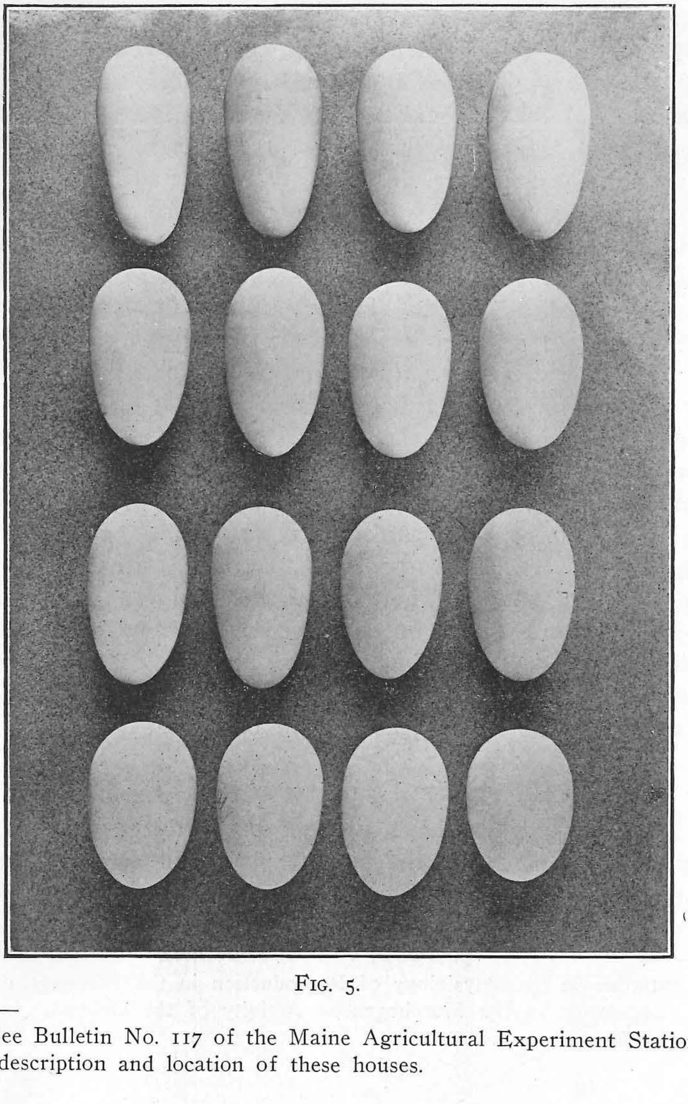

FIG. 5.

*See Bulletin No. 117 of the Maine Agricultural Experiment Station for description and location of these houses.

house is 40x40 feet and contains, besides a main grain storage room, and a loft for the storage of brooders, surplus supplies of fence wire, and other miscellaneous material, an egg sorting and storing room and a fire room in which are placed hot water heaters for providing water for the use of the poultryman and for heating the poultry laboratory. This poultry laboratory occupies the whole north side of the ground floor of the building. It consists of three rooms especially equipped for carrying on experimental studies of a physiological character on poultry. The grain storage house is built in direct connection with House No. 2 and House No. 3 so that there is now an uninterrupted indoor passage way between the extreme ends of these houses.

During the summer of 1908 it was decided to abandon the old heated house belonging to the poultry plant. This house has been described in previous bulletins of the Station under the designation of House No. 1. It has not been used in recent years for any other purpose than the storage of cockerels during the winter months. It was not a satisfactory house for the carrying over of laying birds, nor could it be used as a breeding house. It was turned over to the College of Agriculture of the University of Maine in the summer of 1908. It was then torn down and the material was used in the building of the poultry plant used by the College of Agriculture for instruction work.

This disposition of House No. 1 left the Station plant without any space for the carrying over of any special classes of birds other than what was provided in Houses 2 and 3. It was deemed necessary to have in connection with the plant some sort of house in which sick birds could be isolated from the rest of the flock. To provide for this need a so-called "hospital" house was constructed. This house is 36x16 feet and is divided through the middle by a solid partition. The western half of the house is constructed on the curtain front plan like a single unit of House No. 2 or No. 3 and is used as an isolation pen for sick birds. Whenever any bird in House No. 2 or House No. 3, in an egg laying test, or in any other experiment, appears to the attendant to be ailing in any particular it is at once transferred to this isolation pen. There the progress of the ailment may be watched and treatment given to the bird if it is thought desirable. In any event the danger of spreading a possible infection through the general flock is avoided by this procedure. If the bird recovers its health and returns to an entirely normal condition it may then be taken back and put in its proper pen in House No. 2 or House No. 3.

The eastern half of the "hospital" house is divided into two rooms, both tightly sheathed with matched boards on both walls and ceilings. These rooms are intended for use in the carrying out of experiments of a physiological character with poultry in which it is necessary to confine individual birds in separate cages. At the present time these rooms are being used in a study of digestion in poultry.

In building this "hospital" house a number of features were introduced which differ from the plans followed in the construction of the other poultry houses of the Station's plant. The house is set on 10 concrete posts high enough so that there is from 6 inches to a foot clear space under the floor timbers over the whole of the house. Concrete posts are also used to support the plank walk which runs along the front of the house. It is believed that this arrangement will materially lessen the trouble arising from the rotting out of floor timbers which has always prevailed in the houses where the sills rest on a more or less tight stone wall. An attempt was made in the construction of the "hospital" house to make it rat proof by filling in with cement the space from the top of the sills up to the level of the top of the floor between the outside boarding and the floor timbers clear around the house. This makes a rim of cement around the floor about 4 inches wide and 4 inches deep. It is felt that it will be difficult for a rat to gnaw through this and get into the space between the sheathing and the boarding of the walls. Time alone, however, will tell how successful this scheme is in abating the rat nuisance. This "hospital" house is located about three feet to the west of House No. 2 and in line with it. The appearance of the house is shown in Fig. 6.

A MODIFICATION OF THE STATION BROODER HOUSE.

As has been described in previous bulletins, the Station raises its chickens in small brooder houses. Each one of these houses contains two Peep-O'-Day brooders. While these houses have been found in general to be satisfactory, there are some minor points in which they have not been entirely so.

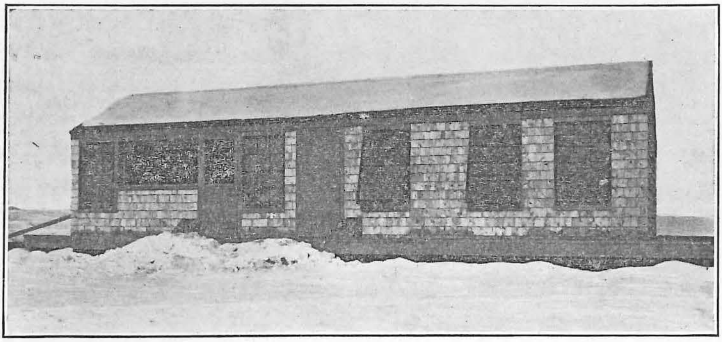

FIG. 6. Front view of new "hospital" house.

What is shown by our experience to be an improvement has recently been made in these houses by providing for better ventilation. When the weather is very hot there is no movement of air within one of these houses, even though the door and windows are open. The air within the house is practically stagnant, and on account of its relatively small volume, becomes intensely hot and stifling when the temperature outside gets high. The effect on the chicks under such circumstances is bad. They retreat to the house to get shade, but only to be injured if not killed entirely by the hot, stifling air of the house. To remedy this difficulty a slot 2 feet long and 1 foot wide has been cut in the back of each house high up under the eaves. This slot is closed with a wooden slide, running in grooves, which is put on the outside of the house. The opening is covered on the inside with a 2″ mesh chicken wire. On very hot days the slide is pulled out completely, so as to expose the whole opening of the slot. At night, or during a period of wet, cold weather, the size of the opening is regulated to suit the conditions. It enables one to keep a current of fresh air through the house in the warmest weather. The effect on the well-being of the chicks during a period of hot weather is most marked and satisfactory. All of the Station's brooder houses have been equipped with these slots.

A NEW TRAP NEST.

All the laying houses of the Experiment Station's plant are equipped with trap nests. Experience showed that the type of trap nest which was formerly used suffered from several rather serious defects so far as accurate experimental work was concerned. It was felt that these defects could be eliminated in another type of nest. During the past year a new and simpler trap nest has been devised which works in a very satisfactory way both in respect to accuracy, certainty, and ease of operation. This new nest has now been installed throughout the plant. A complete description of it is given in a special circular which will be sent to anyone who may apply for it.

Notes on New Methods.

Every progressive poultry plant whether conducted for experimental purposes or commercially is continually trying to improve its methods of management or devising new methods to meet new conditions which may arise. Certain new methods worked out at the Station are deemed of sufficient general interest to warrant description here.

METHODS USED IN PEDIGREE POULTRY BREEDING.

There is an increasing tendency in all stock breeding work to give closer attention to pedigree records than has hitherto been the case. All progress in breeding depends on having carefully pedigreed stock. The importance of this has been generally recognized for the larger domestic animals, like horses and cattle, but it has not been recognized that it is equally important for small animals like poultry. The moment one begins to make any systematic attempt to breed a desired character such as high egg production into a strain of poultry, the keeping of accurate pedigrees becomes absolutely essential. Furthermore such pedigrees must be known for both sides of the ancestry. It is not sufficient merely to take account of the female line and let the male line go, but it is necessary for successful work to know the *individual* ancestors of both sexes. The Experiment Station is carrying on investigations in breeding for egg production. In this work it is necessary to know the individual ancestors of every bird. This is known at the present time for one generation. The band numbers of the mother and the father of every pullet put into the laying houses of the Experiment Station plant in the fall of 1908 are known.

In order to rear poultry of known pedigree it is necessary to have methods particularly adapted to this kind of breeding work.

During the last year special study has been made in the direction of devising such methods and putting them on a practical basis. A bulletin (Bulletin No. 159) has been issued giving a detailed account of the methods and devices which the Station has found to be useful in pedigree poultry breeding. This bulleletin included an account of methods of leg banding newly hatched chicks, of incubating pedigree eggs in such a way as to be absolutely certain of the pedigrees of the chickens when they hatch from the eggs, and of keeping pedigree records in general. Anyone interested in putting his poultry breeding on a strict pedigree basis so that at any time he can tell the ancestry of his birds may obtain this bulletin on application to the Director of the Station.

LIQUOR CRESOLIS COMPOSITUS AS A GERMICIDE AND DISINFECTANT.

There can be no doubt that one absolutely necessary supply about every well conducted poultry plant must be some sort of disinfecting solution. Furthermore, such a disinfectant ought to fulfill satisfactorily several requirements. In the first place, it must be inexpensive. Further, it must be powerful and certain in its action even in dilute solutions. Finally, it must be of such a character as not to injure the birds if it, by accident or design, comes in contact with them. There are a great many commercial disinfectants on the market. Some of the most successful and widely used of these have either a phenol (carbolic acid) or a cresol base. Many of these preparations are excellent and their excellence is attested by their very wide popularity among poultrymen. There is one objection, however, to all of them. That is, that they are relatively expensive. The farmer or poultrymen who uses them pays a good round price for the manufacture of something which he could manufacture himself, the only cost in that event being the cost for the raw materials. With this consideration in mind, it was felt to be desirable to experiment with the making of disinfecting solutions at the Station until one could be found which would combine the advantages which have been mentioned above together with ease and simplicity of manufacture. A number of such experiments were carried out during the past year. No useful purpose will be served by a detailed description of all these experiments, but we may proceed at once to the final conclusion reached, namely, that, on the whole, the *liquor cresolis compositus* of the United States Pharmacopoeia most closely meets the need for an ideal poultry plant disinfectant of anything now available. Experiments carried out by the Bureau of Animal Industry of the Department of Agriculture* have shown that bulk for bulk a solution of *liquor cresolis compositus* made from the least effective kind of cresol is on the average one and a half times as effective a germicide as carbolic acid. The experiments showed that this solution was one of the most powerful known germicides and disinfectants. The experience of the Station shows that in addition to the germicidal value of a cresol solution, it has a very considerable value as a poultry insecticide. It has even been used with satisfactory results to rid hens of lice by direct spraying of the birds. A very small application in spray was found to rid a bird of lice without harmful effect to the bird itself.† Furthermore in the experience of the Station it is, when applied as a spray, very effective in ridding the houses, nests, etc., of lice.

Liquor cresolis compositus, or as it may for convenience be called, cresol soap, may be easily manufactured by any poultryman. The only requisite is a careful attention to the details in the process and a rigid following of the instructions given below. In order to make clear the reasons for the method of manufacture which will be outlined it may be well to give some account of the nature of the substance itself. The active base or cresol soap disinfecting solution is commercial cresol. This is a thick, sirupy fluid varying in color in different lots from a nearly colorless fluid to a dark brown. It does not mix readily with water, and, therefore, in order to make satisfactorily a dilute solution of it, it is necessary first to incorporate the cresol with some substance which will mix with water and will carry the cresol over into the mixture. The commercial cresol as it is obtained, is a corrosive substance, being in this respect not un-

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*McBryde, C. N., The Germicidal Value of Liquor Cresolis Compositus (U. S. P). Bur. Amer. Ind. Bulletin 100, pp. 1-24, 1907.

†We do not recommend this method of ridding birds of lice because of the danger that the bird will take cold as a result of the wetting. This experiment was performed simply to test the value of the cresol solution as an insecticide under the most unfavorable conditions for its action.

like carbolic acid. It should, of course, be handled with great care and the pure cresol should not be allowed to come in contact with the skin. If it does so accidentally the spot should be immediately washed off with plenty of clean water. The price of commercial cresol varies with the drug market. It can be obtained through any druggist. On the day that this is written the quotation on cresol in the New York market is 24c. per pound. In purchasing this article one should order simply "commercial cresol."

Since cresol will not mix with water some method of making it do so must be found if it is to be used as a disinfecting solution. The plan which has been adopted is to make a cresol *soap* which shall be, like other soaps, soluble in water and at the same time carry over into the solution a considerable amount of the cresol. This is done in the following way.

Measure out 4 quarts of raw linseed oil in a 4 or 5 gallon stone crock; then weigh out in a dish 1¾ lbs. of commercial potassium hydroxide or caustic potash, which may be obtained from any druggist at a cost of from 10 to 15 cents a pound. Dissolve this caustic potash in one pint of water; let it stand for at least 3 hours until the potash is completely dissolved and the solution is cold; then add the *cold* potash solution *very slowly* to the linseed oil, stirring constantly. Not less than five minutes should be taken for the adding of this solution of potash to the oil. For 5 hours after mixing the oil and potash mixture (soap) should be stirred thoroughly about once every hour and then left standing for 10 or 12 hours. By the expiration of that time saponification should be complete. The soap should then be stirred and broken up into small pieces and 5¼ quarts of commercial cresol should be added. The soap will slowly dissolve in this cresol. It may take 2 days for complete solution to be effected. The length of time taken in dissolving will depend on the condition of the soap, which in turn varies with different lots of linseed oil. When the soap is all dissolved the solution, which is *liquor cresolis compositus* or cresol soap, is then ready to use. This cresol soap will mix in any proportion with water and yield a clear solution.

As has been said, cresol soap is an extremely powerful disinfectant. In the Station poultry plant for general purposes of disinfecting the houses, brooders, brooder houses, incubators, nests, and other wood work, it is used in a 1 or 2 per cent solution with water. Three tablespoonfuls of the cresol soap to each gallon of water will make a satisfactory solution. This solution may be applied through any kind of spray pump or with a brush. Being a clear watery fluid it can be used in any spray pump without difficulty. For disinfecting brooders or incubators which there is reason to believe have been particularly liable to infection with the germs of white diarrhea or other diseases the cresol may be used in double the strength given above and applied with a scrub brush in addition to the spray.

The first consideration in choosing a disinfectant must be its *effectiveness*. It is a poor sort of economy to use a disinfectant which costs little and will kill few or no germs. Taking into account its effectiveness in dilute solutions, *liquor cresolis compositus* is believed to be one of the best and cheapest germicides and disinfectants available. The Station is using it altogether in its own work, and feels justified in recommending it to poultrymen.

EGG RECORD SHEETS.

The purpose of using trap nests is to obtain records of the performance of individual hens. The records obtained from such work only attain their highest value if they are kept in such form as (1) to be easy of reference, and (2) to combine a maximum of detail with a minimum of space on paper. If large numbers of birds are trap nested it is not feasible to use the house records as the permanent records. The original records made in the poultry house must be transferred to some form of permanent record sheet.

In 1908 the permanent records of egg production were transferred to a loose leaf system in conformity with all other records taken in the poultry work.* A loose leaf record sheet (5″x8″) was designed for the purpose. This sheet is shown in reduced facsimile in Fig. 7. It will be observed that one sheet holds the daily egg record of one bird for one year, together with a considerable amount of pertinent data respecting the egg production of her ancestors, and her own egg production after the pullet year. Spaces are provided for totals and sub-totals at the right hand of the sheet.

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*Cf. Bulletin No. 159.

Maine Agric. Expt. Station.—EGG RECORDS.

HOUSE NO. HATCHED BIRD NO.

PEN NO. VARIETY

DATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	TOTALS	
NOV.																																	
DEC.																																	
JAN.																																	
FEB.																																	
MAR.																																	
APR.																																	
MAY																																	
JUNE																																	
JULY																																	
AUG.																																	
SEPT.																																	
OCT.																																	

RELATION	BAND NO.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	TOTAL
MOTHER														
MOTHER'S MOTHER														
FATHER'S MOTHER														
SUBJECT—2ND YEAR														
SUBJECT—3RD YEAR														

FATHER FATHER'S FATHER REMARKS

MOTHER'S FATHER

FIG. 7. Facsimile of permanent egg record sheet. Reduced about one-half.

For the house records a weekly sheet is used ruled to accommodate 50 birds on each sheet. These sheets are 8½"x15¾" in size. They have a 2" margin on the left for binding. The heading and arrangement of columns on one of these house sheets are shown in facsimile (reduced) in Fig. 8.

House No. ....

Pen No. ....

Variety ....

MAINE AGRICULTURAL EXPERIMENT STATION
DAILY EGG RECORD
YEAR LETTER

WEEK BEGINNING

D—DEAD
B—BROODY
O—RELEASED
M—MOULT BEGUN
X—BROKEN EGG

	BIRD NUMBER	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY		

FIG. 8. Facsimile of weekly house egg record sheet. Reduced.

The additional columns at the right of this sheet are for inserting notes. At the bottom of the sheet lines are provided for eggs laid on the floor, and for daily totals. The band numbers of the birds are put in on these sheets with a hand numbering machine.

SEASONAL DISTRIBUTION OF EGG PRODUCTION.

It is, of course, a well known fact that egg production is not distributed equally over all seasons of the year. In general there is a tolerably close accord between egg production and the four seasons of the year—spring, summer, fall and winter. The usual relation in the northern part of the country is that pullets hatched in the spring begin to lay sometime in the late fall, and lay more or less well during the winter according to a variety of circumstances. In the early spring they begin to lay heavily and keep this up usually throughout the spring. In the summer the egg production drops off and, finally, in the fall, molting occurs and the production drops very low during the early fall months. The details regarding the seasonal distribution are well brought out if the average production for each month of the year be plotted as a polygon. Such a diagram has been prepared for this bulletin and is shown in Fig. 9. This polygon is based on

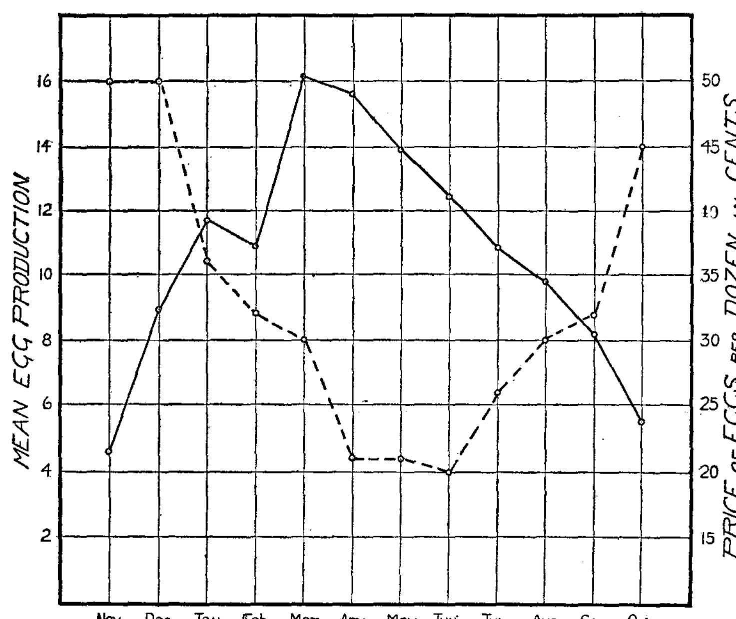

FIG. 9. Diagram showing the average egg production in each month of the year based on nine years' trap nest records. The egg production curve is given by a solid line. The dotted line represents the average maximum New York price of eggs for each month of the year 1907 as taken from the Crop Reporter. The scale of egg production is given on the left hand margin of the diagram. On the right hand margin is given the scale of egg prices in cents per dozen.

the Station's egg records collected during the past nine years. The average production for each month as plotted in the diagram is the weighted mean production for that month based on all the normal records which exist at the Station. In calculating these general means the average egg production for a particular year is weighted according to the number of birds which were trap nested that year, or, in other words, according to the number of birds which made the average.

This diagram shows that beginning with an average production of between 4 and 5 eggs in November the line rises rather sharply to an average production of nearly 12 eggs per bird in January. The line drops slightly in February, then rises very sharply to a maximum of a little more than 16 eggs per bird for the month of March. From March on the line drops very steadily, forming almost a straight line until it reaches a low point in October. There is a slight deviation of the line upward in August and September marking a summer rise in egg production.

It has been thought a matter of some interest to plot on this same diagram with the average monthly egg production line, a line showing the price of eggs in the same months. This price curve is given by the dotted line and is based on New York market quotations for the year 1907 taken from the April, 1908, Crop Reporter. It will be seen that as is to be expected, the price line looks very much like the egg production line turned upside down. In the months when the egg production is high, the price of eggs is low, and *vice versa*. It is of interest to note that while the general form of the price curve is similar to that of the production curve turned upside down, yet there is a lag of the price curve behind the production curve. The explanation of this lag, of course, lies in such factors as rate of shipment, movement of cold storage eggs, and similar things.

It is usual to attribute the most strikingly marked features of such egg production curves as that given in Fig. 9 to climatic influences. It is commonly said that when it begins to warm up in the spring the hens begin to lay better and the relationship between climate and egg production is thought to be a causal one. There is a tacit assumption that it is *because* it gets warmer in the spring that the hens lay more eggs in the spring.

As a matter of fact there is strong evidence to show that the shape of the egg production curve is based upon deep-seated biological factors rather than directly on these climatic changes. It is not the place here to go into an extensive discussion of the evidence on this point. Such evidence will be presented later in another publication.

Whatever the cause of the unequal seasonal distribution of egg production may be, the fact of its existence must be granted by all. If this fact be granted it immediately raises the question as to whether it will not be advantageous in studying the problem of egg production in general to endeavor to use a time unit which conforms to the natural periodicity displayed by hens. In recent years it has been the custom in the discussion of egg production to make the unit one year. This custom has been followed in the work of this Station; in the egg-laying competitions in South Australia, which have excited world-wide interest, and by many other institutions and experimentors. It is safe to say, however, that all experimentors and students of the subject of egg production have felt that the year was not in all respects an ideal unit for such studies. A serious objection to it is immediately apparent if one makes a close study of individual egg records. The total number of eggs laid by a bird in a year gives an inadequate and incomplete idea of her egg producing ability. Birds which make the same yearly total records are by no means always equivalent as egg producers. This fact can be easily shown by examples taken from the Station's individual trap nest records. Some such illustrative examples are shown in Table I. In this table are given the monthly egg records of four individual birds, each of which was an unusually high producer. In addition to the egg records there are given also (1) the price of a single egg in each month of the year based as before on the 1907 New York market quotations taken from the Crop Reporter, and (2) the total worth of the eggs laid by each hen in each month calculated on the basis of these prices.

TABLE I.

Table Showing the Distribution of Egg Production and the Worth of the Eggs Laid by Four High Producing Hens.

Laying—Bird No. 7.	Price per egg.	Total worth of eggs.	Laying—Bird No. 46.	Price per egg.	Total worth of eggs.	MONTH.	Laying—Bird No. 379.	Price per egg.	Total worth of eggs.	Laying—Bird No. 505.	Price per egg.	Total worth of eggs.
0	$4\frac{1}{6}$c	0	0	$4\frac{1}{6}$c	0	November....	15	$4\frac{1}{6}$c	.625	0	$4\frac{1}{6}$	0
0	$4\frac{1}{6}$c	0	21	$4\frac{1}{6}$c	.875	December....	19	$4\frac{1}{6}$c	.76	19	$4\frac{1}{6}$	.76
15	3c	.45	22	3c	.66	January......	13	3c	.39	19	3c	.57
18	$2\frac{2}{3}$c	.48	21	$2\frac{2}{3}$c	.56	February.....	16	$2\frac{2}{3}$c	.43	20	$2\frac{2}{3}$	.53
25	$2\frac{1}{2}$c	.63	20	$2\frac{1}{2}$c	.50	March	20	$2\frac{1}{2}$c	.50	2	$2\frac{1}{2}$	.05
25	$1\frac{3}{4}$c	.44	21	$1\frac{3}{4}$c	.37	April.........	26	$1\frac{3}{4}$c	.455	19	$1\frac{3}{4}$	.33
31	$1\frac{3}{4}$c	.54	15	$1\frac{3}{4}$c	.26	May..........	14	$1\frac{3}{4}$c	.245	22	$1\frac{3}{4}$	.385
28	$1\frac{2}{3}$c	.47	21	$1\frac{2}{3}$c	.35	June	18	$1\frac{2}{3}$c	.30	28	$1\frac{2}{3}$	.47
24	$2\frac{1}{6}$c	.52	7	$2\frac{1}{6}$c	.15	July	15	$2\frac{1}{6}$c	.325	27	$2\frac{1}{6}$	.585
8	$2\frac{1}{2}$c	.20	11	$2\frac{1}{2}$c	.275	August.......	14	$2\frac{1}{2}$c	.35	23	$2\frac{1}{2}$	.575
19	$2\frac{2}{3}$c	.51	8	$2\frac{2}{3}$c	.21	September ...	15	$2\frac{2}{3}$c	.40	13	$2\frac{2}{3}$	.35
0	$3\frac{3}{4}$c	0	17	$3\frac{3}{4}$c	.64	October	18	$3\frac{3}{4}$c	.675	12	$3\frac{3}{4}$	.45
193		$4 24	184		$4.85		203		$5.455	204		$5.055

Let us consider first the two hens whose records are given in the left hand half of the table. Bird No. 7 laid in her pullet year (November 1 to November 1) 193 eggs. In the same period bird No. 46 laid 184 eggs, that is, 9 less. In spite of the fact that No. 46 laid 9 fewer eggs than did bird No. 7, her eggs were worth 61 cents more in the year. The reason for this somewhat paradoxical fact that the hen that laid the smaller number of eggs was the more valuable, obviously arises from the fact that bird No. 46 laid more eggs when the prices were high than did bird No. 7. Bird No. 7 was an extremely poor winter layer. On the other hand bird No. 46 was a fairly good winter layer.

A similar relation is shown by the two birds in the right hand half of the table. Bird No. 379 laid in her pullet year 203 eggs while bird No. 505 laid 204 eggs. No. 379's 203 eggs were worth on the basis of the prices used, $5.46, whereas bird No. 505's 204 eggs were worth only $5.06—a difference of 40 cents in the cash production of the hens during the year. This result again is due, as is apparent from a detailed examination of the table, to the fact that No. 505 was a poor layer when prices were high and only succeeded in making her high total record by laying at a time of year when eggs were worth very little. It is instructive to compare No. 379's record with that of No. 7. No. 379 laid 10 more eggs in the year than did No. 7. No. 379's eggs were worth, however, $1.22 more. In other words, the 10 extra eggs laid by No. 379 were worth on the basis of these figures rather better than 12 cents apiece.

The figures given in this table show how important from a purely commercial standpoint is a consideration of the *distribution* of egg production as well as of *total* egg production. In the breeding work of this Station it is felt to be very important, indeed absolutely necessary, to consider something besides total yearly records. The Station is endeavoring in its work to learn how to breed *winter* layers. In order to make any progress in this direction it is obviously necessary to consider the detailed figures for winter production as well as the figures for total production. Nothing is more certain than that a 200-egg hen is not necessarily a particularly good winter layer. Birds No. 7 and No. 505 given in Table I are examples in point. It would be possible to take from the Station's records many birds whose yearly record would not exceed 160 eggs yet which were better winter layers than either No. 7 or No. 505, both of which fall for practical purposes in the category of the 200-egg hen.

Moved by these circumstances it has been decided to adopt a new set of units in future discussions of egg production records in the work of the Station. It is impossible at this place to go into an extensive discussion as to the biological reasons for finally deciding upon the units which have been chosen. The plan which is now followed in the discussion of the egg production work here is to break the year up into four parts. The first of these includes the months of November, December, January and February. Broadly speaking this period is thus seen to be the period of winter laying. The second period includes the months of March, April and May. This broadly speaking obviously corresponds to the breeding season. The third period includes the months of June, July and August and is clearly the summer period. Finally, the fourth period includes the months of September and October and is the period in which molting and its associated drop in egg production commonly occur. In future discussions of egg production it is proposed to consider separately the egg production in each of these periods. By this method it will be possible to compare for example the production in the winter laying period of different lots of birds, or their ability to lay during the breeding season, and so on.

THE MEASUREMENT OF EGG PRODUCTION.

It has been shown in the previous section that the total yearly production of a hen is not always the most desirable measure of her egg producing capacity. A little consideration of the matter will show further that no absolute figures whatever are so significant as a measure of egg production as are relative figures. In making any statement regarding the egg producing ability of a hen the time unit discussed must always be held in mind. This is apparent enough in the ordinary treatment of the subject. When one speaks of a "200-egg hen" the implication is that a hen is meant that laid 200 eggs in 365 days. Almost any hen will lay 200 eggs if allowed long enough time in which to make the record. The time factor must always be taken account of in egg production work. It seems desirable to take explicit account of this factor by making the time involved an integral part of the measure of egg production used. The simplest method of doing this is to put all records of production on a relative or percentage basis. This may be done according to the following rule. *The measure of an individual hen's egg production in any given time may be taken to be the percentage which the number of eggs actually laid is of the maximum number of eggs which might have been laid by the individual in this given length of time, assuming the production of one egg a day to be the maximum of which a hen is capable.* According to this rule if a hen lays 20 eggs in the month of June (30 days) this hen's egg production is 66 2-3 per cent for that month. Or again if a hen lays 31 eggs in the months of December and January (62 days) she would have a 50 per cent record in egg production for those months. Such a rule as this puts all egg records on a comparative basis. It will be recognized that this is a great advantage for the purpose of scientific discussion. On any other basis no records are strictly comparable which do not cover equal and the same periods of time.

In order to facilitate the calculation of such relative or percentage egg records Table II has been prepared. The purpose of this table is to show the number of days from (and including) the first day of any given month in the year to (and excluding) the first day of any other month. On the assumption that the maximum possible productivity of a hen is one egg a day the values in Table II give the maximum possible egg production for any specified period of a year. These figures then may be used in calculating the percentage egg production.

TABLE II.

Table Showing the Maximum Possible Number of Eggs Which Can be Laid Between the First Day of Any Given Month in the Year and the First Day of Any Other Month, Assuming (a) that 1 Egg Per Day is the Maximum Rate, and (b) that February has 28 Days.

From \ To	November 1.	December 1.	January 1.	February 1.	March 1.	April 1.	May 1.	June 1.	July 1.	August 1.	September 1.	October 1.
November 1	0 365	30	61	92	120	151	181	212	242	273	304	334
December 1	335	0 365	31	62	90	121	151	182	212	243	274	304
January 1	304	334	0 365	31	59	90	120	151	181	212	243	273
February 1	273	303	334	0 365	28	59	89	120	150	181	212	242
March 1	245	275	306	337	0 365	31	61	92	122	153	184	214
April 1	214	244	275	306	334	0 365	30	61	91	122	153	183
May 1	184	214	245	276	304	335	0 365	31	61	92	123	153
June 1	153	183	214	245	273	304	334	0 365	30	61	92	122
July 1	123	153	184	215	243	274	304	335	0 365	31	62	92
August 1	92	122	153	184	212	243	273	304	334	0 365	31	61
September 1	61	91	122	153	181	212	242	273	303	334	0 365	30
October 1	31	61	92	123	151	182	212	243	273	304	335	0 365

An example will show the use of this table: Suppose a hen laid 84 eggs between March 1 and July 1. What would be its percentage production? A glance at the table shows that from March 1 to July 1 there are 122 days. To determine the percentage production we have then $(84 \times 100) \div 122 = 68.9\%$. Similar calculations may be made with equal ease for any other period of a year.

FIELD EXPERIMENTS IN 1906-8.

CHAS. D. WOODS and J. M. BARTLETT.

In addition to the field experiments conducted by the Plant Pathologists of the Station and reported in bulletins 149 and 164, a number of co-operative field experiments were planned and carried out by the writers during the years 1906-8. Some of these experiments, notably, test of varieties of potatoes for blight resistance and yield and a modified ridge *versus* the high ridge culture ordinarily practiced in Aroostook County, are to be continued.

EXPERIMENTS WITH FERTILIZERS ON POTATOES IN 1906.

The object of this experiment was to compare home mixed fertilizers with ready mixed goods using the same amount of plant food as nearly as possible in each case.

The field selected for the purpose was on the "Kenney Farm," so called, about 3 miles from Houlton village, and planted this season by Mr. W. S. Blake, through whose courtesy the Station was allowed to make its experiment. The field was an old one and had been cultivated for many years and this season was planted to potatoes for the second crop since the land was in grass, the piece yielding about 100 barrels to the acre in 1905. The land was high, naturally well drained, and the soil was somewhat finer than most of the potato lands, quite free from stone and apparently sufficiently uniform to make the different plots favorable for comparing different kinds of fertilizers. Fourteen acres were used in all for the experiment, being divided into plots of one acre each.

For a mixed fertilizer Watson's High Grade Potato Fertilizer was used and the home mixed goods were made according to the following formulas.

Home mixed formulas used for one acre in 1906.

INGREDIENTS.	NUMBER OF FORMULA.			
	1	2	3	4
	Pounds.	Pounds.	Pounds.	Pounds.
Nitrate of soda	100	175	100	100
Screened tankage	200	400	-	200
Dried blood	160	-	300	160
Acid phosphate	600	600	600	600
Sulphate of potash	160	160	160	320

Plant food per acre furnished by fertilizer used in 1906.

	Nitrogen.	Phosphoric Acid.		Potash.
		Available.	Total.	
	Pounds.	Pounds.	Pounds.	Pounds.
Formula No. 1	48	98	122	80
Formula No. 2	48	112	154	80
Formula No. 3	48	84	90	80
Formula No. 4	48	98	122	160
Watson's Improved	48	108	150	76

The field was planted May 19-26 to Green Mountain potatoes and about two-thirds of the fertilizer used, 1000 lbs. of the Watson and 800 lbs. of the home mixed to an acre, was applied at this time. On June 11 to 14 when the potatoes were just breaking the ground the remainder of the fertilizer was put on, making up the plant food equivalent to 1500 lbs. of Watson's fertilizer or in round numbers about 45 pounds of nitrogen, 90 pounds available phosphoric acid and 80 pounds of potash except on plot 14, where the potash was doubled, making 160 pounds to the acre. The second application was made with the potato planter, the plow being removed. During the growing season the field was thoroughly tilled and sprayed but suffered considerably from the hot, dry weather in August and early September, which stunted the growth of the tubers. On September 14th harvesting was begun as more than half of the tops were dead and growth of tubers had practically ceased. No late blight or rot was found on the piece.

The yield of tubers for the different plots is shown in the following table. The variations in the yields are chiefly due to slight variations in the soil of the plots, as for instance No. 5 was on the highest portion of the field and suffered a little more from drought than its neighbors and No. 12 contained a low wet spot which reduced the yield.

Arrangement of acre plots and yield of merchantable potatoes per acre.

Number of Plot.	Kind of Fertilizer.	Yield of Potatoes—bbls.*
1	Watson's	89
2	Formula No. 1	89
3	Watson's	91
4	Formula No. 2	90
5	Watson's	86
6	Formula No. 3	98
7	Watson's	101
8	Formula No. 1	102
9	Watson's	98
10	Formula No. 2	100
11	Watson's	98
12	Formula No. 3	91
13	Watson's	103
14	Formula No. 4	105

Average yield with Watson's improved..	95	barrels per acre
Average for formula No. 1	95½	barrels per acre
Average for formula No. 2	95	barrels per acre
Average for formula No. 3	94½	barrels per acre
Average for formula No. 4	105	barrels per acre

Formula No. 4 with double the amount of potash gave 10 bbls. more potatoes than the average, but the increase in yield cannot be attributed to the extra potash but more properly to the soil of the plot which was about the best in the field for a dry season, and it will be noticed that No. 13 yielded only 2 barrels less and it was not quite so good a plot as regards location.

*One barrel equals 2.75 bushel.

High Ridge vs. Modified Ridge Culture for Potato Growing.

The method of ridge culture is almost universally used by potato growers in Aroostook County. Probably over 90 per cent of the farmers practice what might be called extreme ridge culture, that is, the ridging begins at the time of planting. The planter most used has a plow so constructed that it makes little more than a mark on the soil unless it is very light, instead of a furrow, then the disks at the rear of the machine cover the seed by throwing up a ridge perhaps four inches high so that the seed at the very start is practically on a level with the surface between the rows. A few farmers make a practice of going over the field with a weeder and somewhat flattening the ridge, but the number that do this is comparatively few. The method most usually followed is to go between the rows with the cultivator perhaps 8 to 10 days after the potatoes are planted and then as soon as they begin to break the ground go over with the horse-hoe and bury them up, also burying the weeds at the same time and thereby raising the height of the ridge. This kind of cultivation is continued until the tops are too large to pass through without injury. By this time an A-shaped ridge has been formed about 12 to 15 inches high and, of course, the surface between the rows has been dropped by the continual scraping up of the dirt so that the tubers growing in the ridge are considerably above the surface between the rows.

It can be readily seen that in a dry season a field so handled must suffer considerably from lack of moisture. Of course, in a wet season as is frequently experienced in Aroostook County no lack of moisture is felt and the drains between the rows are an advantage rather than an injury, but in an extremely dry season it would seem that the drainage is too great. The ridges being high and narrow dry out very quickly and it would appear therefore that the crop must suffer more from lack of moisture than it would if the roots of the plants were below the level as they are when modified level culture is practiced.

The two dry seasons of 1905 and 1906 were somewhat disastrous to potato fields cultivated with the high ridge and the crop was considerably below a normal crop in the dry sections of the county. For this reason the experiments here reported were undertaken in 1907 for the purpose of comparing a more nearly level culture such as is practiced in southern New England and some dryer sections of the country with the ridge method common in Aroostook County.

Mr. Oscar A. Benn, who lives a short distance out of Houlton, has practiced a modification of a ridge and level culture for several years and reports it as successful. He plants the seed as deep as possible with a Robbins planter and keeps the field free from weeds by frequently going over it with the weeder, in three different directions—crosswise, lengthwise and diagonally. In this way he claims to keep the weeds down during the first stages of growth without injury to the plants more cheaply than he can by the ridge method. The weeder is used until the plants get too high for a weeder, then the cultivator is run between the rows until the plants are 8 to 9 inches high. At this time the horse-hoe is used to throw up a low ridge which is broader and flatter on the top than the ordinary ridge and is not more than half as high. The horse-hoe is used only once and this is usually the final hoeing of the field. Mr. Benn claims that the potatoes are more easily taken care of by this method; more easily harvested, and in a season that is at all dry, better crops are obtained than by the method of ridging.

The experiments here reported were carried on practically by Mr. Benn's method. It was not thought best to attempt to use strictly level culture, as the planter in common use in the county does not put the seed sufficiently deep for a perfectly level culture and it was not thought that potatoes could be as easily harvested by the digger that is in common use.

EXPERIMENT IN 1907.

The season of 1907 proved an extremely wet one and unfavorable for this experiment so that the modified method of ridge culture could not be strictly followed. Six acres on the farm of Mr. John Watson, Houlton, were given to the experiment, three acres being used alternately for the modified ridge and three check plots were cultivated by the method of high ridge.

The piece was planted May 24 and 25 and a few days after the weeder was run crosswise over the field, which very nearly leveled the ground on the level culture plots and left the potatoes covered about 3 inches. Five days later, the level culture plots were again gone over lengthwise with the weeder and June 10 the weeder was run lengthwise over them. In the meantime it had been found necessary to run the cultivator between the rows. June 10 the potatoes were just appearing above the surface of the ground and on account of abundant rains they grew very rapidly and the tops were so tender that it was not deemed wise to again run the weeder through them and cultivation was restricted to hand hoes and cultivation between the rows. Two hand hoeings were deemed necessary for these plots. When the tops were about 4 inches high the horse-hoe was run over them, throwing up a ridge wider and flatter than the ordinary ridge used and not more than half as high. Otherwise than the cultivation the plots were treated the same as the check plots and harvesting was begun September 30 with the results shown below.

The yield on plot 2 is much below the others but this was apparently not due to the method of culture but to the soil. There was a strip of several rods on the upper part of this lot where the tubers were very scabby and only a light yield was obtained. This condition extended slightly into plot 3, reducing the yield of that plot somewhat but not nearly to such an extent as on plot 2. For this reason in a comparison plot 2 should be omitted.

Yield Per Acre for Each Plot. 1907.

No. 1.	No. 2	No. 3	No. 4.	No. 5	No. 6
Full ridge	Modified ridge	Full ridge	Modified ridge	Full ridge	Modified ridge
133.0 bbls	85.9 bbls.	108 bbls.	112 bbls.	113.3 bbls.	129 bbls.

Average for full ridge culture..................	118 barrels
Average for modified ridge culture, all 3 plots....	109 barrels
Average for modified ridge culture, plots 4 and 6..	121 barrels

EXPERIMENT IN 1908.

For the modified culture experiment this year 90 rows, nearly three acres, were planted on new land on the northwest part of Mr. John Watson's farm in Houlton. The plan of planting in a solid piece instead of in strips as in 1907 was adopted for convenience in cultivating early in the season when it is desirable to run the weeder and smoothing harrow crosswise to keep down the weeds. Check acres for comparison were planted in the ordinary way, on either side of the piece planted by the modified culture method. The first check acre and 56 rows of the modified ridge culture plot were planted May 24 to 26, but on account of rain the remaining 34 rows and the other check acre were not planted until June 2. The Robbins planter was used to plant the field and for the modified ridge culture plot it was set to plant as deeply as possible, the seed being on the average 3 inches below the surface of the ground after leveling the ridge off. As soon as the planting was completed the smoothing harrow was run crosswise to level off the ridges formed by the planter. A few days later the weeder was likewise run over the piece to destroy any weeds that were starting. On June 22 the rows first planted were up and the cultivator was run between them, followed by the weeder two days later. This method of culture was continued each week until the plants were about 6 inches high when the weeder was discontinued and the cultivator set wide so as to run as near the plants as possible was run over the piece twice a week. On July 7 the horse-hoe set wide so as to throw up only a low, wide ridge was run over the piece. Work with the cultivator was continued and again on July 15 the horse-hoe was employed to disturb the earth around the plants and conserve the moisture. At this time the tops were getting large and cultivation was discontinued. July 20 the field was visited and the potatoes found to be growing finely, very free from weeds and apparently not suffering from the quite severe drought we were having. Sufficient rain, however, fell early in August to warrant a good crop with all kinds of culture. About September 15 killing frosts stopped further growth and digging was begun on the 18th. The yields were as follows:

	Merchantable Barrels.	Total Barrels
High ridge check plot*	114	118
Modified ridge, 3 acres	328	341
High ridge check plot	97.5	101.5
Average for check plots	105.8	109.5
Average modified culture plots	109.3	113.3

The averages for the 2 years (omitting plot 2 of 1907 experiment) are:

*The plots were strictly comparable as to area but were a little less than an acre each.

High ridge culture	114 barrels
Modified ridge culture	117 barrels

In these two seasons there was nothing to choose between the two methods so far as yield was concerned. It is planned to continue this experiment on the same farm in 1909.

A TEST OF BLIGHT RESISTANT VARIETIES OF POTATOES.

About 1903 Prof. William Stuart of the Vermont Experiment Station began a study of disease resistant potatoes. After some little progress had been made, the scope of the investigation was enlarged and extended in co-operation with the Bureau of Plant Industry of the U. S. Department of Agriculture. In 1904, Prof. L. R. Jones, the Botanist of the Vermont Station, was in Europe as special agent of the Department of Agriculture and made a study of the blight resistant varieties of potatoes that were in cultivation in England and on the continent, particularly in Germany and Holland. A large number of the more promising varieties were brought to America and were grown for 3 years at the Vermont Experiment Station in co-operation with the Bureau of Plant Industry. Quite a number of American varieties were grown in comparison with the European varieties.

Twenty-seven of these varieties which seemed to be the most hopeful were sent to this Station in the spring of 1908 for testing as to their disease resistance in the Maine climate. There was also grown in comparison with these, a selected Green Mountain which Mr. J. W. Lowell of Gardiner originated by selection over a period of several years. The numbers with the exception of that given to the Lowell Green Mountain are the original Vermont Station numbers.

The numbers included between 501 and 517 originated in Germany, 523 in Holland, the numbers between 540 and 597 were all of English origin, and the others are of American origin. The amount of seed that was sent varied so greatly (from 10 pounds to 120 pounds) that it was not practicable to grow these varieties for a yield test. They were therefore grown to study their blight resistant qualities and to form as one best might a judgment as to the value of the variety from the apparent crop yield, size, smoothness, general appearance and cooking qualities of the tuber.

The seed was planted May 18 and 19 on Mr. John Watson's farm, Houlton. Before planting all the seed was treated with formaldehyde gas for scab fungus. The seed of each variety was divided into two equal portions, and one portion of each kind was planted on a field which was not to be sprayed, and the other portion on a field which was to be sprayed with Bordeaux mixture in the usual manner.

In the season of 1908, there was no late blight in the county but early blight was quite prevalent in some places and manifested itself on some of these potatoes. The crop was harvested September 24 and 25, 1908.

As a result of the test, 14 of the varieties have been discarded as unsuited to Maine. Seed has been saved of the following numbers,—506, 511, 512, 517, 540, 542, 594, 596, 602, 610, 736, 4229, 4517 and Lowell's Green Mountain. It is proposed to plant these both for blight resistance and for yield tests on the John Watson farm in the season of 1909. Each variety will be divided as in 1908 into two portions and part will be planted in a field that is to be sprayed and part in a field that is to be left unsprayed.

In the table which follows, there are given the notes and observations made during the season of 1908. The observations upon growth and upon the quality of tubers are made entirely upon the crop from the unsprayed field.

VARIETIES TESTED.

501 *Sophie.* Seed small white potatoes which being planted on the outside row did not have quite so good a chance as the others. Vines strong growing and showed very little injury and practically no early blight until frost. The yield was rather poor of small potatoes.

Cooking test: Boiled, quite dry and mealy. Baked, rather wet. Flavor, good.

505 *Irene.* Seed received, 60 pounds small red potatoes. Vines were vigorous and showed very little injury from early blight. Yield small and rather inferior potatoes.

Cooking test: Boiled, quite dry and mealy. Baked, quite dry and mealy. Flavor, very good.

506 *Professor Maercker.* Strong grower, vines showed very little injury, some tip burn but no early blight until very last of season. A good yield of large white tubers.

Cooking test: Boiled, quite dry and mealy. Baked, quite dry and mealy. Flavor, very good.

507 *Silesia.* Vines grew vigorously until about middle of August, showing no injury. About August 11 they showed some tip burn. On

August 20 they showed considerable injury and some early blight but continued green until frost. Quite good yield medium sized white potatoes.

Cooking test: Boiled, quite dry and mealy. Baked, fairly dry. Flavor, good.

508 *Max Eyth.* Very healthy and vigorous grower, showing very little injury from early blight or tip burn. Yield light, rather small red potatoes.

509 *Mohort.* Began to show early blight and tip burn August 8 and by August 20 showed considerable blight. The vines however were vigorous and a part of the tips kept green until frost came. Gave fair yield of medium sized white potatoes.

Cooking test: Baked, rather soggy. Flavor, not very good; rather strong.

511 *President Kruger.* On August 8 the vines showed some tip burn and August 20 considerable early blight. They were large and vigorous however and a part of the tops remained green until killed by frost. Yield was fairly good, medium sized round white potatoes.

Cooking test: Baked, quite dry; fine grained. Flavor, good.

512 *Professor Wohltmann.* Vines were quite vigorous growers but showed more or less tip burn and some early blight. Gave fair yield of medium sized red potatoes.

Cooking test: Baked, not very dry. Flavor, good.

516 *Fuerst Bismark.* Showed some tip burn and early blight on August 8 and considerable on August 20 but some of the vines kept green until frost.

Cooking test: Baked, quite dry and mealy. Flavor, quite good.

517 *Apollo.* Large white good looking potatoes. Good yield.

Cooking test: Boiled, quite dry and mealy. Baked, quite dry and mealy. Flavor, good.

523 *Daisy.* Very strong and healthy. Showed practically no blight. Vine very green when frost came. Lot of small potatoes not ripe. Too late for this climate.

540 *Factor.* Good strong vines showing very little blight. Good yield large white potatoes.

Cooking test: Boiled, quite dry and mealy. Baked, quite dry and mealy. Flavor, good.

642 *Langworthy.* Good strong growing vines that showed no injury until late in the season when some early blight was noticeable. September 1 a larger part of the tops remained green and tubers growing until frost killed the vines. Yield fair of medium sized white potatoes.

594 *Evergood.* On August 8 this variety showed some vine injury and on August 20 considerable injury and early blight which continued to increase to end of season, somewhat reducing the yield. Fair yield of small white potatoes.

Cooking test: Boiled, quite dry and mealy. Baked, not very dry. Flavor, good.

595 *Goodfellow.* A strong vigorous grower and showed very little vine injury until the very last of the season. It was affected by the light

early frosts and had some early blight. Small yield of medium to small white potatoes.

Cooking test: Boiled, quite mealy. Baked, rather wet. Flavor, fair.

596 *Up-to-date.* Strong, vigorous grower and showed practically no injury until frost. A large yield of good sized smooth white round potatoes.

Cooking test: Boiled, fairly dry. Baked, not quite as good. Flavor, quite good.

597 *North Star.* Vines quite healthy and vigorous but showed some injury and early blight on August 20. Vines mostly remained green until frost. Yield not very good. Potatoes small, not ripe and clinging to the vines. Too late for this climate.

Cooking test: Boiled, quite dry and mealy. Baked, quite dry and mealy. Flavor, good.

602 *Cambridge Russet.* On August 8 this variety showed some tip burn but was quite healthy. On August 20 it showed very little early blight but on August 28 it showed a good deal of early blight and the two rows could be easily detected on the unsprayed plot while the sprayed was green. On September 9 vines were dead but on sprayed portion still green. Yield fairly good, medium sized white potatoes. The potatoes were larger and better on the sprayed plot than the unsprayed.

Cooking test: Boiled, dry and mealy. Baked, dry and mealy. Flavor, very good.

610 *Blight Proof.* Vines very healthy and showed very little injury up to coming of frost. Fair yield of large round and handsome potatoes. A desirable variety.

Cooking test: Boiled, dry and mealy. Baked, dry and mealy. Flavor, very good.

617 *Late Blightless.* Tops vigorous and showed very little injury. Yield fair but not ripe. Potatoes rather small. Too late for this climate.

637 *Alexander No. 1.* Vines healthy and vigorous, large top. Yield good, of good sized red potatoes but not very ripe.

652 *Professor Maerker.* Vines vigorous and strong; showed very little injury. Yield not very large. Potatoes white, medium size, not ripe, clinging to vines.

Cooking test: Boiled, fair quality. Flavor, fair.

736 *Smith's Blight Proof.* Showed a little early blight last of the season but generally healthy. Fair yield, good sized white potatoes.

Cooking test: Boiled, only fairly good. Baked, only fairly good. Flavor, fair.

4229 *Lawrence Seedling.* Tops were vigorous and strong and showed very little injury from early blight. Yield very large, round reddish-colored potatoes. A desirable potato except for color and its deep eyes.

Cooking test: Boiled, dry and mealy. Baked, dry and mealy. Flavor, good.

4518 *Rust Proof.* Vines remained vigorous and showed very little early blight up to time of frost. Yield good, large round white potatoes.

Cooking test: Boiled, quite mealy; baked, quite mealy; flavor, fair.

28 *Lowell's Green Mountain.* The vines remained nearly free from any injury and were very little affected by early b'ight. It suffered less than unselected Green Mountains which were sprayed. Yield was good on both the sprayed and the unsprayed.

Cooking test: Boiled, quite dry and mealy. Baked, quite dry and mealy. Flavor, good.

Target Brand Fungicide on Potatoes.

At the request of the Horticultural Distributing Company of Martinsburg, W. Va., the Station undertook an experiment with potatoes in which the Target Brand Fungicide was to be used in the place of the Regular Bordeaux Mixture.

The following were the essential points in the agreement which were entered into between the Experiment Station and the Company.

Three-acre strips shall be used in the experiment. These plots shall be adjoining each other. The character of soil, preparation (including fertilizer), planting, cultivation, etc., shall be uniform on all three plots except: Plots A and C shall be sprayed with Regular Bordeaux Mixture and on same date Plot B shall be sprayed with Target Brand Fungicide.

The Bordeaux Mixture and the Target Brand Fungicide will both be applied with a Watson Improved 4-rowed automatic sprayer, and so far as possible, equal number of gallons of each shall be applied per acre and on same dates.

The Director of the Maine Agricultural Experiment Station personally or by a competent representative shall supervise all the work, including spraying and harvesting.

The American Horticultural Distributing Company may send a representative to observe any or all of the details of the experiments.

The American Horticultural Distributing Company shall deliver free of charge at Houlton, Maine, the fungicide necessary for use on Plot B and shall deposit with the Houlton Trust Company of Houlton, Maine, one hundred and twenty-five ($125) dollars to be paid in part or entirely to the owner of the field when the experiment is concluded provided injury is done to the potatoes which injury is due to the use of the Target Brand Fungicide.

Whether or not there is injury shall be determined:

(a) If the yield of merchantable potatoes upon plot B shall be less than the average yield (Plots A plus C ÷ 2) upon plots A and C, the injury shall be in proportion to the decrease in yield at market price in Houlton on December 1, 1908.

(b) If the quality of the potatoes grown upon Plot B shall be inferior so as to affect the market value, the injury shall be considered as due to the fungicide and the financial loss shall be decided by one or three of the large buyers of potatoes in Houlton.

In any case the Station shall have the right, if it desires, to publish the results of the experiment.

The following letter was sent October 6, 1908, to the company reporting the results of the experiment:—

"We have harvested the potatoes on the acre upon which fungicide was used and upon the two acres grown upon either side. There was no late blight in the county this year. You may remember that the Target Brand Bordeaux which you sent to us was not received until very nearly time to use it and in consequence of this it was impossible for us to use the Quick Bordeaux which you sent to us, and the experiment was wholly with the Target Brand Fungicide and did not include the Quick Bordeaux. The yields were as follows:—

Fungicide plots:	merchantable potatoes	103 barrels
	small potatoes	6 barrels
	Total	109 barrels
Check plot to the south:	merchantable	122 barrels
	small	5 barrels
	Total	127 barrels
Check plot to the north:	merchantable	118 barrels
	small	4 barrels
	Total	122 barrels

The average merchantable potatoes on the two check plots was 120 barrels; and on the fungicide 103 barrels, or a decrease in yield of 17 barrels, which in my judgment is entirely due to the fungicide. The areas north and south of the fungicide were sprayed with Bordeaux and on the same days on which the fungicide was applied. Sprayings were made every 10 days during the growing season, beginning early in July.

As I stated above, there was no late blight in the county. Early in August, the fungicide plots began to show signs of vine injury and later they developed a good deal of early blight. The field sloped gently to the east so that the field was in sight as one drove on to the farm, for perhaps half a mile, and there was no time after the 10th of August but that anyone could have picked out the fungicide plot at that distance. In my judgment the decreased yield was due to this vine injury, and to its failure to protect from early blight as thoroughly as Regular Bordeaux Mixture."

ALFALFA.

The Station began experimenting with alfalfa in 1903. The reports for the work of the year 1904-5 are given on pages 35 and following of bulletin 126. A number of co-operative experiments were entered into in 1906, with seed specially furnished by the Bureau of Plant Industry of the U. S. Department of Agriculture; and at the same time three-quarters of an acre was planted with the same seed by the Experiment Station on the farm of John Watson at Houlton. A number of the experimenters reported that they obtained a fair stand and in some instances the alfalfa went through the winter of 1906-7 in very good shape. So far as we have been able to learn by correspondence, however, in no case was a permanent stand obtained.

The experimental field at Houlton gave the best stand of any that has been obtained in the State, so far as the writers know. Notes made in September, 1906, show that the field was in good shape. There was a very uniform stand that had been cut twice with an estimated yield of 1¼ tons in the two cuttings. At that date it stood from 12 to 16 inches high and seemed to be in excellent shape for going into the winter, with the exception that here and there through the piece were occasional plants affected with the leaf spot of alfalfa,—*Pseudepeziza medicaginis*. The alfalfa went through the winter of 1906-7 in good shape and in the year 1907 three cuttings were made, and in the fall of 1907 the piece was still looking in very good shape. The leaf spot of alfalfa had not gained any on the field and the plants were, for the most part, free from disease. There was in the winter of 1907-8 an unusual amount of ice, with the result that the alfalfa was entirely smothered out and in the spring of 1908 there were only a few plants alive on the field. The Station has made no further experiments in the growing of alfalfa and is not likely to in the near future.

It is to be remembered, however, that although there have been hundreds of attempts in Maine to grow alfalfa and that thus far no permanent success has been obtained, negative results do not reach to positive conclusions, and it may be that some one will find a method of growing this valuable crop that will be applicable to Maine conditions. There, however, can be no hope of success unless pains are taken to inoculate the soil with the bacteria which produce the root nodules whereby the alfalfa plant, like other legumes, is able to acquire atmospheric nitrogen. It is probable that this inoculation can only surely be accomplished by obtaining soil from alfalfa fields where the nodules are abundant. The culture method of inoculation is still in the experimental stage and cannot, so far as the writers know, be relied upon. Another seeming requisite is an abundance of lime and if alfalfa is to be successfully grown, the field will have to be heavily limed. Land that will grow clover luxuriantly will not of necessity carry lime enough for alfalfa plants.

The following quoted from bulletin 126 seems to be as pertinent now as when it was written:—

"In order for alfalfa to be of value to Maine agriculture a good stand must be obtained and the stand must be able to continue not one, but several years. The Station does not advise anyone in this State to grow alfalfa at present except in an experimental way. That alfalfa would be a valuable addition to our forage crops needs no demonstration. If the difficulties which thus far have prevented its successful culture can be surmounted, it will more than recompense the cost of the many hundreds of trials that have been given this plant in Maine during the past 25 years."

Wild Mustard.

During several years, beginning with 1904, the writers endeavored to kill wild mustard in sown grain crops by spraying with copper sulphate and with iron sulphate. The first season's experiment was markedly successful. The second year an attempt was made to repeat the experiment on a large scale in Aroostook County and while the plants were stunted it did not result in destroying the weed. While it has been generally recognized throughout the State that wild mustard or charlock is one of Maine's worst weeds in sown crops, it is not generally known and was not known to the writers in 1905 that there are two plants which differ so little in appearance that they are both known as wild mustard. One of these is the wild mustard proper, *Sinapsis arvensis,* which is also frequently and properly called "charlock." The weed which very closely resembles it and is sometimes called jointed or white charlock is the wild radish, *Raphanus raphanistrum.* Young wild mustard plants are readily killed by spraying with a solution of either copper sulphate or iron sulphate. The wild radish is very resistant and in experiments made at this Station has even defied treatment with 20 per cent solution of iron sulphate reinforced with 5 per cent of sulphuric acid. In the first year's experiments conducted on the College Farm at Orono the weed that was killed was wild mustard. In the second year's experiments in Aroostook County the failure to kill was due to the weed being wild radish.

It is perfectly possible to kill wild mustard by spraying. The only discouraging thing about spraying for wild mustard in Maine is that so much that is commonly called wild mustard is wild radish, and while it has been claimed by investigators in Germany and France that they have killed wild radish by spraying with a 20 per cent solution of iron sulphate, it is more than probable that they were wrong in identifying the plant.

TO KILL WILD MUSTARD.

If one desires to kill wild mustard (not wild radish) it can be readily accomplished in seeded crops without injury to the grain or grass by spraying with a 20 per cent solution of iron sulphate. A power sprayer on the same general plan as a potato sprayer should be used.

The solution is readily made as follows: Empty a 100-pound sack of granulated iron sulphate into an oil barrel (which will hold about 50 gallons). Fill the barrel up with water and stir vigorously for a few minutes until the sulphate goes into solution. The solution can be put into the spray tank and used at once, or it can be kept in the barrel until the desired time for use. Iron sulphate solution is not poisonous and can be handled without fear; white clothing coming in contact with it, however, will be discolored by iron stains.

The spraying should be made on a calm, bright day after the dew has disappeared. If rain follows within a few hours the spraying is not as effective. The grain fields should be sprayed when the mustard plants are in the third leaf and before the plants are in blossom. If sprayed after the plants are in bloom, it will kill the leaves but will not prevent the formation of seed.

LIME IN SEEDING DOWN.

During the past few years in many fields and in different localities marked improvements have been made upon certain crops, particularly the yield of legumes, by the liberal application of lime. There are undoubtedly thousands of acres in Maine that would be benefited by an occasional liberal application of lime, so far as clover and certain other crops are concerned.

There is probably no one money crop of greater importance in Maine than the potato. Not only does Aroostook County grow many millions of bushels each year but potato growing is now practiced successfully in other sections of the State on a large commercial scale. It has been learned how to control the ordinary fungous diseases which result in the killing of the tops and the loss of crop from premature ripening, or from rot. In potato culture the most serious obstacle at present is potato scab. This is a fungous disease and seems to grow best in the presence of an alkali. In order to study the effect of liming soils upon the development of scab in a potato crop* it was deemed best to use the lime as one would in ordinary farm practice. For this purpose a field was treated with lime and after the grain and grass crops had been removed it was experimented with for 2 years as regards the development of scab upon potatoes. The effect upon potatoes has been reported.*

An experiment upon another field was begun in 1907 on which it is proposed to follow up the effect of lime upon the development of scab on potatoes. On this field smaller amounts of lime were used than on the Watson field to see if the beneficial effect of the lime might be had and at the same time not introduce soil conditions favorable to the growth of the scab fungus. There is here reported the effect of lime upon the

*See Bulletin 140 this Station, p. 4.

grain crop and the legumes when it was applied at the time of seeding down. It is planned to test the effect upon the potato crop in 1909 and 1910.

ON WATSON FARM.

The piece of land used for the purpose was on Mr. John Watson's farm in Houlton, and had been in potatoes two years, receiving about 1200 lbs. of high grade fertilizer to the acre each year. After plowing it also received a liberal coat of stable manure. When seeded in 1905 it was divided into plots of one-half acre each and 300 lbs. of a complete fertilizer were added to each plot. To plots Nos. 2 and 6 were added 500 lbs. of lime and Nos. 4 and 8, 1000 lbs. of lime to each plot which was harrowed in before the grain was sowed.

The lime seemed to have little or no effect on the oat crop and the yields of the different plots were not kept separate but the clover growing in 1906 showed a marked difference between the plots that were limed and those that were not limed. The clover plants were much longer and greener and lines between them and the plots not limed were very plain. The greatest difference was on the higher and dryer portions of the field. The ends of the plot that were low and moist showed but little difference in appearance of yield. The following is the yields estimated when the hay was loaded on to the racks.

*Estimated Yield of Hay.**

Plot No. 2,* 500 lbs. lime	3,000 lbs.
Plot No. 3, no lime	1,500 lbs.
Plot No. 4, 1,000 lbs. lime	2,600 lbs.
Plot No. 5, no lime	1,300 lbs.
Plot No. 6, 500 lbs. lime	2,800 lbs.
Plot No. 7, no lime	2,300 lbs.
Plot No. 8, 1,000 lbs. lime	3,000 lbs.
Plot No. 9, no lime	2,300 lbs.

While the above figures are not strictly accurate they show quite closely the difference in yields. If a few rods of one end of the plot that was low and moist had been left out the differ-

*Half acre plots.

ence would have been still greater, for certainly on the dryer portions of the field the yield of the limed plots was at least 4 times that of the others.

ON THE EDBLAD FARM.

In 1907 a second experiment with lime was begun on the farm of Mr. H. Edblad of Houlton.

The experiment covered 6 plots of one acre each. The lime was applied with a fertilizer distributor at the time of seeding the field in 1907 to oats, grass and clover. All plots were treated alike except that to No. 1 was added 1000 lbs. agricultural lime, No. 2, no lime, No. 3, 750 lbs. lime, No. 4, no lime, No. 5, 500 lbs. lime. There was no appreciable effect on the yield of grain (oats) and straw.

The winter of 1907 and 1908 was open with very little snow, consequently much of the clover killed out. Plot No. 1 was on lower ground than the others, was better covered with snow during the winter, and being more moist suffered less from the dry weather of the summer of 1908 than the other plots. There was a very good stand of clover all over this plot. On all the other plots the clover was killed out in spots making the stand somewhat uneven. The plots were harvested July 21-22 when the clover was in bloom.

The yields estimated while loading were as follows:—

*Estimated Yield of Hay.**

No. 1,* 1,000 lbs. lime applied....................	5,300 lbs.
No. 2, no lime applied...........................	3,200 lbs.
No. 3, 750 lbs. lime applied......................	4,400 lbs.
No. 4, no lime applied...........................	3,000 lbs.
No. 5, 500 lbs. lime applied......................	3,250 lbs.

It is clear that in these cases the application of lime materially increased the yield of clover, and it is probable that in many places where clover has not been successfully grown, the application of lime might prove a remedy.

It is, however, a question whether in a State which is so largely dependent upon the potato as a money crop, as is Maine, it be wise to use lime in connection with crops until the

*Acre plots.

question of the scab fungus has been more thoroughly worked out and the methods of controlling it further developed, and particularly it is learned how to fight it after a soil is once infested. It is an open question whether it is not better policy to have smaller yields of legumes and keep the soil somewhat acid, in order to make the conditions for the development of potato scab as little favorable as possible. In the experiments here reported, there is apparently no special benefit from the lime upon the grain crop or upon the ordinary English grasses, but it proved to be beneficial on the legumes. To Maine farmers who make potato growing an essential feature of their business it is suggested that if they use lime, they do so in an experimental way at the rate of perhaps 500 pounds to the acre, and that they carefully note the effect upon the yield of clover and the development of scab.

TWO RECENT EPIDEMICS OF LATE BLIGHT AND ROT OF POTATOES IN AROOSTOOK COUNTY.

W. J. Morse.

The summer and fall of 1907 and that of 1909 presented ideal weather conditions for the development of late blight and rot of potatoes in Aroostook county and some other parts of Maine. As a direct result of these weather conditions and the consequent development of the blight, by very conservative estimate, the loss in diminished or damaged crops in each of these years amounted to several hundred thousand dollars. Much of this loss occurred on fields where the owners were attempting to spray with Bordeaux mixture, and in many cases felt that they were spraying carefully and thoroughly.

During the season of 1907 the writer was engaged in carrying on spraying experiments in Houlton and in Foxcroft, both to test the relative efficiency of thorough spraying as compared with that usually practiced by most growers, and to test the relative efficiency of certain substitutes for standard Bordeaux mixture. No such experiment was conducted in 1909 but during both seasons the conditions in various parts of the State were closely observed and carefully followed up as soon as weather conditions indicated that an outbreak was imminent.

Repeated visits were made to the various potato growing sections, particularly where blight was appearing, and careful notes were made of spraying operations and the resulting successes or failures therefrom.

The results secured from the experiments of 1907 and the field observations during the two seasons of severe epidemic blight and rot, taken in connection with results previously obtained by Director Woods of this Station under similar conditions,* and at other experiment stations, particularly those obtained at the Vermont and the New York State Stations, lead to but one conclusion, namely: *that from 75 to 95 per cent of the loss from blight and rot even under the severe weather conditions experienced during the two growing seasons under consideration is unnecessary and unwarranted.* In fact there are few plant diseases which are so completely and thoroughly controlled by Bordeaux mixture as the late blight of potatoes and the resulting decay of the tuber caused by the same fungus.

Granted that the above statement is true, why has there been an apparent almost universal failure from spraying during the season of 1909, and to a somewhat similar extent in 1907, instead of universal success? There are several factors responsible for this condition of affairs, some of which it is proposed to discuss in some detail: The general lack of knowledge of the nature of the fungus causing the disease and its method of distribution, the intimate relation of the development of the disease to weather conditions, improperly made Bordeaux mixture, inefficient or improperly constructed spraying machinery, resulting in imperfectly covering the foliage, too few applications, or if the number of sprayings are sufficient, applied at the wrong time, digging and storing too early if blight gains a foothold on the foliage.

RELATION OF FUNGUS TO PLANT AND SPRAY TO FUNGUS.

The late blight of potatoes is caused by a parasitic fungus, a low form of plant life, which is made up of minute, almost colorless threads which permeate the tissues of the healthy leaf, killing the living cells of which the leaf is made and drawing its nourishment therefrom. In the summer when once estab-

*Me. Agric. Expt. Sta. Bul. 73 (1901) and Bul. 87 (1902).

lished on a few leaves in a field it spreads very rapidly, if weather conditions are right, by means of little reproductive bodies called spores, which every blighting leaf produces by thousands, if not millions.

Certain soluble copper compounds in exceedingly minute quantities are almost immediately fatal to these little spores as soon as solutions containing such copper salts touch them. The efficiency of Bordeaux mixture as a fungicide depends upon the copper sulphate or blue vitriol used in its preparation. The lime when added makes a very finely divided, but temporarily insoluble compound suspended in water which we call Bordeaux mixture. The lime forms with the copper salt, compounds which slowly become soluble and makes an adhesive mixture, when dry, which slowly gives up the copper—fast enough to kill the fungus spores but not fast enough to damage the potato leaves. A very weak solution of copper sulphate would have the same effect but it would have to be applied daily in rainy weather. Spraying then serves a two-fold purpose, primarily to cover the entire healthy leaf with a thin protective film of Bordeaux mixture which is constantly giving up minute quantities of soluble copper salts which kill all blight spores which find lodgment thereon before they can germinate and enter the leaf, and secondly if the blight is already started the spray may at the time of application kill many millions of spores which are ripe and ready for distribution.

The relation of the fungus to the disease is better understood by reference to Fig. 15, page 410. At the left is seen a section of an infected potato leaf, highly magnified. It will be seen that the leaf is made up of many irregularly shaped units or cells, those above and below being flattened and forming a protective layer. In the lower layer certain lip-shaped openings are seen. These are the breathing pores or stomata through which the fungus most easily enters the leaf. It is possible, however, for the germ tube of the fungus to penetrate directly through the cell wall as shown in the illustration. Running between the cells of the leaf may be seen the threads of the fungus. In the drawing these fungus threads, though naturally nearly colorless, have been colored to make them stand out more distinctly. Projecting downward from the underside are two different appearing bodies. The tapering, pointed ones are natural leaf-hairs. The others, thread-like and branched and bearing the knob-like bodies, are the fruiting organs of the fungus, each little knob being a spore. The top row at the right shows the stages in the development of a spore. After the spore is formed it may divide up into from 6 to 16 little swarm spores, each provided with two little hair-like processes by which it is enabled to swim around in drops or films of rain or dew. Later these lose their swimming organs and begin to throw out a germ tube. If the swarm spore is lodged upon a potato leaf the tube usually enters the leaf through the breathing pores, branches and permeates the tissues, killing them as it goes. Thus it produces the characteristic blotches on the leaves as shown by Fig. 16, page 411. The spores may be washed down into the soil also and infect the tubers in the soil, or if the crop is dug while the tops are still partly green, but blighting badly, the tubers may become infected at this time and the rot develop in storage as in the season of 1909.

The remaining illustrations of Fig. 15, page 410, show the stages in the formation of swarm spores and how they finally germinate and enter the leaf. After a small dead area is produced the fungus throws out the fruiting organs as illustrated on the large section of the leaf and the process already described is repeated over again. This makes plain why it is absolutely necessary to cover each and every potato leaflet with a thorough protective coating of Bordeaux mixture, and why spraying partially or improperly done may be practically useless.

When potatoes are blighting badly, if the margins of blighting spots are examined on the under sides of the leaves a delicate white fringe may be seen. (See Fig. 16.) This is made up of hundreds of little fruiting organs each bearing from one to several fruiting bodies, each of which will divide into from 6 to 16, usually about 10, swarm spores and *each of these swarm spores capable, under proper conditions, of producing another blighting leaf or capable of causing the destruction of a merchantable tuber.* It is thus easily seen how that one blighting leaf may produce sufficient spores to infect every hill of potatoes on an acre of land, provided all the spores produced could come in contact with these plants. This explains why a field, apparently free from blight, may be found to be badly affected only a few days later, and how potatoes showing a comparatively small amount of blight on the foliage before being killed by frost or before being dug, may develop a large amount of rot in the field or in storage as the case may be. In the first instance the blight existed for some days on the lower and more shaded leaves (where it would not be noticed by the ordinary observer) till a day or two of favorable weather occurred. Then a large crop of spores were produced which infected the plants on the whole field. In the case of tuber

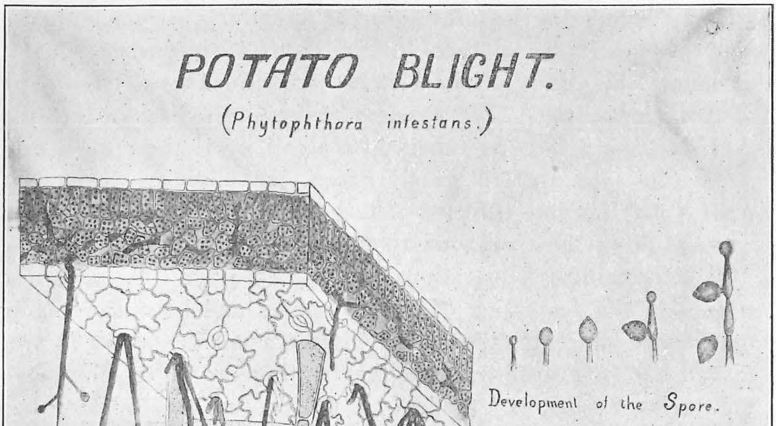

FIG. 15. From drawings by De Bary, Ward and Jones. The fungous threads and spores, though nearly colorless, are colored in the drawing to make them stand out more distinctly.

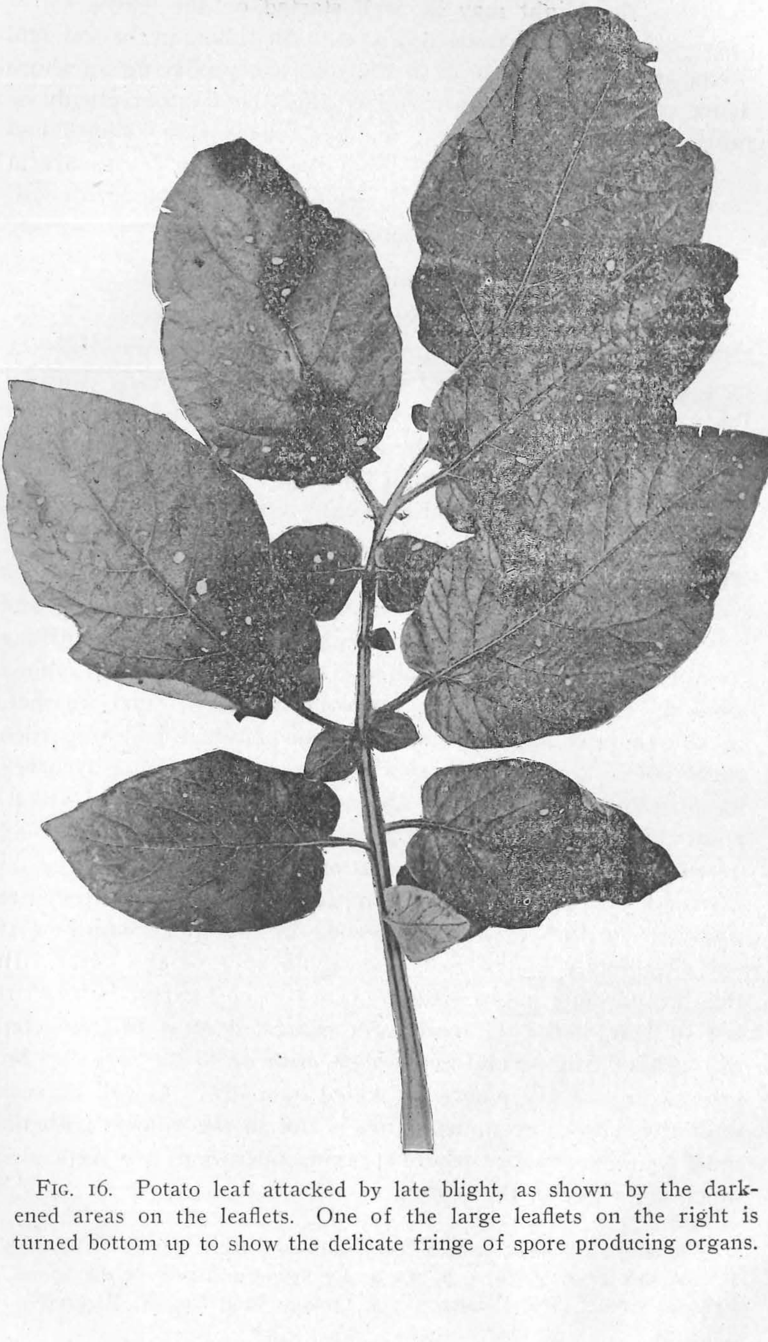

FIG. 16. Potato leaf attacked by late blight, as shown by the darkened areas on the leaflets. One of the large leaflets on the right is turned bottom up to show the delicate fringe of spore producing organs.

infection the blight may be well started on the leaves and a heavy rain wash the spores down on to the tubers in the soil, and decay at once starts up, or if the tops are producing an abundance of spores when the crop is dug, the weather cloudy or rainy, the atmosphere humid, and the tubers after being showered with millions of spores from the blighting leaves are at once picked up and stored in large bins without being allowed to dry off, infection is almost sure to result as in the fall of 1909.

WEATHER CONDITIONS AND THE DISEASE.

Rain, dew, wind and insects are the chief agencies for distributing the disease. So far as known the only way that the crop of any one year is first infected is from planting diseased tubers in which the fungus has remained semi-dormant over the winter. Hence the first blow to be struck in the fight against this disease is to plant nothing but healthy, sound tubers.

Late blight revels in moist, cloudy weather and, contrary to the general notion, in relatively cool or moderate temperatures.* The spores are produced in greatest abundance in rainy or cloudy weather and are extremely susceptible to drying and hence one need never fear an outbreak in dry, hot, sunshiny weather. Wet weather is almost sure to bring it on unless spraying is kept up during the continuance of such weather. In fact there is no other disease of our common field or garden crops where a careful observer can predict with more accuracy its probable appearance or absence. From a financial standpoint this is a point that no progressive potato grower should overlook. While spraying operations should not be delayed till favorable conditions for blight appear, how thoroughly they are followed up may well be governed by weather conditions if one thoroughly understands the significance of the latter. In this latitude late blight seldom occurs to any extent before the last of July, hence the main fight against it must be conducted throughout August and September, *even up to the very day the crop is dug or the plants are killed by frost.* As will be seen later this latter recommendation is not in accordance with the most common practice where spraying operations are suspended much too early in the season.

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* "Humid, still days, with a temperature of about 73° F. Above 78° F. and below 50° F. there is practically no germination of the spores." Fraser, Samuel, The Potato, p. 114, Orange Judd Co., N. Y. (1908).

PROPERLY MADE BORDEAUX ESSENTIAL.

In attempting to point out the factors which have been found to be responsible for most of the failures to secure complete protection from late blight and rot by spraying with Bordeaux mixture, the methods of preparing the mixture, which are commonly practiced, will first be considered. Unfortunately lack of ability to implicitly follow directions is a common fault of humanity and the maker of spray mixtures is no exception to the rule.

Bordeaux mixture as now recommended is the result of over 20 years of investigation and experimentation by some of the most careful workers in this country and in Europe and the formula recommended for potatoes conforms to the general consensus of opinion among these investigators. Anyone who departs from the formula, or who does not follow carefully the directions for preparing the spray should bear in mind that he alone is responsible if his Bordeaux mixture fails to keep off the disease on account of being too dilute or, if improperly prepared, kills the foliage of the potato itself.

A rather surprising state of affairs was discovered when the methods of making of Bordeaux mixture by potato growers in Aroostook county were investigated. The amount of copper sulphate used for each 50 gallons of spray varied from 2½ to 12 or 15 pounds. Very commonly indeed, with a desire to do more efficient work, the amount of copper sulphate is increased to 8 and 10 pounds to 50 gallons of spray without any attempt made to more thoroughly cover the foliage by means of more nozzles per row or better adjustments of the nozzles on the sprayers. Fortunately the potato plant is much less susceptible to such strong sprays than fruit trees which would be ruined by such treatment.

It is a common practice, also, to use much more lime than copper sulphate—the maker reasoning that lime is inexpensive and a considerable excess may do good and certainly will do no harm. The function of the lime is to unite with the copper sulphate and convert it into temporarily insoluble compounds, and it is doubtful if a large excess of lime adds to the fungicidal value of the mixture. Experiments have shown, however, that an excess of lime materially decreases the adhesive qualities of the mixture. "Those mixtures are best in adhesiveness, and in efficiency, in which the approximation of equal parts of copper sulphate and lime are maintained."*

One season's experiments conducted at this Station indicate that the prepared or hydrated lime will give equally good results as stone or lump lime used in making Bordeaux mixture, judged by the appearance of the foliage and by the yield per acre at harvest time.†

Guess work is very frequently substituted for weights and measures, and the amount of lime and copper sulphate, or the stock solutions of these ingredients in a given amount of spray varied with the ability or judgment of the maker. One remarkable case was found where the individual prepared his stock solution of copper sulphate as follows: 50 pounds of the crystals were placed in a sack and suspended in a 50-gallon barrel of water in the usual way and allowed to dissolve. Then as fast as 5 or 10 gallons of this stock solution were taken out an equal amount of water was put in to replace it and this continued through the season. From time to time another 50 pounds of blue vitriol would be dissolved in the liquid. Thus it will be seen that except for the first lot of stock solution removed none used was of standard strength throughout the season. Bordeaux mixture prepared from such stock solutions cannot be expected to produce satisfactory results.

Properly prepared Bordeaux mixture should contain 5 pounds each of copper sulphate and lime to 50 gallons of water, and the ingredients should be weighed and measured. The copper sulphate should be dissolved and the lime slaked in separate vessels. *Never pour concentrated solutions of lime and copper sulphate together.* The most adhesive and satisfactory mixture is prepared by diluting each strong solution with half of the water and then these two *dilute* solutions should be united quickly and thoroughly mixed at once. Full directions for preparing Bordeaux mixture as contained in a circular entitled "How to Fight Potato Enemies," which will be sent on application to the Maine Experiment Station.

Properly prepared and applied Bordeaux mixture is a remarkably adhesive compound. If it once becomes dry on the foliage, which only requires a short time, it will be effective and resist

*Crandall, C. S. Ill. Exp. Sta. Bul. 135, p. 218.

†Woods, C. D. Me. Expt. Sta. Bul. 98, p. 191-200 (1903).

excessive washings of rain for some time. The writer has preserved specimens of potato leaves taken at Foxcroft October 5, 1907, which are well coated with Bordeaux mixture yet none had been applied to them for 38 days previously. At Orono during this period 6.66 inches of rain fell; 2.18 inches of this fell in 24 hours. These leaves had been thoroughly sprayed 6 times during the season. If Bordeaux mixture does not show these adhesive qualities there is some fault with the method of preparation which should be remedied.

IMPROPER SPRAYING.

During a four-day trip over several of the larger potato growing towns in Northern Aroostook shortly after the blight had become well established, just two fields were seen which had been properly sprayed, yet some two or three thousand acres of potatoes were inspected. These conclusions as to spraying methods were arrived at by noting the condition of the fields, inspecting the spraying machinery and questioning the owners as to the methods of preparing the mixture, number of applications, time of application, etc.

The sprayers as a rule are deficient in that they do not carry enough nozzles and do not have sufficient adjustments. Bearing in mind the nature of the fungus which causes the disease, and the millions of spores which it produces, and bearing in mind also that each and every one of these spores is capable of infecting from one to several other leaves or tubers under right conditions, it will be seen that under some circumstances *a sprayer which does not cover every leaf with a thin film of spray may be practically useless* unless this defect can be remedied, the results obtained from such sprayers being so unsatisfactory that spraying often becomes discredited with the user and is abandoned. The majority of sprayers in use are equipped with single nozzles to the row which cannot be raised much above the tops of the plants, when the latter are full grown. Such a sprayer used at the time when late blight is rife, and when the tops cover the ground, covers as a rule less than one-third of the foliage. All the remaining leaves being unprotected are killed with blight and millions of spores are washed down into the soil to infect the tubers. No matter how many times or how often such a sprayer is used on a field the resulting rot may be as great in seasons like those of 1907 and 1909, as if it had not been used at all.

EFFICIENT SPRAYERS AND SPRAYING.

One nozzle alone to a row should never be used on a potato sprayer when the tops grow as large as they do in Maine, except when the plants are small. When the plants are large, two or more nozzles should be used to the row, so arranged that the cones of spray will interfere with each other as little as possible, thus covering the widest possible area, or a strip at least 3 feet wide when the foliage covers the ground. There should be an up and down adjustment, sufficient so that the whole battery of nozzles may be raised as the plants grow taller. A side to side adjustment, to be varied with the distance between the rows, is desirable also. Those sprayers which have additional nozzles which direct the spray sidewise into the tops from between the rows possess a distinct advantage in that they not only tend to more thoroughly cover the leaves but they also tend to reach the very ones which are first attacked by blight—the lower and more shaded leaves and those resting on the ground.

The finer the spray and the greater the pressure with which it is thrown the more effective will be the work. A very fine mist forcibly applied covers the leaf with a thin film which adheres, while even greater applications of spray applied in coarse drops may be less effective, first because it is not so evenly distributed, and, secondly, because there is much more danger of the larger drops running together and dripping off the leaves. High pressure also tends to drive the mixture in among the leaves, thus touching the lower leaves, and more effectually coating both sides of the leaves, which is very important.

The Vermorel type of nozzle appears to be the most satisfactory and is the one most used by our growers. New brass caps should be applied to these each year, however, as the small holes in these soon become worn and throw too coarse spray as a result. In use these nozzles should be carefully watched to see if each and every one is constantly working and throws a spray of maximum fineness. If not the machine should be stopped and the difficulty corrected. In purchasing a sprayer care should be taken to determine if the pump is powerful enough to throw a fine mist when the maximum number of nozzles necessary are in use. Sprayers equipped with hand pumps and designed to cover three or four rows at a time as fast as a horse can walk are not recommended. In practice the pressure usually maintained on these pumps is much too low to do effective work.

Unfortunately there has crept into our literature on potato spraying the statement, and the notion is quite firmly grounded in the minds of many of the potato growers and apparently in the minds of makers of potato spraying machinery as well, that 50 gallons of spray per acre is a sufficient and proper amount to apply. A little thought will show how erroneous it is to conduct spraying operations on such a basis when the object is to cover the entire foliage. When the tops are small 50 gallons will usually do this, but it is absolutely impossible to do thorough work with this amount of spray when the plants are full grown. *Every leaf should be covered at each spraying, regardless of whether it takes 50, 100 or 150 gallons of Bordeaux per acre.* In bad seasons like those under consideration it is advisable during the times when conditions are very threatening to go over the field twice at each spraying, in opposite directions on the row. However on account of danger of loss from drip, the second application should not be put on till the first is dry. This procedure is by all means recommended in place of using a stronger mixture, if more thorough work is desired.

WHEN TO SPRAY.

Very commonly men were found who did not spray during rainy weather as they considered it to be useless. This also is a mistaken notion. As has already been pointed out it is during rainy weather that spore production is the most rapid and infection is most sure to take place. Therefore it is conceivable that one spraying during rainy weather may be more beneficial, even though it be washed off within a few hours as is supposed to be the case by most people, than one applied during bright, clear weather. However, as previously stated, properly prepared Bordeaux mixture is remarkably adhesive and will stand considerable washing if once dried on the foliage. Hence, *never omit to spray on account of rainy weather,* provided the rain stops long enough to apply the mixture and to allow it to dry on. There is often no excuse for the man who loses his crop by blight on account of rainy weather. If everything is in readiness it is a very exceptional season when the rain does not stop long enough to spray at least a part of a field at a time and to allow the spray to dry on after it is applied.

In 1909 many failures can be traced directly to too few sprayings and in every case investigated the spraying was discontinued much too early, considering the nature of the season. Large numbers of instances were found where the fields were sprayed but three times and cases where only two or even one application was made were by no means rare. Where these few applications were made, they were invariably made too early in the season, and while they doubtless did some good they were by no means distributed to the best advantage.

If one thoroughly understands the weather conditions which are likely to produce late blight it is possible to distribute 3 or 4 thorough sprayings in such a manner as to give pratically complete protection to the crop in ordinary seasons, but it would doubtless be impossible in such seasons as those of 1907 and 1909. If only 3 sprayings are made in this section it would usually be best to wait till late in July or the first of August before beginning. However, for the general grower who has not the benefit of long experience or the advice of a trained observer on these points it is unsafe to depend upon so few sprayings in a season. It has been the policy of this Station to recommend that spraying be begun when the tops are 6 to 8 inches high and repeated every 10 days (every week, if the weather is very cloudy or rainy)* until the last of August or the first of September, or later if necessary. In the light of the experience obtained during 1909 the only modification of these recommendations suggested is to lay particular stress upon the clause "or later if necessary." In ordinary years the tops are killed by frost early in September and there is enough spray still adhering to them to furnish adequate protection till this takes place or the crop is dug. This year the tops were partially killed late in August but much of them were untouched

*Cases might occur in exceptional seasons when the rains are very heavy and conditions very threatening where two or even three of the sprayings might be made at a less interval between.

till digging time. As a result of inefficient spraying, combined with excessive washing of rain, these were slowly dying of blight all through September and showering millions of spores on to the water-soaked soil, which resulted in an abnormal amount of tuber infection. Hence, *the tops should be protected by spray up to the day they are killed by frost or the crop is dug,* particularly in rainy seasons. As far as late blight is concerned some of the earlier sprayings might be dispensed with, but these early sprayings are necessary as protection against the early blight and ravages of the flea-beetle.

SPRAYING IS EFFECTIVE.

Spraying must be looked upon as a form of insurance but records covering a series of years show that it is the most profitable kind of insurance. Long continued experiments at the New York and Vermont Experiment Stations show that spraying is seldom conducted at a loss, after allowing for time and materials, and frequently it is the means of saving a large per cent of the crop. Records of yields of sprayed and unsprayed plots side by side covering a period of 17 years show an average increase of 113 bushels per acre or 68 per cent as a result of spraying. The greatest increase in any one year was 224 bushels and the least was 32 bushels per acre.* The writer upon Commissioner Gilman's farm in Foxcroft in 1907 secured an increase over unsprayed plots of 231 bushels of sound tubers per acre from 6 double sprayings, 162 bushels from 6 single sprayings, and 186 bushels from 3 double sprayings plus one single spraying. He also secured from 6 double sprayings on the John Watson farm at Houlton 420 bushels of sound tubers on a measured acre with no decay following in storage, while fields in this vicinity either unsprayed or less thoroughly protected were showing from 25 to 75 per cent of rot. Other well sprayed fields nearby were equally well protected. The plots at Foxcroft which had 6 double sprayings gave 0.6 per cent of rot while those at Houlton showed 9.1 per cent. There is no doubt that equally good results might have been obtained on nearly every field in Aroostook county in 1909 if they had all received as thorough spraying. In fact a few cases, particularly in the vicinity of Houlton, were found where

*Jones, L. R. and Giddings, N. J., Vt. Exp. Sta. Rep. 20, p. 339 (1908).

spraying had been thoroughly done. Here the foliage was fully protected through the season and little or no rot was found on digging. Though dug early, two of these lots showed no rot and one other a slight amount after about three weeks of abnormally warm weather in storage.

These demonstrations that thorough spraying with Bordeaux mixture will give entire protection from the ravages of late blight are by no means new in Maine. Nine years ago Director Woods of this Station secured with four sprayings at Houlton increased yields valued at over $40.00 per acre at the current price of potatoes at an estimated expense of $2.50 per acre.*

DECAY IN STORAGE, 1909.

The season of 1909 in Aroostook county demonstrated again on a large scale what has previously been shown to be true experimentally, namely: that where potatoes are blighting it is unsafe to dig and store the crop for at least ten days after the tops are killed by frost, and even a longer delay will do no harm.†

The crop on many fields where the blight had secured more or less of a foothold was dug early in September. In many cases these tubers were practically all sound when dug but the blighting leaves were producing spores abundantly which were showered on the potatoes. These potatoes on account of the excessive rains came out of the soil wet and in most cases were not allowed to dry off before being picked up and placed in barrels, thus furnishing ideal conditions for infection by late blight.‡ They were then placed in storage or shipped to market. The weather following was quite warm and humid. As a result of this infection, much of the stock which went to

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*Woods, C. D. Me. Expt. Stat. Bulletin 112 pp. 2-5 (1905).

†Jones, L. R. and Morse, W. J. Repts. Vt. Exp. Sta. 15, pp. 219-223 (1902); 16, pp. 161-163 (1903).

See also Proceedings Society for Promotion of Agricultural Science (1904).

Woods, C. D., Me. Expt. Stat. Bulletin 112, pp. 2-5 (1905).

‡This is not a mere supposition for the writer has assisted in performing an experiment where these conditions were produced artificially with identical results. See Jones, L. R. and Morse, W. J. Vt. Exp. Sta. Rept. 18, pp. 284-287 (1905).

Director Woods also cites a similar experience as occurring in 1902. See Me. Expt. Sta. Bul. 112, p. 1 (1905).

market was a total loss, and in some cases the results in storage were nearly equally bad. If a repetition of this disaster is to be avoided, it will be necessary to first keep the blight off by thorough spraying such as has been previously recommended in this article. If blight does gain a foothold to any extent, if possible do not disturb the crop till at least ten days after the tops are killed by frost, two weeks will be better. There will be some rot in any event if the tops show much blight, but the net result of sound tubers in the end will be largely in favor of late digging.

OTHER CAUSES OF DECAY.

In closing this discussion it should be remarked that there are present in the State two other potato diseases which cause decay of the tuber and which cannot be prevented by any amount of spraying. There is no evidence, however, up to the present time, that either of these diseases has been a contributing factor to the epidemics of tuber decay which have occurred in Maine. One of these is the Fusarium dry rot which differs from the late blight rot in that it nearly always begins at the stem end of the tuber in the form of a brownish or blackened ring a short distance below the surface, and the later stages of the rot are more or less different also. The other tuber decay is a soft bacterial rot caused by the same organism which produces the Blackleg disease of the stem. Potatoes affected by the late blight fungus usually develop a soft, stinking rot in storage under moist, warm conditions, but the writer believes that most of this decay is due to a secondary infection by ordinary saprophytic soil bacteria which otherwise could not attack the healthy tubers themselves.

SUMMARY.

Adverse weather conditions were responsible for severe epidemics of late blight and rot of the potato in Maine, particularly in Aroostook county, during the seasons of 1907 and 1909. (P. 406.)

Blight is caused by a parasitic fungus which spreads through the leaves, killing the tissues as it goes. Each blighting leaf produces thousands of minute fungous spores, each capable of infecting another leaf, or a potato tuber. (P. 407.)

Bordeaux mixture forms a protective film on the healthy leaves, kills the spores which fall thereon, and also kills those produced on the diseased leaves at the time of application. (P. 408.)

Much, if not all, of the disease comes originally from planting diseased seed tubers. Rain, dew, wind, insects, etc., are the chief agencies in disseminating the spores. (P. 412.)

Late blight is most destructive in rainy or cloudy weather. Hot, dry, sunshiny weather is fatal to the blight spores, and outbreaks of the disease never occur under these conditions. (P. 412.)

Much of the Bordeaux mixture used is carelessly and improperly prepared. Only standard Bordeaux mixture containing 5 pounds of copper sulphate and 5 pounds of lime to 50 gallons of water should be used. The most adhesive mixture is made by diluting the copper sulphate and lime solutions each with half of the water and then quickly and thoroughly mixing. *The ingredients should be weighed and measured and the proportions should not be varied.* (P. 413.)

The sprayers carry too few nozzles per row and do not have sufficient adjustments of nozzles. Pumps should be powerful and nozzles in such condition that the spray will be delivered forcibly and in a fine mist. (P. 415.)

Fifty gallons per acre is not enough spray to use when the plants cover the ground. Every leaf should be coated at each application. When conditions are very threatening, go over the rows a second time in opposite directions, after the first application becomes dry. (P. 417.)

Never omit spraying on account of rainy weather; this is the one time when spraying is most needed. (P. 417.)

Under Maine conditions it is necessary to begin when the tops are 6-8 inches high and spray every week or ten days till the tops are killed by frost or the crop harvested. If weather conditions are favorable, sprayings may be less frequent early in the season, but not through August and September. If the conditions are very threatening spraying at less intervals is advised. Much loss from blight and rot results from too few sprayings and stopping too early in the season. (P. 418.)

Thorough spraying under very adverse weather conditions has been found effective both in Maine and elsewhere. Thoroughly sprayed fields in Aroostook county in 1909 showed very little loss from either blight or rot. (P. 419.)

Much storage rot in 1909 resulted from infection at digging time. If blight has not been kept off the foliage wait at least ten days, if possible, after the tops are killed by frost before harvesting. (P. 420.)

Two other tuber decays occur but these were not contributing factors in the two epidemics. (P. 421.)

THE PINE-LEAF CHERMES AND THE GREEN-WINGED CHERMES.*

EDITH M. PATCH.

THE PINE-LEAF CHERMES (*Chermes pinifoliæ* Fitch).

On account of recent troubles, varying in nature and impor tance, of the white pine in Maine, a close watch has been kept over the pine by people throughout the State, which has resulted in their becoming interested in many insects of the white pine heretofore attracting but little attention.

Conspicuous among such insects during the early summer of 1909 was a dark reddish-brown plant louse, "The Pine-leaf Chermes," shown in Fig. 43 in its characteristic position on the pine needles where it settles to lay its eggs. This Chermes appears upon the pine needle about the middle of June, and some years in conspicuous numbers.

The past summer (1909) hardly a pine in the vicinity of Orono could be found that was not abundantly infested with these winged forms, and that the same was true in other parts of the State was shown by specimens submitted to the Station. One such report from Gilead June 25, accompanying specimens, read "Millions of the flies on white pine."

The eggs of this species are not expelled from the bodies of the females. The insects attach themselves firmly to the

*Papers from the Maine Agricultural Experiment Station; Entomology No. 37.

pine needles with their heads toward the base of the needle and die there with the eggs held in the abdomen which is like a little sac protected by the wing of the parent *Chermes.* Such a cluster contains about 100 eggs. These hatch in 8 or 10 days from the time the Chermes appear on the needle of the pine. The young settle about the new growth of the shoot and piercing the tender tissue with their beaks, suck the sap. Where the infestation is heavy this causes a yellowish and sickly appearance of the new growth which is sometimes thus considerably stunted. The young, though exceedingly minute, can be located because they produce a white flocculent waxy secretion which makes their presence discernible.*

The Pine-leaf Chermes is one of those species of plant lice that have alternate "host plants," that is, they pass one stage of their life on one plant and the succeeding stage on another species of plant.

The winged Chermes that appear suddenly upon the needles of the pine in mid-June have not developed on the white pine but in a cone-like gall common on the Red Spruce and Black Spruce, see Fig. 44. This gall is an abnormally developed shoot, the unusual form of growth being stimulated in some way by the presence of the Chermes. The young Chermes can be found in these galls by opening the sections of the galls where little reddish brown objects will be seen,—the developing Chermes.

These galls though sometimes very abundant in Maine are likely to escape notice as they are so cone-like in appearance as to seem to the superficial glance a normal part of the spruce. They were observed by Packard as common in Maine and the plant louse forming them was named *abieticolens* in 1879, the fact that they were the same species Fitch recorded for the pine needle not being known at that time.†

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*Another much smaller species of plant louse (*Chermes pinicorticis*) is frequently present on the trunk of the same tree in such numbers as sometimes to cover almost the entire trunk with a white down.

†This species develops in a cone-like gall on the black and red spruces (in which connection it was named *abieticolens* in 1879 by Thomas and subsequently merged by error with *abietis* in 1897), and migrates to the needles of the white pine (in which connection it had been previously named *pinifoliae* by Fitch in 1858, and merged by error with *pinicorticis* in 1869). This historical discussion with full reasons for resurrecting

The full grown Chermes acquire wings about the middle of June when they leave the spruce galls and seek the white pine.

Remedial Measures. There would seem to be no practical method of combatting this insect in forest growth. With ornamental trees, however, the galls could be removed from the spruce previous to the emerging of the winged form. Also if the species prove constantly troublesome it might be desirable not to plant the white pine in the vicinity of black or red spruce and *vice versa.*

Spraying with whale-oil soap (1 pound to 2 gallons of water) would doubtless destroy the young on the white pine shoots, but it is doubtful that this would be usually worth while in Maine where Syrphus flies abound. The larvæ of these, little light colored maggots, have been found to feed industriously on the young Chermes. So numerous are these beneficial maggots at times in the midst of the white waxy secretion of the Chermes that they are sometimes mistaken by people submitting them for determination as the cause of the trouble.

THE GREEN-WINGED CHERMES (*Chermes abietis* Linn).

An entirely different sort of gall common in Maine on the White Spruce, and Norway Spruce, is caused by another species of Chermes which is here termed the "Green-winged Chermes," as the conspicuous and constant green tinge of the wings is a character which will readily serve to distinguish it from the "Pine-leaf Chermes" by those who would find a more technical comparison troublesome.

Fig. 45 shows 3 of these galls together with 6 cones, about natural size, on a white spruce twig. It will be seen that these galls differ from those shown in Fig. 44 in not being cone-like and in not being characteristically terminal on the shoot. These *abietis* galls do not usually cause the death of the shoot on which they grow, but they do cause deformed branches and frequently ruin a small tree for ornamental purposes. Such galls are very abundant on the Norway spruces on the University of Maine

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this doubly merged species under the original name of *pinifoliae,* which has been discarded for about 40 years, will be published presently in more technical form by the Maine Agricultural Experiment Station. For the purposes of this economic bulletin it is not necessary to include either detailed descriptions or discussion.

campus. That they are troublesome on native spruce in this locality is shown by the fact that on a single white spruce 3 feet tall more than 990 of this season's galls were counted August 1, 1909. Where so numerous, these galls are much smaller than those shown in Fig. 45.

These galls begin to open about August 15 in Maine. The full grown pupæ walk out on the spruce needles, where they molt their pupal skins. The newly emerged winged insect is yellowish with distinctly green wings and even the wings of the aged specimens retain the green color.

Unlike the Pine-leaf Chermes, this Green-winged Chermes does not use alternate host plants. That is, it does not seek the pine or any different kind of tree to lay eggs on than that on which it produces the galls. Shortly after emerging from the gall it lays its eggs on the spruce and the young which hatch from them do not acquire wings but develop to a wingless form living solitary over winter on the twig. This is the form that lays eggs in the spring for the generation that causes the development of the gall which shelters them.

Remedial Measures. Spraying the trees in April with whale-oil soap solution (1 pound to 2 gallons of water) has been reported as effectual. (34th Report Mass. Agric. College). The practice of removing and burning the galls will serve to control this species sufficiently on ornamental trees. At Orono great numbers of the winged forms are caught in spiders' webs that are spun irregularly over the spruce twigs.

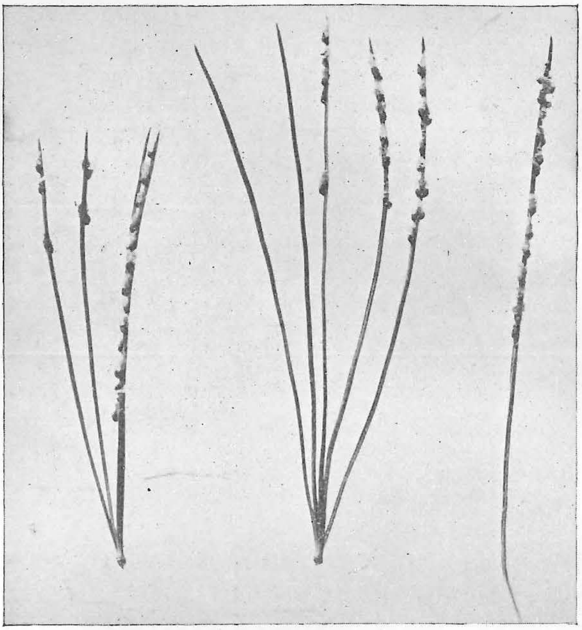

FIG. 43.—The Pine-Leaf Chermes. Migrants from the spruce-gall to the white pine.

FIG. 44.—Black spruce twig with two cone-like galls caused by the Pine-Leaf Chermes.

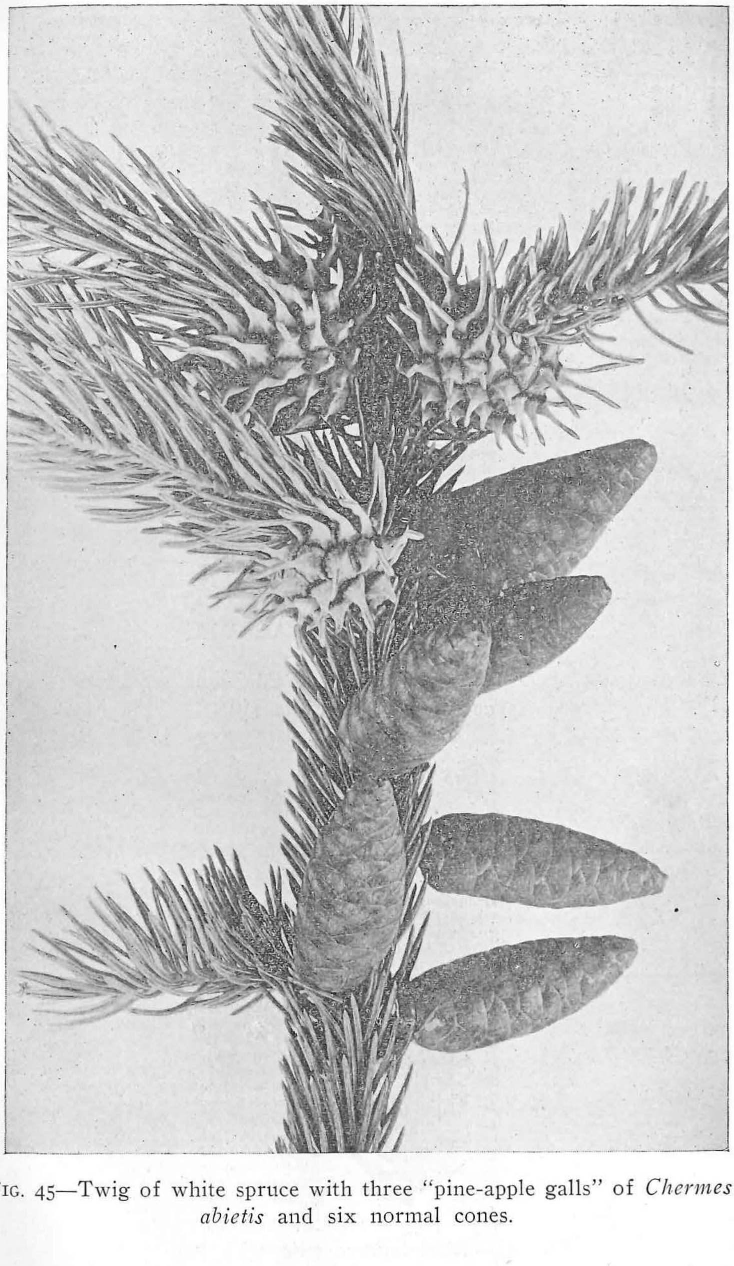

FIG. 45—Twig of white spruce with three "pine-apple galls" of *Chermes abietis* and six normal cones.

BLACKLEG.

A Bacterial Disease of the Stem and Tuber of the Irish Potato.*

W. J. Morse.

For the past three seasons the writer has had under observation a stem and tuber disease of the Irish potato in Maine which in some respects presents rather grave aspects unless the growers and shippers of seed potatoes in that part of the country where the disease has become established take immediate and radical measures to prevent its propagation and spread. In this connection it should be mentioned that it is only here and there that the disease has as yet assumed such proportions as to produce appreciable loss in this territory, and then more frequently in wet seasons or on low ground, but careful examination of fields over a considerable portion of the potato growing area of the State shows that this is a malady of much more general distribution than was at first supposed.

Unfortunately, there is considerable reason to believe that the disease is conveyed to the new crop by means of infected seed tubers. While the majority of Maine's 18 to 20 million bushels of potatoes are sold for table stock, the seed trade with Southern States has, in the past few years, reached such proportions that it cannot be ignored. So far as can be learned, blackleg assumes much more serious aspects in the states farther south, and this trade is demanding seed not only pure and true to name but also free from disease.

The fact that most of the outbreaks occurred many miles from the laboratory presented certain difficulties such that the organisms associated with the disease were not isolated in pure culture till late in the summer of 1908 when the disease was defi-

*Attention has been called to this disease in the following previous publications of this Station. Bul. 149, p. 323 (1907) and Bul. 164, p. 2 (1909). It was briefly described on page 6 of a revised edition of a circular entitled "How to Fight Potato Enemies" (March, 1908) and in September, 1908, a newspaper bulletin was issued which briefly described the appearance, nature and cause of the disease and cautioned dealers against shipping seed tubers from fields affected with this trouble.

nitely proven to be of a bacterial nature. The study of these organisms is not completed, but certain facts of practical importance to the seed grower have been ascertained. Therefore it seems best to issue at this time a preliminary bulletin upon the more practical phases of the subject as now known and leave the more technical studies and final conclusions for a later publication.

Blackleg in America, as is shown later, is a disease of more than local distribution, doubtless occurring to some extent at least over a considerable area of the potato growing sections in Eastern United States and Canada. There is reason to believe that it has existed in some localities for many years but it is only very recently that it has been recognized and recorded in the literature of American plant diseases. So far as the writer has been able to determine the first mention of this trouble in this country as a distinct disease was when Jones recorded its occurrence in Vermont in 1906,* and described in some detail the signs of the disease as it occurs in the field. Since its appearance in every way agreed with the *Schwarzbeinigkeit* or "blackleg" which he had studied in Europe† he used the same term as a common name of the American form of the disease. The writer was fortunate enough to see the field upon which Doctor Jones based his description. Since the appearance of the diseased plants as observed in Maine was identical with those seen in Vermont and since the term "blackleg" is especially applicable, suggesting the inky-black of the diseased stems, it seems best to continue the use of this term.

CAUSAL ORGANISMS.

In July, 1906, Harrison began the publication of a series of articles upon "A Bacterial Rot of the Potato, Caused by *Bacillus solanisaprus*."‡ In this account he describes a disease of the stem and tuber of the Irish potato which he had under observation in different provinces of Canada at least as early as 1900. He very carefully studied and described in considerable detail the organism responsible for the disease, which he called *Bacillus solanisaprus*, n. sp., differing in some respects from the description of *B. solanicola* Delacroix and *B. phytophthorus*, the

*Jones, L. R., Vt. Sta. Rept. 19, p. 257 (1906).
†U. S. Dept. Agr., Bu. Pl. Ind. Bul. 87, p. 17 (1905).
‡Harrison, F. C., Central. f. Bakt. II Abt. XVII, p. 34 *et seq* (1906).

latter of which is given by Dr. Appel as the cause of the *Schwartzbeinigkeit* in Germany.* Professor Harrison found his organism to be pathogenic on various varieties of potatoes, and also demonstrated its ability to produce soft rots on a considerable number of unrelated vegetables.

It is not the province of this article to discuss the relationship of the bacteria associated with blackleg in Maine with those already described as a cause of disease of the potato in America and elsewhere, or to take up in detail the morphological, cultural, physical and biochemical features of the organisms. When the studies now in progress are completed these questions will be discussed in detail, but a general statement at this time may be of service.

Pathogens from two different sources have been secured which are not identical in all respects in cultural characters, but it is doubtful if these differences are of sufficient amount to constitute separate species. One of these agrees in most respects, as far as studied, with the published description of *B. solanisaprus,* except in its ability to ferment certain carbohydrates which Harrison says the latter does not ferment. Ordinarily this would be considered sufficient to constitute a separate species. On the other hand, extended study of the fermentation of dextrose, lactose, and saccharose by the closely related organisms causing soft rots of various vegetables indicates that with germs of this class fermentation of the carbohydrates mentioned is not strong and is very variable. Hence with this group it is a questionable character upon which to erect a species.† Moreover preliminary work upon fermentation with an authentic culture of *B. solanisaprus* in comparison with the organisms isolated in Maine suggest the possibility that the differences in fermentative ability are not so great as was first supposed.

The blackleg organisms differ in cultural characters and in their effects upon the host from *Bacillus solanacearum* Smith, the cause of the southern bacterial disease of the potato and egg plant.

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*Appell, Dr. Otto, Arb. K. Gsndhtsamt., Biol. Abt., 3 (1903), No. 4, pp. 364-432.

†Harding, H. A., and Morse, W. J. The Bacterial Soft Rots of Certain Vegetables. Technical Bulletin No. 11, Part I. N. Y. Expt. Station (1909).

CHARACTER AND APPEARANCE OF THE DISEASE.

Plants affected by blackleg are readily distinguished in the field by any close observer, even at a distance. However, at first sight the general aspect of the diseased plants does not differ materially from that produced from several other causes which injure or kill the parts below or at the surface of the ground, such as the *Fusarium* disease, the *Rhizoctonia* trouble, or even mechanical injury to the stem. The affected plants appear more or less unthrifty and usually undersized, varying with the severity of the attack. The branches and leaves, instead of spreading out normally, tend to grow upward, forming a somewhat more compact top, frequently with the young leaves curled and folded up along the mid-rib. Later they become lighter green or even yellow and the whole plant gradually dies. If the disease progresses rapidly, the stem may fall over quite suddenly and wilt with very little previous signs of disease, other than the upward tend of the foliage noted above.

The diagnosis of suspected cases is easily confirmed by pulling up the affected plants. Blackleg, as its name indicates, is characterized by a pronounced blackening of the stem below ground, usually running up one, two, or even three inches above the surface. Sometimes under very favorable conditions, i. e., continued wet, cloudy weather, especially where plants are growing on a naturally moist soil, the inky-black discoloration may follow up a portion of the stem for several inches above the ground.* During the active progress of the disease the invaded tissues show a soft, wet decay. Preparations made from the tissues that are just being invaded, and examined with sufficient magnification show them to be filled with motile bacteria.

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*Inoculation of leaf petioles, or any part of a potato stem above or below ground with cultures of the bacteria isolated from diseased stems invariably produced the same characteristic black lesions. One plant was found in the field, however, which was affected with a rapid soft decay of the aerial portions of stem without discoloration. Several cultures were obtained from colonies on plates poured from this stem. In every case tried these have, when inoculated into plants in the greenhouse, produced not the colorless decay of the stem but the characteristic blackleg decay. It may be said, however, that the bacteriological studies upon this strain, so far as made, indicate greater variation from the published description of *B. solanisaprus* than others being studied.

Usually the seed tubers attached to affected stems are entirely decayed by a soft rot, or have disappeared entirely, while those attached to surrounding healthy plants are generally quite firm. If young tubers have been formed before the complete invasion of the stem they are occasionally affected in the same manner, although, as a rule, there is a tendency for the disease not to follow out upon the branches which bear the tubers but upward on the main stem toward the surface. Apparently the disease works more rapidly or attacks the plants as a rule at an earlier stage in their growth than the *Rhizoctonia* or "potato rosette" disease described by Rolfs in Colorado and Selby in Ohio,* for there is less tendency to produce little potatoes as there described. Occasionally when the disease makes slow progress on account of dry weather this tendency to throw out new shoots above the affected region bearing many small potatoes has been observed, even to the extent of producing small green tubers upon the stem above ground.

Out of a large number of affected fields examined only one indicated possible spreading in the field. This was in 1907. There was very little blackleg in the entire field of 20 acres except in one spot a few rods square where all the plants were diseased. It was first noticed near the center and gradually worked outward. The season was excessively wet, and the affected area coincided with a low pocket or depression in the field where water would stand for a few hours after each heavy rainfall, thus indicating how in this exceptional case the disease spread from hill to hill. In all other cases observed affected plants were scattered promiscuously over the field, always more common and more severely attacked on the lower or more moist portions of the field. If one stalk from a given seed-piece was diseased any others coming from the same piece were invariably found to be affected to a greater or less degree also.

As a rule the plants first begin to show signs of disease when they are 6 to 8 inches high and growing rapidly, i. e., in northern Maine at or soon following the first of July. The progress of the disease is markedly influenced by weather conditions. Very moist, cloudy weather may tend to favor rapid progress, resulting in the early death of the young plants,

*Rolfs, F. M., Col. Exp. Sta., Bulletin 70 (1902) and Bulletin 91 (1904). Selby, A. D., Ohio Exp. Sta. Bulletin 139 (1903).

so that only the dead stalks remain scattered among the healthy plants, within a month or six weeks, or even less time, after its first appearance. A period of dry weather coming on after the disease is well started below ground may check its progress, but cause the death of the plant at an equally early period on account of its inability to withstand the lessened water supply. Again conditions between these extremes, such as existed during the summer of 1909, may prolong the attack well into August.

In brief there is no evidence that blackleg under ordinary field conditions in Maine spreads from plant to plant in the field. The number of diseased plants appears to be determined by the number of infected seed pieces planted, modified by conditions of the soil, wet or dry. Infection of the growing plant always, so far as observed, begins below ground, usually at the junction of the stem with the seed piece, which probably decays or begins to decay before the stem is attacked. The rapidity of the progress of the disease and its severity varies with the weather conditions, or amount of moisture in the soil, but a plant once attacked never recovers sufficiently to produce merchantable tubers.

MEANS OF DISTRIBUTION.

As suggested in the preceding paragraph there is every reason to believe that blackleg is largely, if not wholly, distributed by means of infected seed tubers. As yet this statement is not backed up by sufficient experimental data, but observations so far made all point to this conclusion. Some of these observations are as follows:—

The first case in Maine seen by the writer was on new land recently cleared of forest and never before planted to any agricultural crop. Here infection either came with the seed or existed on land never before under the plow, which latter seems improbable. A field of four acres on the University Farm in 1907 was planted with seed from 5 or 6 different sources. Along one side 3 barrels of selected potatoes, Green Mountain variety each from a different source, were planted. The plants from one of these barrel lots showed quite a percentage of blackleg but careful search, several times on different dates, over the remainder of the field failed to reveal a single diseased plant. The disease had not been previously seen on this farm. Case after case has been seen on different farms where one field or part of a field developed the disease while another field on the same farm or a part of the same field did not show it. Inquiry has invariably resulted in showing that the seed tubers from the two different areas came from different sources. Several attempts have been made to trace the seed to see if the disease was present on the farm where it was produced. A few cases presented data of some reliability, giving an affirmative answer to the question. The too common practice of growers of selling their entire crop in the fall or winter and then picking up seed from mixed lots of local dealers, makes it impossible in most cases to trace the source of the seed.

In describing the outbreak on the Station farm in Vermont, Jones makes the following significant statement: "The field was planted with Green Mountain potatoes, the seed being from Houlton, Maine."* This statement is all the more significant in view of the fact that as a specialist in the study of potato diseases he has conducted experimental work on this farm for twenty years, has had an intimate knowledge of the condition of every crop of potatoes raised thereon during this time, and this was the first recorded outbreak of blackleg.

Professor T. C. Johnson of the Virginia Truck Experiment Station says:† "I examined a field in Augusta County (Virginia) in which some Maine grown Cobbler seed was planted, and also some home grown seed of other varieties. In portions of the Cobbler field the injury from 'blackleg' was as much as 8 to 10 per cent, the average injury from the field possibly not being over 3-5 per cent. The portions of the field planted to other varieties of home grown seed had no 'blackleg' whatever. I have not been able to find any 'blackleg' in the trucking fields in which home grown seed was used. The general opinion is that the disease was introduced with the seed potatoes but this has not been definitely proven."

Professor J. B. S. Norton writes, in answer to an inquiry, that during the past season he has seen one case of blackleg on a field planted to Maine seed in Somerset County, Maryland.

A letter from Professor G. E. Adams of Kingston, Rhode Island, states that in 1907 he found 5 hills of potatoes which

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*l. c., p. 258.

†In correspondence, September 1909.

appeared to be suffering from blackleg. "These potatoes were grown from seed which was obtained from England in the spring of that year." This is interesting as suggesting the possible origin of the disease in Maine. Harrison's account of the distribution and amount of damage produced by this disease in Canada,* even though we disregard the large amount of bacterial soft rot of the tuber following invasions of the late blight fungus *Phytophthora infestans* and the ordinary decay caused by this fungus itself, which he has apparently attributed to the soft rot associated with the stem disease, indicates that blackleg is a more common and destructive disease in certain provinces of Canada than in any sections of the United States thus far reported. Importation of seed stock from England would naturally be more common in Canada than to the United States. Therefore, it is conceivable that tubers infected with this disease have from time to time and at various places been introduced into Canada from England. Once in Canada, particularly in New Brunswick, the spread of the disease to Maine was a comparatively easy matter and a logical sequence, for Maine's greatest potato district borders on this latter province and quite a percentage of the potato growers of this section are former residents of the adjoining sections of Canada.

There is evidence that the introduction of the disease into some parts of Maine, at least, is by no means a matter of recent date. Many practical men when the diseased plants are pointed out to them will say that they have seen occasional hills showing this trouble several years past but have looked upon it as something of minor importance. Usually the period given varies from 5 to 10 years, but Mr. Borden Blackstone of Perham assures the writer that 30 years ago he observed something which he believes to be identical with this.

PARTLY DECAYED SEED TUBERS SPREAD THE DISEASE.

In an attempt to artificially inoculate seed tubers in the spring of 1909 three bushels of tubers, Green Mountain variety, were used. One bushel was planted as purchased. The tubers of the other two bushels were liberally sprayed with a living, virulent culture of the bacteria which cause the disease. They were allowed to dry off while spread on the floor under an open shed away from the direct sunlight, and covered lightly with builder's paper. Then one bushel of these latter was soaked in formal-

*l. c. pp. 34 and 391.

dehyde solution as is customary in treating for scab.* About a week later all three lots were planted. There was a good stand on all three plots, and no blackleg was observed on any of them. This was somewhat surprising in view of the experience of the previous year which was as follows:

Attempts to isolate the specific organisms from plants growing at a distance of from 50 to 100 miles from the laboratory, generally with the disease in the later stages when found, only resulted in failure during 1907, and the early part of the summer of 1908. Then recourse was had to the following method. Seed tubers bearing short sprouts were planted in boxes on July 25. Before planting the tubers were wet with a watery extract made by crushing some diseased stems, and after planting this extract was poured over the soil above. On August 18 several of the young stems from these tubers showed well developed cases of blackleg. From these virulent organisms were isolated with ease. In this connection it should be said that the tubers in the boxes were kept constantly quite wet while the land on which the culture-sprayed tubers were planted in 1909 was exceedingly dry for some weeks following. Later experiments showed that the organisms themselves were readily killed by drying. They were doubtless all dead before the tubers were planted.

The writer is of the opinion that the disease starts as a rule not from organisms resting on the unbroken skin of the surface of the tuber, but rather from those lurking in wounds, cracks or decayed portions of the flesh of the tuber where the disinfecting solutions may not penetrate. Hence seed treatment with any disinfecting solution should be supplemented by rigid inspection and the rejection of seed tubers which show any diseased or unsound portions.

GEOGRAPHICAL DISTRIBUTION IN AMERICA.

The extent of the distribution of this disease in the United States is indicated by the records of the Plant Disease Survey of the Bureau of Plant Industry at Washington. Mr. W. W. Gilbert, assistant pathologist, writes as follows: "I have looked through our records and find we have located the blackleg dis-

*Soaked 2 hours in a solution consisting of 8 fluid ounces of formalin (40% solution formaldehyde) and 15 gallons of water.

ease of potatoes in the following places: In South Carolina, in the trucking sections in the vicinity of Charleston; in Virginia, about Norfolk, Portsmouth, and at several points on the Eastern Shore; in Maryland at Beltsville; in New York, on Long Island; in Colorado in the vicinity of Greeley; in Ohio at Plainesville, and I find also a note of Mr. Orton's which states that the disease probably occurs in Oregon."

Answers to inquiries addressed to officials in experiment stations in the following states: Alabama, Connecticut, Delaware, Florida, Georgia, Kentucky, Maryland, New Hampshire, New Jersey, New York, North Carolina, Rhode Island, South Carolina, Vermont, Virginia and Wisconsin, indicate that except in Virginia the disease is not common enough to attract attention, it only being reported from the states mentioned below. From Connecticut Dr. Geo. P. Clinton writes: "I think that 'blackleg' disease you describe is the same as that I mention in my 1904 Report, p. 324, questioning if it is the southern bacterial disease." In Maryland Prof. J. B. S. Norton reports one authentic case from Somerset County, but expresses the opinion that the disease is more common than this indicates. One doubtful case is reported by Dr. F. L. Stevens of North Carolina. In Rhode Island Prof. G. E. Adams reports one case where the seed tubers were imported from England. In Vermont Prof. H. A. Edson states that it has only been observed on one farm where it was first introduced with the seed and reported by Doctor Jones in 1906.* In Virginia Prof. T. C. Johnson first reported the existence of the disease to the writer some over a year ago, and writing on September 27, 1909, he says: "The 'blackleg' is becoming somewhat general in this section of Virginia." There can be no doubt as to the identity of the disease in Virginia and Maine, as Professor Johnson is perfectly familiar with its appearance as it occurs in the field in both states.

In Maine, as has already been stated, the disease is not uncommon, but as a rule it occurs only as an occasional isolated affected stalk scattered over the fields, though several cases were found during the two wet seasons of 1907 and 1909 where from 5 to 15 or 20 per cent of the plants were affected.

*See p. 430.

These latter instances represented, with one exception, small fields of from 1 to 5 acres.

The similar appearing trouble which Harrison has described in Canada he stated had been found throughout the Province of Ontario, its presence had been reported from Nova Scotia, New Brunswick and Quebec, and one case reported from the Northwest Territory.*

ECONOMIC ASPECTS.

There is little evidence to show that blackleg has caused or is likely to cause serious and widespread losses on Maine potato fields, although its occurrence appears to be on the increase. While one of the worst cases found in 1909 was on well-drained, elevated land, the soil was quite wet on account of excessive rainfall throughout the season. So far as observed it is only to be feared as a serious pest in this section upon low, wet lands or on higher ground during abnormally wet seasons. However, in localities where the disease is prevalent during wet seasons occasional affected hills are found upon the dryer soils and during years when the rainfall is not excessive.

In Virginia so far as can be learned from correspondence, etc., the disease appears to assume more serious proportions wherever it occurs at all, and there seems to be a growing conviction around Norfolk, and in some places on the Eastern Shore, that it comes from and first occurs upon fields planted with northern seed.

Inoculation into sound tubers with pure cultures of the organisms associated with the disease produces a rapid soft-rot, and no doubt some of the loss from wet rot in the field and in storage is caused by this organism. However, in the writer's experience this is largely confined to the small tubers which have been formed in the hills attacked, before the stalks are killed. Even here only a small part of such tubers are found to be decayed. The disease appears to start from the seed piece, which is invariably decayed, and passes directly up the main stem. The underground tuber-bearing branches of the stem are cut off and the disease follows them out a short distance, but more frequently it stops before reaching the young tubers. If the young tubers are reached a soft, wet decay results. Out of a

*l. c. p. 35.

large number of plants grown in pots and inoculated with pure cultures of the organisms, at or near the surface of the soil, in only a very few cases did the disease spread downward and outward on the underground branches of the stem sufficiently as to reach and cause decay of the young tubers.

The fact that the organism so readily and rapidly destroys potato tubers when inoculated into them would indicate that in addition to producing a dangerous stem-disease it has potential qualities for becoming a serious pest as a cause of tuber decay. However, there is no evidence that this has been the case in Maine in the past. Epidemics of potato-rot are not infrequent, but these are invariably associated with and follow outbreakes of late blight, *Phytophthora infestans* De Bary, upon the foliage and this fungus is invariably found in the decayed tubers. Even in seasons when the late blight is rife the rot is almost entirely controlled by proper and thorugh spraying of the foliage, which would not be the case if the blackleg organism was a contributing factor.

In these epidemics of tuber decay following late blight while the rot as a rule shows the characteristics of that caused by the late blight fungus, there is associated with it very frequently a soft, foul-smelling decay which is apparently of a bacterial nature. While there is every reason to believe that the blackleg organism is capable of causing some of this soft bacterial decay, the writer's experience leads him to believe the great majority of it is caused by secondary infection by saprophytic bacteria following the invasion and killing of the healthy tissues by the late blight fungus. Attempts to isolate bacteria capable of destroying healthy tubers from those so diseased have invariably resulted in failure. The removal of some of the soft, decayed tissue from such tubers and inserting it in sound tubers led to no decay of the latter, while the same procedure where the decayed tissue was taken from a rotting tuber previously inoculated with the blackleg organism invariably produced a characteristic and rapid decay of the healthy tuber into which it was inserted.

Moreover, this soft-rot of the tuber following and associated with the decay caused by *Phytophthora infestans* is familiar to all who have had much practical, field experience with outbreaks of disease caused by this fungus, and has been observed frequently by horticulturists and plant pathologists in this country upon fields which showed no evidence of blackleg upon the growing stems. If the organism was present in sufficient degree to cause material loss from tuber decay it would seem that its appearance on the stem could not have escaped notice.

Harrison* apparently takes an opposite view to the above and seems inclined to attribute to his *B. solanisaprus* a much more active part in the cause of tuber decay in Canada. He asserts that the Experimentalist of the Ontario Agricultural College and others have confused the terms "blight" and "rot," but fails to state distinctly that *Phytophthora infestans* not only causes the well known blight of the foliage but also is a well recognized cause of decay of the tuber often referred to as the "late blight rot." He shows, in one instance, at least, where spraying for fungi was practiced, that the real cause of the rot was of a bacterial nature. However, the statements to which he objects such as "The potatoes grown in the Experimental Department have been comparatively free from blight, although in some parts of the province the rot has proven very troublesome in some seasons," and "results show that there was less rot on the potatoes on which Bordeaux mixture and paris green were used," are not necessarily confusing. They might be made with propriety in referring to the late blight of the foliage and the infection and decay of the tuber by the same fungus resulting from spores being washed down into the soil from the diseased leaves, and in no way be confused with the bacterial trouble.

To summarize, in no part of the United States has blackleg as yet produced widespread and severe losses to the potato crop. Such losses as have been experienced in Maine are largely confined to the killing of the affected plants before the tubers have reached merchantable size, but the amount of this loss appears to be increasing. Little or no loss from decay of mature tubers by this disease has been observed in this State, but much loss from tuber decay in Canada is credited to *B. solanisaprus*. However, the distribution of the disease is becoming quite general, and it may become a serious pest under certain favorable conditions and in certain sections of the country. In Maine while the losses from diminished crops have not been and may not be great, the real danger is from the

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*l. c. pp. 34 and 391.

possible loss of a valuable seed trade from certain sections where the disease may assume more serious proportions than it does in this State.

MEANS OF PREVENTION.

The observations here recorded and the uncompleted bacteriological studies of the organisms associated with the disease indicate that the introduction of blackleg into uninfected soils can easily be prevented. The organisms are readily killed by exposure to sunlight, even in December when the intensity of the sun's rays is at its lowest ebb. They are also quite susceptible to dessication. Young, active, vigorous cultures spread upon small sterile glass discs, allowed to dry at room temperature were found to be dead in less than half an hour after the moisture had disappeared from the surface of the smear, and thus far no evidence of spore formation has been observed in old cultures. They are, however, able to live a long time in the presence of moisture.

The introduction of small quantities of living, beef-broth cultures into tubes of sterile water containing formaldehyde or corrosive sublimate killed the germs, although the percentage of the two germicides used was many times less than that of the disinfection solution later recommended, and the exposure being for a much shorter period. The germs introduced into control tubes of pure, sterile, distilled water at the same time were not killed.

The fact that the organisms are readily killed by drying and, as already stated, (P. 436), no disease was produced by spraying smooth seed tubers with vigorous active culture and allowing them to dry several days before planting indicates that the germs are probably not carried over on the surface of the tubers. Very likely they live over winter in wounds or cracks in the seed tubers or in small decayed areas, there being sufficient moisture to keep them alive, but the temperature of storage is low enough to arrest their active development till after the tubers are planted and begin to put forth shoots.

Hence as a means of prevention: First, select seed, if possible, from fields upon which the disease has not appeared. Second, discard for seed purposes all tubers which have wounds, cracks or decayed areas.* Third, disinfect all seed tubers with corrosive sublimate or formaldehyde before cutting. Spreading the seed tubers out in thin layers in a clean, dry place exposed to the direct rays of the sun for several days would be an excellent supplementary practice and tend to hasten germination as well. The disinfection of seed tubers and the rejection of all such as show blemishes or diseased areas will not only prevent the spread of blackleg but also the propagation and spread of scab and most other tuber diseases which attack the potato in Maine.

METHODS OF DISINFECTING SEED POTATOES.

For disinfecting seed tubers for blackleg the same methods are recommended as for potato scab. Either of the following may be used.

Liquid Disinfection.

No. 1.

Corrosive sublimate .... 2 ounces
Water .... 15 gallons

Immerse seed tubers for 1½ hours in this solution.

No. 2.

Formaldehyde (40% solution),
8 fluid ounces (½ pint).
Water .... 15 gallons

Immerse seed tubers 2 hours in this solution.

Corrosive sublimate dissolves readily in water, but wooden containers must be used on account of its corrosive action upon metals. On account of its poisonous nature the corrosive sublimate solution must be kept out of reach of animals which might drink it, and the treated tubers should not be used for food. There is no danger from the use of formaldehyde; it is non-poisonous to the higher forms of animal life as ordinarily used. Since both of these solutions are effective No. 2 is recommended in preference wherever formaldehyde can be purchased, for the reasons given above.

*This sorting out of the diseased tubers should always be done as far as possible before cutting on account of possible contamination of the freshly cut, moist surfaces of healthy seed pieces by the germs carried by the hands or knives used in cutting those tubers where the diseased areas extended below where the disinfecting agents penetrated.

While no experiments have been tried upon the blackleg organisms to determine the germicidal effect of formaldehyde gas generated by means of potassium permanganate, its successful use in destroying the bacteria associated with certain contagious diseases of man is well known. The writer has also found this method equally, if not more effective, in treating seed tubers for potato scab than soaking in the solutions already mentioned. Therefore, if a large amount of seed tubers are to be treated at one time the following gas treatment is recommended.

Disinfection with Formaydehyde Gas.

Potassium permanganate ....23 ounces
Formaldehyde (40% solution)...........3 pints

The above is sufficient for each 1000 cubic feet of space.

The disinfection with formaldehyde gas should be done before the sprouts begin to start on the seed tubers. Place the seed tubers in bushel crates or shallow slat-work bins in a room where all cracks have been tightly stopped and the door made as near air-tight as possible, when closed. Spread the potassium permanganate evenly over the bottom of a large, rather deep pan or pail. If the quantity is large a small wash tub, or half a barrel may be used. Pour in the formaydehyde and give the dish one rapid tilt to ensure thorough mixing; leave the room at once and tightly close from without. Keep closed for about 24 hours, or at least over night.

The dish used for a generator should be placed in the middle of the room. *To avoid injury from the strong gas as it is liberated no potatoes should be placed directly above the generator.* It is also better to leave a clear space of at least three feet on all sides of the generator, and the slat-work bins or crates should be so arranged that the gas can circulate on all sides of them and mix with the air of the room before it comes in contact with the potatoes. Formaldehyde gas possesses about the same specific gravity as air, but when generated in this way the strong gas is driven off very rapidly mixed with hot, watery vapor and probably the most of it goes first to the top of the room, but it quickly diffuses and mixes with the air contained therein.

Temperature is an important factor in disinfecting with formaldehyde. It is more effective above 80 degrees F. and disinfection with this gas should never be attempted where the temperature of the chamber used is below 50 degrees F. A certain amount of moisture in the air is also very essential, therefore just before placing the formaldehyde in the generator the floor of the disinfecting chamber should be thoroughly wet down with boiling water. However, no water should be placed on the tubers to be treated.

The exposure of the tubers to the gas should not be made in sacks. It takes a large volume of gas and a long exposure to penetrate the sacks. Large quantities of the formaldehyde are lost by uniting chemically with the organic matter of the fabric, and the meshes tend to convert the gas into a solid substance known as paraform.

Upon completion of the time required to disinfect, the door of the room is opened and in a very short time the gas will have diffused outward sufficiently to allow the treated tubers to be taken out. There is absolutely no danger to human beings in working with the gas as here recommended. When first going into the room it may cause some irritation of the mucous membranes of the nose and throat but this soon passes away.

It should be mentioned that the amounts of formaldehyde here recommended and the length of exposure to the gas are far in excess of that found necessary for disinfecting rooms for contagious diseases, and are doubtless considerably greater than are needed for treating seed tubers. However, experiments have shown that the large amount of gas and long exposure, if done according to directions here given, will not injure the germinating quality of the tubers and will control the scab fungus as well, therefore it seems best to advise a treatment which will answer for both diseases at the same time. If it is desired to reduce the amount of solution and the time of exposure the writer would not advise going below 2 pints of formaldehyde solution and a proportionate amount of potassium permangante for each 1000 cubic feet of space and 12 hours for the lower limit of exposure.

Whether or not the disease germs can remain in the soil for any length of time to infect later crops is still an open question. The fact that field observations show that the disease is almost invariably confined to scattered hills and to stalks which spring from decayed seed pieces indicates that most if not all the infection comes from diseased seed. However, the somewhat closely related organisms which are associated with the soft rots of cabbage, cauliflower, etc., apparently remain alive in the soil for some time at least. There is no reason why the blackleg organism should not do the same. Therefore, land upon which a potato crop has been grown which was attacked by this disease should be kept in other crops, preferably grass, clover or cereals, for as long as possible before again using it for potatoes. The practice of growing two crops of potatoes on the same land in successive years should be discouraged, and low, poorly drained soils should be avoided. Fields which show scattered affected stalks should be frequently inspected during the growing season and all diseased plants and any tubers which may have formed on them dug up and burned. Under no condition should the crop from badly or even moderately affected fields be used for planting in Maine or shipped South for seed. Several of the leading seed dealers in Maine are doing their best to comply with these recommendations and all growers should coöperate with them in their efforts to furnish stock free from disease.

SUMMARY.

Blackleg is a bacterial disease of the stem and tuber of the potato. A similar appearing malady caused by bacteria has been reported from Canada, and another from England, Germany, France and other parts of Europe. Preliminary studies of the organisms associated with the disease indicate that they are closely related to those already described as a cause of similar troubles elsewhere, but whether they are identical with any of the described species of bacteria is not fully determined. (P. 429-432.)

The attacked plants are usually untrifty, light green or even yellow, and undersized. The branches and leaves have a tendency to grow upward forming a rather compact top, often with the young leaves curled and folded up along the mid-rib. The most characteristic thing about them is the inky-black discoloration of the stem, at or below the surface of the ground, but frequently running up the stem from one to several inches above ground. The seed-piece from which the attacked plants spring is invariably attacked with a soft-rot, and the disease appears to start on the stem at its junction with the diseased seed tuber.

The germs of the disease are capable of causing a rapid decay of the young tubers, and these are sometimes attacked also. (P. 432-434.)

The evidence thus far obtained indicates that blackleg is largely distributed by means of germs carried in wounds, cracks and decayed areas of seed tubers. On account of the readiness with which the organisms are killed by drying there is little to fear from sound, smooth seed stock, but this should be treated with a disinfecting solution as a matter of precaution. There is some reason to think that blackleg was introduced into Canada from England and from there to the United States. (P. 434-437.)

Blackleg is apparently becoming quite widely distributed throughout the eastern part of the United States. In most states it is not common enough to attract attention, and in no region has it done much damage, although it may become a serious pest in some sections. It is not believed that it is likely to do much damage in Maine, except in low, wet soils or during abnormally wet seasons. The similar appearing trouble caused by *Bacillus solanisaprus* Harrison is widely distributed in Canada and is there claimed to be of considerable economic importance as a cause of tuber decay. (P. 437-442.)

The propagation and spread of the disease probably can be controlled largely by the selection of seed from fields free from the disease, the rejection of all seed tubers which have wounds, cracks or decayed areas and treating the remainder with corrosive sublimate or formalhedyde solutions, or with formaldehyde gas as is done for potato scab. It is not known whether or not the disease germs will remain alive in the soil to infect future crops of potatoes, but as a precautionary measure the land on which the disease occurs should be kept in grass, clover, or cereals for as long a time as possible before planting it to potatoes again. (P. 442-446.)

APPENDIX.

Annual Report of the State Pomological Society

1909-1910.

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OFFICERS FOR 1909.

President.
WILLIAM CRAIG, Auburn.

Vice Presidents.
E. L. WHITE, Bowdoinham.
G. L. PALMER, So. Livermore.

Secretary.
W. J. RICKER, Turner.

Treasurer.
E. L. LINCOLN, Wayne.

Executive Committee.
President and Secretary, *ex-officio;* Chas. E. Wheeler, Chesterville; Will E. Leland, Sangerville; F. H. Morse, Waterford.

Trustees.
Androscoggin County—Silas A. Shaw, Auburn.
Aroostook County—Edward Tarr, Mapleton.
Cumberland County—John W. True, New Gloucester.
Franklin County—E. E. Hardy, Farmington, R. F. D.
Hancock County—William H. Miller, Bar Harbor.
Kennebec County—E. A. Lapham, Pittston.
Knox County—Alonzo Butler, Union.
Lincoln County—H. J. A. Simmons, Waldoboro.
Oxford County—W. H. Allen, Buckfield.
Penobscot County—Samuel L. Boardman, Bangor.
Piscataquis County—C. C. Dunham, Foxcroft.
Sagadahoc County—J. H. King, Bowdoinham.
Somerset County—Frank E. Nowell, Fairfield.
Waldo County—Fred Atwood, Winterport.
Washington County—D. W. Campbell, Cherryfield.
York County—J. Merrill Lord, Kezar Falls.
Member of the Experiment Station Council: Charles S. Pope, Manchester.

CONTENTS.

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.

Allen, Wm. H.......Buckfield
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
Bisbee, Stanley.......Mechanic Falls
Blanchard, Mrs. E. M.......Lewiston
Blossom, O. E.......Turner Center
Boardman, Samuel L.......Bangor
Briggs, John.......Turner
Burr, John.......Freeport
Butler, Alonzo.......Union
Chadbourne, C. L.......North Bridgton
Chandler, Mrs. Lucy A.......Freeport
Chase, Henry M., 103 Federal St., Portland
Corbett, Herman.......Farmington
Craig, William.......Auburn
Crowell, Mrs. Ella H.......Skowhegan
Crowell, John H.......Farmington
Dana, Woodbury S.......Portland
Dawes, S. H.......Harrison
DeCoster, Virgil P.......Buckfield
Denison, Mrs. Cora M.......Harrison
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
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
Gulley, Alfred G.......Storrs, Conn.
Hackett, E. C.......West Gloucester
Hall, Mrs. H. A.......Brewer
Hanscom, John.......Saco
Hardy, E. E.......Farmington
Harris, William M.......Auburn
Heald, U. H.......Paris
Herrick, A. A.......Norway
Hixon, A. A.......Worcester, Mass
Hoyt, Mrs. Francis.......Winthrop
Jackson, F. A.......Winthrop
Keene, Charles S.......Turner
Knowlton, D. H.......Farmington
Lapham, E. A.......Pittston
Leland, Will E.......East Sangerville
Lincoln, E. L.......Wayne
Litchfield, J. H.......Auburn
Litchfield, Mrs. L. K.......Lewiston
Lombard, Thurston M.......Auburn
Lord, J. Merrill.......Kezar Falls
Luce, Willis A.......Columbia Falls
Macaulay, T. B.......Montreal, Can.
Mayo, E. P.......Waterville
McAllister, Zaccheus.......West Lovell
McCabe, George L.......North Bangor
McLaughlin, Henry.......Bangor
McManus, John.......Brunswick
Merrill, Oliver F.......Gardiner
Mitchell, Frederick H.......Turner
Mitchell & Co.......Waterville
Moody, Charles H.......Turner
Moore, William G.......Monmouth
Moor, F. A.......Waterville
Morse, F. H.......Waterford
Morton, J. A.......Bethel
Munson, W. M.......Morgantown, W. Va.
Page, F. W.......Augusta
Palmer, George L.......South Livermore
Parsons, Howard G.......Turner Center
Pope, Charles S.......Manchester
Prince, Edward M.......West Farmington
Pulsifer, D. W.......Poland
Purington, E. F.......Farmington
Richards, John T.......Gardiner
Ricker, A. S.......Turner
Roak, George M.......Auburn
Sanborn, Miss G. P.......Augusta
Sawyer, Andrew S.......Cape Elizabeth
Saunders, Ernest.......Lewiston
Seavey, Mrs. G. M.......Auburn
Simmons, H. J. A.......Waldoboro
Skillings, C. W.......North Auburn
Smith, Frederic O.......New Vineyard
Smith, Henry S.......Monmouth
Snow, Mary S.......Bangor
Stanley, H. O.......Winthrop
Staples, Geo. W., 904 Main St., Hartford, Conn.
Starrett, L. F.......Warren
Stetson, Henry.......Auburn
Stilphen, Asbury C.......Gardiner
Taylor, Miss L. L.......(Lakeside) Belgrade
Thomas, William W.......Portland

LIFE MEMBERS—CONCLUDED.

Thomas, D. S ....North Auburn	Wade, Patrick........... ....Portland
Thurston, Edwin.........West Farmington	Walker, Charles S ....Peru
Tilton, William S.............Boston, Mass.	Walker, Elmer V....................Oxford
Townsend, Mrs. B. T ....Freeport	Waterman, Willard H....... .East Auburn
True, Davis P................Leeds Center	Waugh, F. A...............Amherst, Mass.
True, John W ....New Gloucester	Weston, Joseph ....Gardiner
Turner, E. P................New Vineyard	Wheeler, Charles E ....Chesterville
Twitchell, Geo. M ....Auburn	White, Edward L ....Bowdoinham
Vickery, James.................. Portland	Woods, Chas. D ....Orono
Vickery, John ....Auburn	Yeaton, Samuel F........West Farmington

ANNUAL MEMBERS FOR 1909.

Abbott, S. E.........................Norway	Merrell, H. H........................Hebron
Black, H. C ....Hebron	Millett, C. R ....Mechanic Falls
Bowers, Dr. J. W ....Portland	Morse, W. J ....Orono
Campbell, David W.............Cherryfield	Packard, Mrs. E. L ....Norway
Clement & Taylor................Winthrop	Perley, F. B......................Vassalboro
Cummings, R. L................West Paris	Perham, G . W. Q............Bryant's Pond
Delano, W. A.......................Norway	Philbrook, E. E....................Portland
Douglass, Edward C......Middleton, Conn.	Reed, R. C ....Temple
Ellis, A. W.........................Fairfield	Ricker, W. J..........................Turner
Frost, H. L ....Arlington, Mass.	Roberts. J. A........................Norway
Gallup, C. M ....Augusta	Ryerson, C. W ....Norway
Goodwin, S. H ....St. Albans	Sawyer, T. F ....Reading, Mass.
Hibbs, J. A.........................Hebron	Shurtleff, W. P...........South Livermore
Hitchings, E. F.................Waterville	Tarr, E...........................Mapleton
Holman, M. F......................Oxford	Thurston, Mrs. F. D................Norway
Keyser, H. L ....Greene	Tucker, Benjamin.................Norway
King, J. H ....Bowdoinham	Washburn, C. C............Mechanic Falls
Lang, B. C ....West Paris	Wilson, A. G., 33 E. Main St., Rochester, N. Y.
Leavitt, E. A ....Auburn	Wyman, E. L ....West Paris
Lincoln, Mrs. E. L..................Wayne	Yeaton, G. A.......................Augusta

REPORT OF THE EXECUTIVE COMMITTEE.

A general idea of the work of the society can be obtained by reading the reports of the different officers and the papers and discussions given at the various meetings of the society.

The executive committee are glad to report a successful year for the society. All its meetings have been well attended, helpful and instructive. It is the general feeling of the board and also among the fruit growers of the state that we are entering upon a new and progressive era in horticulture here in Maine and New England and it is hoped and expected that this society will grow and its power of usefulness will extend so that every progressive fruit grower in the state will be a member and look on its meetings as a source of pleasure and profit which it will be counted a great misfortune to lose.

The finances of the society are in good condition. The permanent fund is invested where it is safe and drawing interest. The books of the treasurer have been audited and found correct and well kept.

RECEIPTS.

Cash on hand	$44 05
Interest on permanent fund	69 00
Merchants' National Bank, Augusta	5 96
Membership fees, life	40 00
Membership fees, annual	51 00
State stipend	1,000 00
	$1,210 01

EXPENDITURES.

Printing and stenographic work	$214 24
Speakers and hotel bills	231 12
Officers' expenses	200 92
Freight and carting	11 37
Premiums paid	297 50
Salary of Secretary	150 00
Salary of Treasurer	25 00
	$1,130 15
Cash on hand	79 86
	$1,210 01

TREASURER'S REPORT.

E. L. Lincoln, Treasurer, in account with the Maine State Pomological Society.

RECEIPTS.

Cash on hand from the year 1908	$44 05
January 2, interest on First National Bank, Farmington	12 00
January 2, interest on Stockton Spring bonds	22 50
July 2, interest on First National Bank, Farmington	12 00
July 2, interest on Stockton Spring bonds	22 50
June 9, received from Merchants' National Bank, Gardiner, final dividend on stock	5 96
From 51 annual members	51 00
From 4 life members	40 00
From State stipend	1,000 00
Total receipts	$1,210 01

EXPENDITURES.

January 1,	Paid Merrill & Webber, order No. 1054	$18 35
	F. H. Morse, order No. 1055	3 25
	Will E. Leland, order No. 1056	7 70
	Charles E. Wheeler, order No. 1057	4 20
	E. L. Lincoln, order No. 1058	1 50
	Wm. Craig, order No. 1059	13 25
	W. J. Ricker, order No. 1060	70
	Gardiner & Morton, order No. 1061	8 00
February 15,	Paid Merrill & Webber, order No. 1062	3 50
	F. H. Thomas, order No. 1063	4 00
	C. E. Wheeler, order No. 1064	7 05
	Will E. Leland, order No. 1065	4 65
	Wm. Craig, order No. 1066	12 27
	W. J. Ricker, order No. 1067	5 70
October 6,	Paid Merrill & Wheeler, order No, 1068	18 00
	W. J. Ricker, order No. 1079	25 37
	E. Belle Oaks, order No. 1080	1 48
	C. E. Wheeler, order No. 1081	2 00
	F. H. Morse, order No. 1082	4 65
November 11,	Paid E. L. Lincoln, order No. 1074	12 25
	F. H. Morse, order No. 1075	6 50
	W. E. Leland, order No. 1076	14 28
	Norway Advertiser, order No. 1077	14 00
	Chas. H. Glass & Co., order No. 1078	14 25
	J. C. Woodrow, order No. 1079	5 62
	E. Cyrus Miller, order No. 1080	29 95
	W. J. Ricker, order No. 1081	7 05
	C. E. Wheeler, order No. 1082	7 60

	W. J. Ricker, order No. 1083	10 00	
	C. E. Wheeler, order No. 1084	4 75	
	Wm. Craig, order No. 1085	10 25	
November 12,	Paid John A. Woodman, order No. 1086	59 50	
	R. L. Cummings, order No. 1087	16 00	
	R. L. Cummings, order No. 1088	9 00	
	L. H. Cushman, order No. 1089	1 50	
	J. A. Roberts, order No. 1090	3 00	
	W. W. Twombley, order No. 1091	3 50	
December 13,	Paid Canadian Express, order No. 1092	25	
	Mrs. George Cummings, order No. 1093	10 00	
	J. W. True, hotel, order No. 1094	3 00	
	Auburn & Turner R. R., order No. 1095	69	
	Maine Telephone Co., order No. 1096	20	
	Mrs. J. W. True, order No. 1097	1 35	
	W. E. Leland, order No. 1098	4 00	
	W. J. Ricker, order No. 1099	156 25	
	W. J. Morse, order No. 1100	3 75	
	Chas. E. Lewis, order No. 1101	5 40	
	O. A. Johannson, order No. 1102	5 20	
December 18,	Paid C. L. Davis, order No. 1103	2 00	
	W. D. Hurd, order No. 1104	42 32	
	R. L. Cummings, order No. 1105	6 00	
	F. H. Morse, order No. 1106	13 00	
	Harry L. Plummer, order No. 1107	10 70	
	Maine State Bookbinding Co., order No. 1108	27 90	
	V. R. Gardiner, order No. 1109	10 31	
	E. L. Lincoln, order No. 1110	27 00	
	M. Dunnett, order No. 1111	6 95	
	Wilfred Wheeler, order No. 1112	10 20	
January 13,	Paid Dr. G. M. Twitchell, order No. 1113	5 00	
	Merrill & Webber, order No. 1114	3 75	
	Treasurer of the State of Maine, order No. 1115	29 56	
	Premiums awarded, order No. 1116	297 50	
	E. P. Mayo, order No. 1117	10 00	
	W. H. Cornforth, order No. 1118	63 25	
Total expenditures		$1,130 15	
Cash on hand		79 86	
			$1,210 01

PERMANENT FUND FOR THE YEAR 1909.

December 31, By members as reported for the year 1908	$1,750 00
Fees received for the year 1909—life members	40 00
Total permanent fund	$1,790 00

PERMANENT FUND INVESTED AS FOLLOWS:

Four shares stock First National Bank, Farmington	$400 00
Two bonds Stockton Springs, at cost	970 00
Deposit in Savings Bank	340 00
Due permanent fund, year 1908	40 00
Due permanent fund, year 1909	40 00
	$1,790 00

Respectfully submitted,

ELLIS L. LINCOLN,

Treasurer.

ANNUAL MEETING, NORWAY,
November 9, 10, 11, 1909.

Meeting called to order by Pres. Craig. Raymond Reed and Ora Blossom appointed to distribute ballot slips and collect ballots. Will E. Leland, Sangerville, and W. E. Leland, Mechanic Falls appointed to count votes. The following officers were elected:

President—G. M. Twitchell, Auburn.

1st Vice-President—H. L. Keyser, Greene.

2nd Vice-President—G. L. Palmer, So. Livermore.

Secretary—E. L. White, Bowdoinham.

Treasurer—E. L. Lincoln, Wayne.

Member of Executive Com.—E. F. Hitchings, Waterville.

Member of Experiment Station Council—C. S. Pope, Manchester.

TRUSTEES.

Androscoggin County—Silas A. Shaw, Auburn.

Aroostook County—Edward Tarr, Mapleton.

Cumberland County—John W. True, New Gloucester.

Franklin County—E. E. Hardy, Farmington, R. F. D.

Hancock County—William H. Miller, Bar Harbor.

Kennebec County—E. A. Lapham, Pittston.

Knox County—Alonzo Butler, Union.

Lincoln County—H. J. A. Simmons, Waldoboro.

Oxford County—W. H. Allen, Buckfield.

Penobscot County—A. A. Eastman, Dexter.

Piscataquis County—C. C. Dunham, Foxcroft.

Sagadahoc County—J. H. King, Bowdoinham.

Somerset County—Frank E. Nowell, Fairfield.

Waldo County—

Washington County—D. W. Campbell, Cherryfield.

York County—J. Merrill Lord, Kezar Falls.

Voted that vacancy of Waldo County be filled by executive committee.

ADDRESS OF WELCOME.

J. A. ROBERTS.

Mr. President; Members of the Maine Pomological Society; Ladies and Gentlemen:

The task appointed to me here this evening is truly a pleasant one, and I rejoice that I have the opportunity once more to bid you welcome in this hall and in this capacity.

The purposes of the Maine State Pomological Society are of the highest. If that organization does its full duty, and if it could extend its work more broadly, it would affect the interests and welfare of our state very largely. We are glad to have you come here. Oxford County is something of a fruit growing section. We raise here a few apples. We raise here, too, some good apples, as the New England show at Boston proved. And our apple growers in all this section are glad to have you come and give them instruction. They are glad to have you bring here your practical men, men who have had large experience in orcharding. They are glad to have you bring scientific men, men who have given their lives to a study of the questions which underlie this business. And our people are hoping that out of this meeting there will come to them much good and much value; that you will leave behind you not only this pleasant occasion, but that you will leave words of wisdom and words of cheer. My friends who are in this business of growing fruit all realize as well as the fruit growers in other parts of the state, that for the last two or three years the work has been hindered and has received, I might almost say, a staggering blow. But for all that, I think that the people in our section, and I hope it is so in the rest of the state, still have faith in the industry of producing fruit in Maine. I think perhaps it is a fair proposition to say that our fruit raising people are engaged in a tremendous struggle. I think perhaps it is a fair proposition for me to say that they are entering upon a new era. They recognize the fact that old conditions and old methods are passing away, and have got to pass away. They are beginning to realize the fact that new conditions and new methods are coming in, and must come in, in order for them to be successful. And I believe that the people of Oxford County, as well as the people in the other counties in the state, have the pluck and perseverance to carry forward this work of producing fruit as beautiful as you see here tonight.

Now, my friends, I am not going to take up the time, but I do want to say this,—that in all your words of wisdom, while you are telling us about the insect pests and the difficulties that are around us everywhere, and in manifold forms, I hope you will not dwell too much on those. Do not discourage the young people from planting trees. They realize something of the difficulties you have told us so much about,—the gypsy moth, and the brown-tail moth, and all the other insects and fungous diseases, and many other things. You have made the road ahead look so hard to travel that many young men are discouraged from entering thereon. Show them this beautiful fruit. Tell them that it was raised here on the hills and in the valleys of this state. Tell them how it is done, and that much of it can be raised. Show them those things. Make the industry pleasant to their eyes, and show them that it can be made profitable.

Now as I said before, we are glad to welcome you here. We trust that your stay with us will be a pleasant one. We have a beautiful village, and we trust that while you are here you will have an opportunity to go out somewhat and see what we have in the way of manufactures and other matters of interest. We hope that your stay with us this time will be so pleasant that you will want to come again in the near future.

RESPONSE.

Edward L. White, Bowdoinham.

Mr. President, Ladies and Gentlemen, and Citizens of the Town of Norway:

I need not say that it is a great source of pleasure to me to express the sincere thanks of the Maine State Pomological Society for your kind welcome to us within your borders. I might, by the consent of the members of the Pomological Society, relate to you the history of your invitation to the executive board of this society. I might say there were several other invitations, but it was the opinion of one and all, spoken right out, "Let us go to the town of Norway. We will certainly have a good time." And when I say that, I think I express the opinion of all the members of the Maine State Pomological Society. And in a simple, friendly way, I think I can sincerely say that it has been one of the greatest aims of the Maine State Pomological Society to get within its membership the growers of fruit. I noticed a short time ago that a committee picked out to judge fruit was picked out in this way,—a wholesaler, a retailer, a consumer. Where does the producer come in,—the grower of fruit?

It has been told me in the history of grape fruit that the producer raised the fruit, and then he had to educate the consumer that he needed the fruit before the wholesaler and the retailer would handle it. And when we come to the McIntosh apple, and look back a few years ago and find it way down among the lowest and now way up among the fancy articles, we can say the same of that as we could of the grape fruit. It was something that the grower had and the consumer didn't know anything about it. The grower knew it was good to eat, and the consumer didn't. Therefore the producer had to use his utmost means to put it into the markets and educate the consumer that he had something good to eat.

So in the work of the Pomological Society, I think the greatest and the most important thing is to educate the grower. I think he is the principal factor in regard to this branch of agriculture. When we look over the State of Maine and see an orchard cultivated and taken care of, what do we see in the owner of that orchard? Is he a narrow minded man? Is he an undesirable citizen? Is he diminishing the wealth of his town, county and state? I think not. I think you will find that he is a broad minded man, a man that is bringing his town up, and his county and his state. And it is the aim of the Maine State Pomological Society to make not only Oxford County, but the whole state, one of the best fruit growing sections in the world. And our fruit is equal to it if we who are young men will only take hold of the work. The obstacles are nothing but that we can overcome, and it needs the young men and the young ladies of the good old State of Maine to take hold of this work and make it better and stronger than it is now.

Again let me say to the citizens of the town of Norway, the Maine State Pomological Society sincerely thanks you for your welcome within its borders.

ANNUAL ADDRESS.

By President W. Craig, Auburn.

Ladies and Gentlemen:

Once again the busy growing season has gone by and we, The Pine Tree State Apple Growers, have come together for renewed acquaintance and to vie with each other in good natured rivalry for the highest honors. All day smiles should cover our faces, for although our crops were jeopardized by hail, drought and storm, nearly all those who had a care for the orchard were rewarded with a bountiful harvest; such is the natural law of compensation.

Some may plead that this was their "off year," but let me tell you now that (barring extremes in weather conditions) if you are up-to-date in your methods there will be no off year.

In looking over our past reports you will find that this society has been doing good work and advocating better methods for over a quarter of a century, and it is well to stop and ask ourselves in plain English: "Are we as a people deriving sufficient benefit for the outlay, or in horticultural terms, has our pomological tree been fruitful and yielded up an annual crop of useful inspiration?"

Is our fruit grown, handled and packed better than twenty years ago? Are we getting more money from our orchards? If not, why? Does the trouble not lie with us individually in neglecting to put into practice the good things we learn at meetings of this kind? Are we not prone to applaud the lecturer who advances new ideas and say that it is "fine," but to go home and do much of our work in the same old way.

The *valuable programme in store* for us at this meeting will prove to be a guidepost towards greater achievements, and may I ask you in good Episcopal terms to "read, mark, learn and inwardly digest" it so that all can turn it to valuable account in securing better fruit, better prices, better education for our families, better homes, better people; and better people means a better world to live in.

We must not be discouraged, however, because the real spirit of investigation and progress is in the air. It was an inspiration to see many of the Grange and fair exhibits this year, a large percent of them being placed on the tables without expectation of a premium.

For the good of our society I would suggest that in the future we arrange prizes to encourage box and barrel competition, gradually eliminating the plate exhibits, which encourage so many undesirable varieties. Furthermore five specimens are (it is said, but I hardly think it is true) too easily borrowed for the occasion.

Display exhibits in box and barrel competition will encourage apple dealers to attend our meetings, thereby developing the commercial side as well as the æsthetic.

Two years ago you honored me. I appreciate your confidence and thank you. I did the best I could under existing conditions. I know not what is in store for me, but this I do know, that if my future path be laid out for me in Maine it will be through pleasant places.

Always let the customary horticultural good fellowship reign in your midst and may showers of blessings attend your efforts.

"What plant we in this apple tree?
Sweets for a hundred flowering springs,
To load the May wind's restless wings,
When from the orchard row, he pours,
Its fragrance through the open doors;
A world of blossoms for the bee,
Flowers for the sick girl's silent room,
For the glad infants, sprigs of bloom
We plant with the apple tree."

REPORT OF SECRETARY.

W. J. RICKER, Turner.

Ladies and Gentlemen:

Last year, when we were in Waterville, we had two things in our minds that we wanted to accomplish during the coming year. One was to get an experimental farm where orchard research could be .carried on. The legislature of 1907 was asked to provide such a farm, but they in their wisdom referred the bill to the next legislature. The matter was left to Dr. Turner to bring before the legislature of 1909. This he did, and with the help of a large number of interested members we got the bill passed, and we have now Highmoor Farm. We are today just as much interested in an experimental farm as we were a year ago, but perhaps interested in it in a different way. Last year we were interested to get the farm. This year we are interested to see what we can get out of it.

The other thing that we were particularly interested in was to get some laws by which we could regulate the standard of box and barrel and provide suitable grades for packing and marking our apples. Dr. Twitchell had long been a committee of one to keep us informed on the doings of other states along this line, and to recommend suitable legislation. After talking the matter over it was left with him, and he drew up a set of laws and submitted them to the executive committee in December. The executive committee went over them with him and recommended that he present them to the legislature. It is unnecessary to say that the laws, after being changed a little were passed, and we today, if we are living up to the laws of the State of Maine, are packing our fruit in standard boxes and barrels, and marking them either "Fancy," "Ones" or "Twos" and marking them in large letters "Maine Apples."

Meeting Maine Pomological Society, Highmoor Farm, October 7, 1909.

The general workings of the society have been about the same as usual. We have held two field meetings, one in June at East Hebron, in connection with the East Hebron Grange and one at Highmoor Farm in October. I presume many of you were at these meetings. They were simply ordinary day meetings, the forenoon given over to orchard research and demonstration, the afternoon filled up with a program. The Highmoor Farm field meeting, thanks to Dr. Woods, I think was the largest and most profitable meeting the society ever had. Dr. Woods took full charge of the program in making the arrangements, and we certainly appreciated it.

We have had, I think, four meetings of the executive committee this year, one in December, closing up the business of last year and making plans for this year, one in Augusta in February, one at East Hebron, and one at Highmoor, but no special business aside from the making of the plans for this annual meeting.

DR. TWITCHELL: I wish I could feel that I was entitled to the credit which the secretary has given me, but justice demands that credit for framing the law which we have on our statute books be located elsewhere. It is true that there was placed in my hands for two or three years the work of arousing sentiment in the pomological societies of New England, with a view to uniform legislation, but credit for the law which was prepared and which has met the approval of our best fruit men belongs to the fruit growers of Oxford County, and I want them to have it.

PRESIDENT CRAIG: I certainly was pleased to know and see the interest that Oxford people took in that work last spring, but I don't know whether I should go quite as far as Dr. Twitchell in stating it was all Oxford County. I think Androscoggin County had a little share in the business, and we don't want to feel that anybody had any special monopoly. We are practicing co-operation. We are all working together, and that is the way we want to do in Maine. To get what we are after we must all work together.

The following resolutions were presented by the committee and adopted.

Whereas, the State of Maine has purchased in the town of

Monmouth a farm upon which there shall be conducted experiments in orcharding by the Maine Agricultural Experiment Station;

And whereas, in order that the fruit growers of the State may derive the largest amount of advantage from these experiments it is necessary that they visit the farm frequently;

And whereas, this farm is situated on the Farmington branch of the Maine Central Railroad about half way between Leeds Junction and Curtis Corner Station, be it

Resolved, by the Maine State Pomological Society in convention assembled at Norway, that the Society appreciates the courtesy extended by the Maine Central Railroad at the recent field meeting in stopping the trains at Highmoor Farm and in furnishing transportation at reduced rates. And be it further

Resolved, that the Society respectfully ask the railroad to establish a flag station at Highmoor Farm at which at least the morning up train and the afternoon down train will stop on signal. And be it

Resolved, that the Secretary of the State Pomological Society be directed to send a copy of these resolutions to the president, general manager, and general passenger agent of the Maine Central Railroad and to the superintendent of the Portland division.

Respectfully submitted,
GEO. M. TWITCHELL,
JOHN W. TRUE,
WILL E. LELAND,
Committee on Resolutions.

BETTER FRUIT FOR NEW ENGLAND.

(Stereopticon Lecture)
E. CYRUS MILLER, Haydenville, Mass.

Mr. President, Members of the State Society, and Friends:

I assure you it is a great pleasure to be here tonight. I have been in the State of Maine before, and have always found it most pleasant and agreeable. I want to bring to you the greetings of the fruit growers of Massachusetts, and assure you that not only in Maine is the interest in fruit growing increasing, but also in Massachusetts, and in fact in all the New England states. I believe, as one of the speakers here tonight said, we are on the edge of a new era in regard to agricultural matters, and particularly in regard to the growing of fruits.

Maine is peculiarly fortunate I believe. It has a great many things in its favor. You have in the first place this society, where you can focus so much of your strength and efforts for improvement and betterment of conditions in your state. Through this society you can get legislative action better and other things which are along the line of improvement. You are fortunate in having an agricultural newspaper in your state which is so well suited to conditions as they exist here. We are favored of course in having in our eastern states agrcultural newspapers of the highest class, both as to the subject matter which they contain, and the editorial treatment of those papers. We have the Rural New Yorker, one of the best papers in the country. We have our American Cultivator. We have the New England Homestead. We have the New England Farmer. We have these papers which give local color to our agricultural efforts and work. And we are peculiarly fortunate in having the assistance of this agricultural press to instruct us, to encourage us and to help us along all these lines for the betterment and uplifting of our agricultural work.

You are fortunate here in the State of Maine in having three other things, which to me seem very important and vital. At the conference of governors, held at Boston about a year or more ago, one of the suggestions which I had to offer was that each and every state in New England should have an official something after the type and style of your state entomologist, someone whose work it should be to instruct and to counsel with the people of the state along that particular line of agricultural work, and give them the best instruction which they could. You here in Maine have an official of that type in Prof. Hitchings, and I have no doubt whatever that he has been of great assistance and benefit to the pomological life of this state. We all know what he has done for your fruit growers in organizing your efforts and presenting specimens of your wonderful fruit at the Boston Fruit Show. And Maine is to be congratulated in having such an official. You are to be congratulated in having such fruit to present there, and then in having a man who is willing to take off his coat and go to work against seemingly large obstacles, and formulate and systematize the work and put it before the people at that show.

You have also what has been referred to tonight as your state experimental farm. Now in that matter you are distinctively ahead of any other state in New England, and I want to say right here that I believe that is going to be an immense benefit to the State of Maine. If it is ably and honestly and efficiently conducted it may be one of the most potent factors in the development of pomological matters in this state. And I beg to caution you to keep your eyes upon it and see that it is made a power not only in agricultural matters but also in horticultural affairs.

Then another point in which Maine is distinctively in advance of other states in New England is in the matter of state legislation regarding the grading and packing of fruit. This is another matter upon which New England should act as a unit, but it seems that you are a little bit in advance of the procession and that you have set the pace in that direction. And while perhaps your bill may be immature and incomplete, I believe it is the entering wedge and that it will be a great benefit to the fruit growing interests of Maine, and I congratulate you in having it. It is going to work hardship to no man or fruit grower. Those who have objected to any such measures are those whose objection should not carry great weight. Those who are honest in their desires to have the fame of Maine fruit known abroad, and favorably known, have been in favor of it.

Now as to conditions which enter into the making of better fruit in New England, I want to say just a few words on the economic side. And first of all, we who are engaged in agriculture and horticulture should have a larger faith in our own soils and climates and conditions. We do not realize the possibilities that are in our soil, and in our climate, and in the conditions about us, such as markets, etc. And last of all, we should have faith in ourselves to work out those things.

Coming down from Boston I read a chapter in a book which I purchased there on a miracle of self confidence. And I wish everyone could read that chapter. The book is called "Peace, Power and Plenty," and although it deals with economic subjects, I believe it may very well be read by anyone engaged in agriculture, horticulture or any phase of work in life. The important thing is the faith in ourselves to work out these problems, and we have just as many advantages here in New England as there are in any other section of the world. I say this is the starting point in regard to the growing of better fruit in New England, faith in ourselves that we can do it.

All one has to do is to walk about this hall, and cast his eyes upon this magnificent exhibition of fruit, which we know is not only fair to look upon but is of the best quality, to see that something is fundamentally lacking in fruit from other sections of the country. In the middle West they have varieties of fruit that cannot be compared with the kinds that we have in New England. In the far West they have apples that are fine in appearance, but do not have the intrinsic merit that our fruit in New England has. And so our fruit here has the double advantage of fine appearance—something that will sell on its looks—and also the merit of quality.

Do not fear that the apple business in particular will be overdone. We have heard that cry for years, and yet what do statistics tell us about the production of fruit? Since the year 1896, when we had a large crop, it has been decreasing every year, and on the other hand our markets have been increasing. We formerly thought a great deal about the market across the water, but today we find that the great middle West is proving a large market for our apple products. In fact this year they have more buyers in the East than ever before. And I might say right here that the apples grown in our own orchards were bought by a Maine man and shipped to the West, and a large part of the fruit in western Massachusetts has gone into the middle West.

Our fruit has two advantages in that section. It has the quality that appeals to them. They have no fruit of quality such as the Baldwin or Greening or Spy. And then on the other hand there is the matter of sentiment. We find in the middle West a large number of sons of New England, and they know what the Baldwin and the Greening and the Spy are. The names are trademarks, and they ask their wholesalers and their retailers and their fruit-stand men for apples from the East, because they know them by association and reputation, and they know they have the advantage of fine appearance and fine quality.

Now one more thing about apple orcharding, and that is, with the exception of the hay crop, there is no crop that may be grown in New England, or in Maine, to which the soil is so well suited as the apple crop. And further than that, there is no acre of land used for agricultural purposes that may be made so valuable as an acre of well cared for and well managed apple orchard. I know of orchards that have been paying six, eight and even ten per cent on a thousand dollars an acre ever since they were twelve years old, and of just the ordinary kind, that is, the kind which is not recognized as the highest degree of excellency. If we took the McIntosh apple, which is selling at the rate of four, five or six dollars a barrel, I would hardly dare to state what the results from an acre of that variety might be.

Now I want to consider briefly a few of the fundamentals that underlie practical pomology. It seems to me that the starting point in the growing of better fruit, should be the improvement of our orchards as they stand today, in other words, in a large number of cases, the renovation of our old orchards, the renovation of trees and orchards which have stood by the roadside and in the fence corners, and been more or less neglected. Isn't it really a marvel to think of our raising such fruit as we do raise, under conditions of comparative neglect? If such fruit as we do get can be grown under such conditions, what are the possibilities, I ask you fairly and plainly? If we shall adopt more modern methods of producing these articles; if we shall feed our trees, or if at least we shall produce an environment about them whereby the plant food that is in the soil, or that may be applied to the soil, shall be made more easily available for those trees; if we shall scrape off that rough and rugged bark that harbors insects, that prevents new development of the bark,—if we shall scrape off that loose bark and give the trees a different appearance; if we shall climb into that tree and cut out the portions of surplus wood, the dead and dying limbs, those that are affected with canker, and revive the tree and put it in better physical condition to produce fruit, and then last but not least if we put on a spraying mixture which shall control, or eliminate the multitude of insects and fungus pests which we have, what, I ask, are the possibilities?

Our old orchards are a serious blemish on our landscapes. There is nothing artistic about them. A forest of fir, pine, spruce or birch, is far more artistic on the landscape than these old scraggy, decrepit apple trees. And so I ask you, if you cannot make them over, or have not the interest to make them over, and to make them more serviceable to you, and give you more pleasure, to say nothing about the profit, to put them into cord wood. By so doing you will eliminate a part of the apple crop that doesn't bring you profit; neither does it bring credit or fame to your state.

You should extend your period of pruning of those trees over a period of three years or more. Do not try to do it all in one year, but extend it over a period so that the tree may not be too much disturbed, and as you cut off a limb here or there, you may seal over the wounds and keep your tree in a good healthy condition. And at the end of three or four years you will have a tree, if you cultivate it and feed it and prune it properly, that will be in condition to be a source of pleasure and profit to you. Of course, if the trees are too closely planted, as is the rule in many cases, it is the wiser plan to cut out every other tree. If you have too many varieties and desire to grow apples on a commercial scale, of course the best plan is to cut out those varieties which are not of known kind and excellence. The market today is calling for relatively few kinds of apples, but it wants those apples of the highest grade, and the higher the grade and the larger proportion of high grade that you have the greater amount per basket or barrel you can get for them.

The spraying of the fruit is very important. However favorably located you are, I believe that the quality of the fruit may be improved by putting on a coating of spraying mixture. The apple tree should be sprayed when it is dormant. I believe that such spraying mixtures as lime and sulphur or sulfocide will work great benefit to trees. They are not only cleansing but they are invigorating. If you have never tried it I beg of you to do so. I am speaking from my own experience, and I would no more neglect winter spraying of our trees than the summer spraying with arsenate of lead or similar preparations.

Now I propose through these pictures on the screen to take you on a short visit to our hillside orchards. And I want to say right here, these orchards have been developed in connection with other forms of farm work, particularly the dairy industry. And one reason why I feel so strong in urging upon the farmers of New England to take up apple growing is because there are so many people who are engaged in dairying, and the dairy may be made a most valuable adjunct to the development of the orchard. It may be made a source of income while the trees are growing and attaining bearing age. And after that time comes and the orchard becomes established, or at least comes to a certain stage of development, I believe all these other things may be eliminated and the orchard may be relied on entirely for an income. That is one way of developing the orchard. The commercial way would be to eliminate everything else and give the whole of the land to the orchard from the start. But the most practical plan to bring before the farmers of New England, I believe, is to place the orchard in conjunction with some other line of effort, because the average farmer hasn't the capital with which to branch out and make orcharding a single line of work. That was the condition of our farm. We worked along developing new land and depending upon the dairy and some market crops with which to grow our trees and grow our fruit.

The first picture that is thrown upon the screen is the picture of our packing house. This is the second story of it in which we usually store our fruit when it has been sold, and in which we sort and pack.

Here is shown a photograph of the truck upon which barrels are to be loaded and taken to the station. We are fortunate in our location, being within a stone's throw of the loading point, which is a very important factor in reducing the expense of our operations.

You should see the ten-year-old Baldwin orchard. It has just about reached a profitable bearing stage. Up to this time we have utilized the land in between the rows in growing hoed crops like potatoes and corn, and a very short rotation of grass. From now on there will be absolutely no crops grown in this orchard or in any other portion of our orchards that are in bearing condition. I believe so strongly in the principle of cultivation in the growing of apples that I am eliminating everything in the orchard where the trees are of bearing age except the apples.

Question. How far apart are those trees?

Ans. Our rule in planting trees is forty feet between the rows and thirty-five feet between the trees in the row. That applies to Baldwins. Where I inter-plant, as I have in some cases, Baldwins and Wealthy, I plant thirty feet apart. But after the Wealthies are taken out it will leave the Baldwins sixty feet apart. And I think I will show you later, by some of the photographs of trees that were planted twenty-two years ago, that sixty feet will be none too far, looking ahead and allowing the same rate of growth to continue as has been made in the past.

We have next a picture of one of a block of trees that has been planted five years. I buy the best two-year-old trees that I can buy, and buy of a good, reputable nursery firm, and specify that only good, healthy, vigorous trees shall be furnished. In the West they talk a great deal about the large growth which their trees attain. I claim that here in the East, if we give the proper treatment and adopt intensive methods of culture, we can grow trees of practically the same size in the same length of time. I believe in growing a tree as rapidly as you can grow it and still mature the wood for the winter. I cease cultivation of all kinds along in mid-summer, and it is a very rare thing to have any winter-killing whatever.

Here is a type of tree that is to be avoided. I think you will agree with me in that. And still how often, upon our country side, do we find trees of this type, where the art of pruning is unknown and where the trees are pruned until they look more like a lion's tail than anything else; where the apples instead of being where they can be easily reached by a picker, are found clear up on the tops of the trees and the bearing surface of the tree is very much restricted. The expense of spraying and picking reduces the profit to the very lowest possible point. I ask you to avoid any such methods of pruning as that, and I think the object lesson will show you conclusively that they are to be avoided. The lower branches, in my opinion, should be pruned so that when they are loaded with fruit they will just about touch the ground.

This view shows you the spring method of treatment of the orchard, and how we plow between the rows in the springtime. Nearly all of our orchards are on more or less of a hillside. The orchards themselves are located upon a kind of over-crested hill, having all exposures and all grades, and this is a moderately steep grade. We plow between the rows, going as close to the trees as we can get comfortably with horses, and I think close enough. In trees of that age, which are about twenty years old, the root system becomes so extended that the whole surface of the ground is covered with a net work of roots. The strips on the side hill serve to hold the wash of the land, and also serve to hold the trees in a certain equilibrium by keeping the fruit upon the trees and allowing it to color more highly than it would if entirely clean cultivation was practiced.

Question. That is on a hillside. Now if you plow that a number of years how would you avoid ridging on the upper side of the row of trees?

Ans. The very first step after plowing those strips between the trees is to level that land off and fill in the open furrow on the upper side and throw in furrows that are plowed out on the lower side. Of course that is quite a bit of work, but it is absolutely essential if you desire to keep your land level so that when you put on a cover crop and roll it down you have everything in nice shape.

Question. Will not a disc harrow do the work cheaply, and as well, instead of plowing?

Ans. A double action cutaway harrow would, such as I am using now. I don't think very much of a disc harrow, because it leaves the land uneven, but the double action cutaway harrow I consider a most valuable tool for any farmer's use.

Question. What cover crop do you use most?

Ans. I use a cover crop of clover and barley in mid-summer.

Here is a picture of a two-year-old orchard. In this section of orchard we have been growing corn. I cultivate the young orchards for about four years, growing potatoes, corn and sometimes tobacco. I have grown tobacco up to within a few years, and sometimes market garden truck, like cabbages or tomatoes.

The next slide shows an orchard, practically the same block of trees you were shown in two other views. It is in a different part of the orchard and at a different season. This was in the fall after the fruit had been taken from the trees. The trees vary in type, but the straight type predominates.

Now we come to another proposition. That is as the land looks frequently in our section before it is taken in hand at all. There is a section that a year ago, just about this time, I was busily engaged upon clearing, a section of about five acres in area, a rough and rugged piece of land on the hillside, as you see. I went to work and cleared those stones and built seventy or a hundred rods of wall on the lower side, removing all the surface stones at first and then putting a plow in and having the plow followed by two men with bars, taking out the stones, and this spring I planted a section of it to young trees and planted that area to corn. And I had a beautiful piece of corn on that field. I also had a splendid growth upon the young trees. So you may see from that photograph the condition of the land where my orchard had been practically made. It had to be worked slowly and a great deal of expense was involved. But the results have justified the expense, and it takes but a very few years in which to get a valuable and profitable orchard.

Here you see a picking scene, showing the low-headed trees and the ladders placed upon them and the pickers ready for work with their baskets. The picking of the apples is the most interesting and fascinating part of orcharding for me.

The next view shows the larger orchard in the dormant period. It is during the latter part of the dormant period that I do most of the pruning. I used to do it in the winter, but lately I do most of it in late winter or early spring.

Here is the spraying outfit which we use, the largest size hand pump, with a tank holding two hundred gallons. Instead of a tower, we utilize a painter's ladder bolted to the wagon upon which a man may reach the tops of any trees which we have.

We now have a close view of one of the trees, showing it in fruit, and here is where we come close to an illustration of the possibilities in apple culture. Here is a tree which two years ago produced something like ten barrels of apples, selling at that time at $3.00 a barrel. This year we had ten or more barrels from that tree, selling at $3.25 a barrel. Think what the returns would be from a whole orchard at that rate, counting thirty trees to the acre! And what has been done there may be done in other places. It is simply a question of applying systematic, intensive methods to the care of the tree.

The next view, taken in the fall, shows a tree that has been planted two years. Of course that tree will look different when it is headed back in the spring. From one-third to one-half of the top will be taken off, and the result will be to make it lower headed, to make the top more bushy and more stable, and give a tree that will have a greater resistance to wind and storm, and also have capacity for bearing a large quantity of fruit.

Question. Would you cut out any of the limbs on that tree next spring, or only cut back from the top?

Ans. I thin out each year everything that is necessary to come out. Of course what might want to come out next year can be left this year. Keep the center of the tree well cleaned out. In starting a young tree I aim to have an open center; to build, as it were, a frame work around the center of the tree, never having an upright, because it is the upright that makes the tall trees. And if you have an open center you can train your trees low much more easily than if you have an upright.

Here we have an orchard equipment, as far as the wagon, barrels, men and ladders are concerned. Such a wagon as that I consider most useful in an orchard. The wheels turn under the body. The tires are wide, and although it may draw a little harder for a team, still you can go about through the orchard much more easily than with a high wagon. It has also a long body, holding something like eighteen or twenty barrels, which is quite essential.

This slide gives a front view of the building which you saw on the first slide that was upon the screen. This is a view from the street side, showing you a front elevation of the building. This building is something like 40 feet wide and 100 feet long, with practically three stories for storing apples. The lower story will hold something like 4,000 barrels, the second story 3,000, and the top story will hold 2,000 or 3,000 barrels. Of course we haven't that number yet but I anticipate it within a few years.

Here is another picking scene, showing the barrels distributed and the pickers at work. My way of managing the picking is to have ten or a dozen men and take two rows of trees, placing the barrels between the rows, and work my men right along those two rows, keeping them together so I may have my eye upon all operations and see that they pick the apples carefully and do not leave any apples on the trees or break the trees.

We now have a picture of a tree which has been planted four months on a section of land which the winter before was covered with forest. This is a type of land which we are using. This tract of land was literally a forest, from which was cut hundreds of thousands of feet of lumber and a great many cords of wood. In the early springtime the brush was burned, and the trees were planted right among the stumps and stones. No effort was made to remove a thing except that in the spring from this section were taken enough stones to build quite a piece of stone wall. Since this time, which was two years ago, the piece has been pretty well cleared of stones, but the stumps are still there. The trees are growing. Of course the methods of caring for trees under these conditions are entirely different from those where you put in a plow and harrow. I grubbed about them with a grub hoe, putting on a bushel of stable manure to every tree, and the result has been, I have obtained a very fine growth on those trees.

Here is another of a block of 600 Baldwin trees, showing them in fruit. The limbs are low and it is easy to gather fruit from such trees. Old men or children can pick fruit from such trees, and pick it as cheaply and as easily as an active man can from a ladder.

This is an interior view of the storage building. Here you see a room where we can easily handle 3,000 barrels of apples. In this room there are something like 1,000 barrels. And a place like this or a storage house of some kind, in my opinion is most essential for anyone engaged in apple growing on any large scale. I have tried all ways for packing apples. I have tried packing them in the field and packing them inside, and I am firmly convinced that with me, and under our conditions, it is far more satisfactory to pick the apples and put them in a storage building, and then at a later time, at my convenience, pack and ship them. If you pick and pack at the same time in the orchard, you run into periods of wet weather. You get your barrels wet and get them out of shape. You are delayed in your work. Whereas, when you are picking you can give all your energies to that operation, and then, when you have your apples under cover, you can pack when it rains, and when the wind blows, and when it is pretty cold outside. This method I believe in most thoroughly.

This picture shows an orchard in bloom. A more beautiful picture in nature I believe was never looked upon than an apple orchard when in full bloom. It is not only beautiful to the eye, but fills the air with fragrance. As I go into the large cities and see the brick and stone buildings, I am always thankful that I am a farmer. I enjoy the out-of-door life, the blue sky and the work that I am engaged in. I think that we as farmers do not realize the blessings of the agricultural life, and that we do not get the enjoyment out of it that we might. We long for those things which we do not have. We have the choicest and richest blessings which the Creator could bestow upon any of his children, and I would give you this thought of being more contented and satisfied with your own life. And then you will have more confidence in your own efforts and powers to take up the work and continue it and make more of a success of it.

I want to refer just now to the case of a young man who became interested in orcharding through my efforts, and who has engaged in orchard work. He is about 37 years of age. He had been engaged in commercial pursuits during his entire business life, but he became interested in orcharding, and he has taken up a tract of forest land upon which he is working now. It is in our neighborhood. The point to which I want to call your attention is the amount of enjoyment that young man gets from his work. He says he can hardly wait for morning to come to get to the woods and begin on his work. He looks like a different man from what he was when in the city, mentally, as well as physically. His work now is being done largely under my direction, but in a few years he will learn the business, because he has such an intense interest in it and loves to do it. He has all the essentials that make for success, and in a few years he will have a fine orchard.

This view is a section which is called Apple Valley. It is a hamlet that is known through the state of Massachusetts, and is often referred to when the possibilities of apples are considered. This valley is occupied by four or five farms, upon which for a number of years, the principal crop has been apples. And here in this valley, surrounded by hills, taking simply the naked trees which they have had in their pastures and in their mowing lots, and grafting them, they have made the apple a source of large profit. And from this little valley has been taken, almost every year, from six to twelve and as high as fifteen thousand dollars worth of apples. The reason for their success is not that this section is better located, or has better soil, or anything of the kind, than many other sections; but it has been primarily that these farmers have understood the fundamentals that underlie the successful growing of apples. "Better fruit" has been in their minds. Their ideals have been high, and they have worked continually to improve their crop. They have adopted all the modern and scientific methods possible in growing their fruit, and the result is that they have a product that finds a ready sale. It is also a section where they have followed the plan of co-operation, that is, selling their entire crop as if they were one individual. They have given an object lesson to people of our state, and their work may be an object lesson even to the farmers of Maine, that wherever there is a community engaged in the same kind of work, they may co-operate in all their work and efforts, and particularly in the selling of their product.

I will complete this lecture by giving you a cordial invitation, if you come to the western section of Massachusetts, to visit our orchards at any time or season of the year. It is a delight for me to have visitors come from your state for the distinct and special purpose of visiting the orchard.

DISCUSSION.

Ques. What do you use for fertilizer on all those trees?

Ans. Our basis has always been stable fertilizer, supplemented by wood ashes. At our experiment station at Amherst they have conducted experiments along that line, and the result is, putting it briefly, that stable fertilizer gives the best growth to the tree, and that wood ashes gives the best color to the fruit, and fruit that matures the earliest. Now I have combined those two elements, and worked for both of those points, to get a healthy, vigorous condition of the trees and also to get a fruit of high color and of fine quality and early maturity.

Ques. How do you keep up the fertility of the balance of your farm?

Ans. By a quick rotation of crops.

Ques. What is your rotation?

Ans. Corn, potatoes, grass and early vegetables.

Ques. What do you use for grass?

Ans. A large proportion of clover. Perhaps half clover and half timothy.

Ques. At what season would you prune your trees if you could do it just at the proper time?

Ans. I would prune all trees in the late portion of winter or the early part of the spring. I don't believe in summer pruning. There may be conditions and circumstances whereby it would be justified, but I believe as a rule that in summer, pruning is debilitating to a tree; and you all know that the average New England tree hasn't got that amount of vigor that it can lose any of it.

Ques. On some of those slides of the orchards in blossom I noticed that the ground apparently hadn't been plowed. Was that a year when you did not plow?

Ans. Those were taken in a year when the plowing had been omitted. From now on, every portion of the bearing orchards will receive cultivation every year, and just the amount of fertilizer that the trees need to keep them in good condition and in good health and vigor, and that will enable them to produce fruit of the highest degree of quality and appearance.

Ques. About how much ashes do you put to the tree, and how near?

Ans. I put neither ashes nor fertilizer very close to the stem of the tree, except when it is small. After the tree has become established, the rule would be to put it around the extremities of the branches.

Ques. Not nearer than seven or eight feet?

Ans. No. Of course it depends upon the size of the tree. With the larger trees, such as you have seen here, I would put it between the extremities of the branches on one side and the extremities of the branches on the other side. The root system becomes extended when the roots fill the soil, and they can take all the plant food that is necessary.

Ques. About how much do you put to a tree?

Ans. A bushel of wood ashes would be the rule, or thirty or forty bushels to the acre, and perhaps four to six cords of fertilizer.

Ques. Do you apply that same amount every year right along?

Ans. No, I would apply that according to the needs of the trees. For instance your trees are bearing heavily this year I would put on a larger application after they have been bearing heavily than if they haven't been bearing, because they have been exhausting themselves. We little realize how exhausting it is for a tree to bear five, ten, or more barrels of apples. It has been figured out how much of fertilizing elements such a crop takes out of the soil. I can't give the figures, but at least we know that we have got to put something back in order to maintain the health and vigor that we desire.

SOME ESSENTIALS FOR SUCCESSFUL CO-OPERATION AMONG MAINE FRUIT GROWERS.

By WILLIAM D. HURD, Amherst, Mass.

In accepting the invitation of the officers of this Association to speak on the subject of Coöperation, I did so with a full realization that this is no new subject in this State. I am fully aware that this subject has been talked here until many consider it worn threadbare; that several prominent people have worked unceasingly during recent years to establish coöperative enterprises; that there are a few stores, or other small enterprises, being successfully carried on; and yet, so far as I know, nothing has been developed which begins to reach the hopes and expectations of the most earnest workers in this cause.

Watching, as I have for more than six years, the efforts to establish coöperative enterprises in Maine, it has seemed to me that the work was being attempted in many cases without due regard to the first essentials necessary to the success of the movement, so it is to some of these that I desire to call your attention in this paper.

Coöperation is desirable because public welfare demands and profits by it. In talking coöperation one must almost "preach a sermon," for coöperation presupposes a condition of society approaching the ideal. Coöperation is the banding together of the stronger with the weaker for the mutual benefit of both.

More than financial gain must be considered, although we will have to admit that the financial side is the incentive for the organization of most business enterprises.

Coöperation in action does not appeal to the average New Englander because it is necessary for him to give up a great deal of his independence if the project is to prosper. I shall have occasion to speak about some specific examples of this later.

There is every good reason for coöperation among farmers. All other lines of business are organized except our own class; and it is time for the farmers of this country to realize fully that great movements in the industrial world today are not set in motion and maintained by individuals, but by men who have the power and ability to organize and coöperate.

Think about this fact too. We are told that sixty per cent of the price paid by the consumer for the products necessary in our daily living goes to the middleman and dealer, and only forty per cent to the farmer,—the producer. Look at any of the gigantic enterprises we call trusts,—the United States Steel Trust, The Beef Trust, Grain Dealers' Association, the railroad combines, and others known to you. They are nothing more nor less than coöperative enterprises, made up, in these cases, only of the few, and organized for the sole purpose of controlling and amassing large fortunes and driving out all competitors.

Opposed to this close combination is true coöperation,—the kind which we are considering today,—the kind that welcomes and does not stifle honest competition, and seeks to obtain for the man who produces a commodity a just proportion of the price that article brings in the markets of the world.

A common saying, and one admitted to be true by many farmers, is that farmers will not hold together. If the farmers of Maine, or any other state, would combine in a legal manner, their financial strength would be far greater than any corporate interests now arrayed against them. I have often felt that right here in this State with your four hundred and twenty-five or more subordinate granges, eighteen or twenty Pomonas, and a State Grange officered by men of the highest intelligence and integrity, you already have all the machinery necessary for the most successful kind of coöperation, if the organization were only used for such purposes. But since the organization has not and does not lend itself readily to enterprises of this nature on a large scale, some other method will have to be devised. I am not going to say that coöperation is the easiest thing in the world. Neither will I place it in the category of desirable things yet impossible, for there are thousands of successful coöperative enterprises in this country, and if you are ready to approach this in the right way, and to submit to some of the essentials which successful coöperative organizations have found it necessary to impose on their members, you will have plenty of examples to profit by, and it is reasonable to suppose that success will crown your efforts.

Foreign countries have led the way in coöperative movements for years. The Orange Judd Farmer is authority for the following facts and figures: "More than 1000 coöperative societies for the purchase of fertilizers, implements, fuel, stock, feed, etc., are in operation in Germany. There are about 1600 associations organized for the sale of farm produce; this country also has 1682 coöperative dairy associations.

In France the coöperative societies control the markets for many agricultural commodities.

The little country of Belgium several years ago had 776 agricultural leagues with a membership of 42,000. There were 780 societies for coöperative purchasing, and coöperative dairies increased from 69 to 427 in ten years.

Holland has many agricultural unions. Forty thousand Dutch farmers supply milk to coöperative creameries.

The membership of coöperative dairies in Denmark numbers 148,000. Seventy-five per cent of all the cows in Denmark contribute their product to these coöperative associations. This country also operates twenty-seven coöperative bacon factories.

Sweden has 430 coöperative creameries; Norway 430; and Siberia 2035."

Great Britain is the home of the coöperative idea. The famous Rochdale movement, formed by twenty-eight mill workers to purchase the necessities of life, and after which many of the movements in our own country have been patterned, has a membership numbering millions, and they enter every field of commercial work with their coöperative plans. At the last annual meeting of the coöperative societies of Great Britain the records showed that during 1908 business amounting to five hundred and thirty-seven million dollars was transacted.

In America four lines of agriculture have lent themselves to successful coöperative enterprises, namely, market gardening, grain growing, the manufacture and marketing of dairy products, and the production and marketing of fruit. The first three are not to be considered in this paper except as the successful organization of them may serve as an example to fruit growers.

The grain growers' association now numbers its smaller coöperative enterprises by the hundreds in the middle West. The battle against the united grain dealers was a hard one. Every device known to crafty traders was used to thwart the efforts of the farmer to organize. Building sites were refused for elevators; switches would not be put in; cars would not be furnished by the railroads; loaded cars were side tracked and demurrage sufficient to eat up any possible profits was charged; the press was used freely to predict and advertise failure; they boycotted for a time commission houses that received coöperative association goods; the local merchants were threatened with department stores; but neither discouraged nor daunted by the efforts of the organized grain dealers, backed by the railroads, the farmers of the middle West have more than sixteen hundred independent elevators, owned by more than three hundred thousand stockholders.

Mr. N. O. Nelson visited fifty-five of these coöperative elevators and stores in Minnesota, delivering an address on coöperation at each place. Writing in a recent number of the Outlook, he says:

"We explained the economic, social and moral value of coöperation. We reminded them that their splendid homes and barns had been built by the coöperative creamery. We laid stress upon the value of coöperation as removing an ever present tendency to greed and fraud in private profit sharing business. We showed them that 'by the people and for the people' is even more important in trade than in government. We pointed out the influence of coöperation on religion in contrast with the adverse influence of private trade. We showed them that the coöperative creamery, elevator, mill, packing house, or store, lead up to consolidated schools, central high schools, better roads, town halls for social and public uses, young people saved from going to cities, the intelligence, social and religious life of the community steadily rising, and we asked them if this is not a natural outgrowth and reasonable prophecy of coöperating in all lines of business affairs."

Instances are numerous in these associations where, at an expense of four thousand dollars for salaries, and on a capital of less than twenty-five thousand dollars, a yearly business of more than six hundred thousand has been carried on. From one-half cent to four cents per bushel beyond the regular market price has been paid for grain, and in addition the coöperators have realized approximately thirty-three per cent on the paid up capital. I speak of this coöperation in grain dealing at this length simply to call to your attention the great success attained by one class of farmers, and the possibilities open in other lines.

The banding together of the fruit growers of Maine, or of any section of this State, for the organizing of this great industry in a coöperative way, is a larger problem than simply organizing for the sale of fruit. The enterprise should also include coöperation in production, which involves many other factors. This brings us to the essentials to be considered in the organization.

It seems to me that one of the first things to be realized is that a sufficient amount of fruit must be raised to make the region of enough importance to draw buyers. When a sufficient volume of business can be guaranteed, not only are buyers attracted, but transportation companies are usually quick to make concessions in order to get business.

Another lesson brought home to every one from the New England Fruit Show was that the fruit must be of a high quality, and uniform, in order to compete with that from the Pacific coast. When New England fruit possesses these two characteristics, it can compete with, and will drive the western fruit from our own markets.

Coöperation in buying supplies is another important thing. One small association in the Hood River region saved its members twelve hundred dollars on spraying material, one thousand dollars on wrapping paper, three thousand dollars on crates, and four thousand dollars on boxes, in one year. To this list might be added in Maine, the fertilizers ordinarily purchased. An association in Maine should expect to build cooperage establishments for the manufacture of barrels and boxes.

The passing of laws by the last legislature regulating the packing of fruit, and the desire on the part of many to market their fruit in a better way, will be a stumbling block to many for some time to come. The coöperative association could either pack the fruit, or engage someone to go about giving instruction in the packing and grading. Here is a good chance for Maine fruit growers to take a lesson from the cow testing associations that have been organized so successfully by Commissioner of Agriculture Gilman and Doctor Leon S. Merrill. This is coöperative work of the highest order. The same kind of work is possible in fruit growing.

An orchard survey of the fruit growing counties of this State would be of great value. Not only could an estimate be made of the extent of the orchards, the varieties, etc., but an accurate account of the methods practiced could be obtained, and, wherever necessary, advice which would lead to the production of a higher grade product could be given. High grade products are one of the unalterable demands of coöperative marketing. In short, why not coöperate and hire a traveling fruit growing instructor just the same as the dairymen have traveling dairy instructors. Some railroads already employ just such men to go up and down their lines giving instruction to farmers. They find it pays them in extra volume of freight.

Coming to coöperative marketing, there are the railroads to be considered. No man, railroad man or other, has been able to explain how railway rates are made. Why a rate from the Pacific Coast to Omaha should be the same as a rate from the coast to Boston or New York, and why the railroads in this State should attempt to charge twice as much on a car of fertilizer between Portland and Bangor as between Boston and Bangor, is unexplainable. But successful coöperative enterprises, with a sufficient volume of business, can bring the railroads to time. Coöperative advertising enters into the marketing problem too. Individuals cannot afford to advertise extensively. One of the largest fruit growers' associations of California has a committee on advertising, which is spending fifty thousand dollars this year where twenty-five thousand dollars was spent last, against five thousand dollars two years ago. This advertising in Sioux City alone doubled the consumption of California fruit consumed there last year. Why should not Maine fruit be advertised?

A good coöperative system would direct your fruit to the best markets. One of the principal objects of the "American Fruit Growers' Union" is to divert and distribute the supply so that markets are neither glutted nor without the products. Any one who has had much to do with markets knows that at times carload after carload of good fruit may come into a certain market on a given day, with the result that the fruit cannot be sold at any price, while perhaps only a few hundred miles away another good market is entirely barren of that product. A good selling agent in the employ of a coöperative concern could watch the movements of fruit and avoid such conditions.

Cold storage houses, similar to potato houses, built along the lines of the railroads, fruit evaporators, and vinegar or canning factories for the utilization of what would otherwise be waste products, are also within the range to be covered by coöperative fruit growing associations. It seems to me that these should be considered seriously by Maine fruit growers. An instance came to my attention a few years ago when seven thousand dollars was paid to the growers of small fruits in one locality where the crop would have been a total loss had it not been for the fact that a couple of canning factories could use the product.

But, you say, all of these things require money, and this brings us to what is perhaps the most important essential in successful coöperation,—the necessity of a thorough going business organization. Failure in the past in nine hundred and ninety-nine cases out of a thousand has been due to poor business organization and management. If you expect to get something for nothing, you better not go into a coöperative business enterprise.

Many farmers of my own acquaintance in this State, while believing in the coöperative idea, have refused to take even a single share of stock. A successful coöperative enterprise must be founded on the same laws of business as though a personal business venture was being started. It is perhaps even harder to start a coöperative enterprise than a personal one, for in the one case one man with one mind is the directing force; and in the other, a dozen, or perhaps several hundred persons with widely varying ideas, all have their hand in organization and management. The coöperative enterprise must, like others, be governed by statute law. The foundation stone of coöperative enterprises is confidence. It is important, then, that men of the highest integrity and unquestioned honesty should be at the head of the association. Managers and directors will be suspected of graft sooner or later. They will have plenty of opportunity to receive private commissions on purchases or brokerage on sales. They must be strong enough to withstand such temptation when it is presented to them. There are always many people to become jealous of the prominence which the managers and directors must necessarily have. A common mistake made in farmers' organizations too, is to expect to secure a manager for thirty, forty, or fifty dollars a month, who is capable of handling twenty-five, fifty, or a hundred thousand dollars worth of business in a year and paying good dividends. Men capable of doing this can earn at least five to ten thousand dollars a year from private enterprises. A successful coöperative enterprise cannot be expected to succeed unless it has at its head a man of experience, tact, and ability, who understands markets, buying and selling, and is a master of the business. Sentiment has no place in coöperation. Because a certain man owns stock, is influential in the community, and has a son who needs a job, is no reason why he should be given an important place at the head of the concern. There will always be scheming for places of advantage in coöperative enterprises the same as there is in politics or business, but all this must be "cut out."

A successful coöperative enterprise must, first of all, have capital. This is often not taken into serious consideration. Enough capital must be available to give stability to the organization and not cripple its opportunity for purchase and sale. Coöperative enterprises must keep out of debt. They must do a cash business, and must keep their rating and business standing first class.

The farmers or coöperators themselves are usually responsible for the failure of their own enterprises. The stockholders are often guilty of such neglect as would down any business in a few months. After a manager and board of directors are elected, the stockholders seem to think that it is their especial privilege to stand off and find fault with the management, rather than to consider the project as a thing of which they are a part. They grow suspicious and jealous, ruptures are caused which keen men in other lines of organized business are quick to detect and take advantage of. No coöperative enterprise can flourish unless it has the hearty support of its own stockholders. While I was living at Orono a coöperative grange store was organized in Bangor. It has had a more or less prosperous existence. The retail dealers of that city have succeeded in underselling the coöperative store in many ways. Instead of sticking by the coöperative store, and seeing it through its early struggles, men of my acquaintance and stockholders too, have deserted their store for the time being and have given their trade to the retail man, who was really working against their own interests, in order to save a very few pennies. Such tactics on the part of the grain growers of the West or the fruit men of California, Colorado, or Oregon, would have killed, in the first year, those organizations which we now look to as models of their kind.

Now, as I have said before, if you are ready to accept and stand by some of these fundamental principles which I have mentioned, you can without much trouble organize in Maine just as successful coöperative enterprises as can be found anywhere on this continent.

California perhaps leads in the success of their fruit packing and shipping associations. Oregon, especially the Hood River region, ranks equally well. The Grand Junction Fruit Growers' Association in Colorado shows remarkable growth. It began business in 1897 with six hundred and sixty-six stockholders, shipped one hundred and sixty-seven cars, and did eighty-eight thousand nine hundred and thirty-seven dollars worth of business. Ten years later, January, 1907, this association had fourteen thousand one hundred and sixty-nine shares of stock, shipped one thousand and thirty-six cars, and the volume of business aggregated eight hundred and fourteen thousand two hundred and seventy-eight dollars. Georgia and Maryland have organized successfully. All of these associations publish lengthy documents of instruction and rules for governing the work of the packers. For detailed information of the work in these states, I would refer you to Bulletin 94, Oregon Experiment Station; Bulletin 122, Colorado Station; Bulletin 18, of the Dairy and Cold Storage Div., Dept. of Agriculture at Ottawa; Bulletin 116, of the Maryland Station; and for the latest record of progress made along the lines of coöperation, to the American Coöperative Journal, a monthly publication printed in Chicago.

The Wathena Fruit Growers' Association of Missouri has been a most successful coöperative enterprise. The following statements have been taken from an article appearing in "The Fruit Grower," published at St. Joseph, Missouri.

"Early in 1905 a few of the growers met and debated that the thing to do was to organize a shipping association and handle their own fruit and buy their own supplies. As a result the Wathena Fruit Growers' Association was organized, and the first year the new organization had but twelve members. The firms which had previously handled the fruit of the growers claimed that the new association could not last; that farmers could not market their fruit to advantage, and all sorts of hindrances were put in the way of the association, in the form of extremely low prices for fruit packages, and unwarranted high prices for fruit at critical times,—this being done to discourage the members of the association, and to entice them away from their organization.

The first year the organization did fairly well, but the members gained much in experience. This year, the second season of its existence, the association has made a splendid record. The organization has 100 members.

The association has bought all the material needed by its members, effecting a considerable saving. For instance, growers near St. Joseph paid 6 and 7 cents apiece for one-third bushel baskets in which to ship peaches; members of the association at Wathena paid 5 cents for the same packages.

At the beginning of the season every member signs a contract to market his fruit through the association; if the St. Joseph market offers a better price, he must receive the consent of the manager before he can take his fruit across the river. This consent, however, is not withheld unless the association needs the fruit to finish filling a car which has been sold.

The association sells practically all its fruit on track, although it sometimes happens that small quantities left after filling cars are consigned to reliable firms. After the manager knows the price to be received for a car of fruit, he makes the 'platform price' to the grower accordingly. This platform price is usually about 25 cents a crate less than the price the association receives. Suppose a carload of strawberries has been sold at $1.50 a crate, and every grower who delivers fruit which passes inspection receives a ticket entitling him to $1.25 a crate, which can be collected by him when he chooses. The next day a car may be loaded at $1.75 a crate; then the platform price is $1.50, and the growers receive credit for the fruit delivered at that price per crate.

When the strawberry season is over the expenses of the association in handling the crop are deducted from the 25 cents profit retained on each crate, and the remaining sum is apportioned to the growers who furnish strawberries, according to the original sums they received as the platform price.

This same plan has been followed through all the season.

The members of the association are much encouraged, and have seen the necessity of maintaining their organization. Greater quantities of fruit have been shipped from Wathena than ever before in a single season, and at a time when all the neighboring country has good fruit crops. Notwithstanding the large fruit crops, however, the prices received by the growers have been better than for many years, and instead of feeling discouraged, the members are planting increased acreages to fruits. Their organization has made the business profitable, when without it they were considering giving up the business.

The association guarantees its fruit. All fruit is inspected when delivered, and after that time the organization stands behind the guarantee. In order to maintain a good reputation for its fruit, the members are urged to plant varieties which will carry a market in good order.

The growers in almost any community can organize along the lines of the Wathena Association. Get a few of the leading growers to start the association; the first year discouragements will be met, but if the organization is properly managed, the next year things will come easier.

'One thing which cannot be too carefully guarded in an organization of this kind,' said the manager, 'is the reputation of the fruit sent out. Every grower must realize that he is a part of a mutual organization, and he must see to it that he does nothing which will injure the reputation of the association or his fruit. Each member is on his honor to pack nothing but good fruit, and it is to the credit of the members that they have established a high reputation for their fruit and their methods.' "

Our New England conditions are so similar to those of Ontario and the other provinces of eastern Canada that it is worth while to consider some of the forms of organization and the regulations of the Canadian fruit growers' associations. From a bulletin issued by the office of the Dairy and Cold Storage Commissions of Ottawa, I learn that there are twenty-five coöperative associations in Ontario, and nine in British Columbia. It might be interesting to you if I quoted some of the by-laws regulating the growing and packing of fruit in one of these associations.

"Each and every member of the Association shall pick his fruit in prime condition and deliver same at packing house or shipping point.

An inspector or manager of the Association shall be appointed by the Directors to supervise the work of grading and packing the fruit of the Association, the salary of the said inspector to be determined at the time of appointment.

The manager shall give personal instructions in their orchards to all the shippers shipping through the Association how to grade and mark their fruit according to the Fruit Marks Act.

He shall also inspect a certain number of each shipper's barrels in each car and immediately before shipment in order to ascertain if the Fruit Marks Act has been carried out, and if he finds that any shipper has intentionally disobeyed the Fruit Marks Act he shall be refused acceptance of fruit and held responsible for space in car.

If the inspector disagrees with shippers regarding grade apples, for the settlement of such disagreement he shall choose one director, the shipper one director, and both jointly any disinterested person, who shall decide, basing their decision on the Fruit Marks Act.

Each and every member shall have the right to give away such fruit of his own raising as he may elect, but he shall not make sale of fruit outside the Association except windfalls and cull grades or any fruit that may not be accepted by the Association. Any member so doing shall pay into the Association treasury the sum of 50 cents per barrel for all fruit so sold excepting grades aforesaid.

Whenever in the opinion of the directors it is impossible for the Assocation to receive at its packing house all fruit grown by its members, they may permit individual members to grade and pack the same for shipment through the Association, such grading and packing to be subject to the inspection of the inspector appointed by the Association.

All members of the Association shall spray their orchards at least four times, and as often beyond that as they deem proper.

No fruit grower shall be admitted as a member of the Association except by a two-thirds vote of the directors."

It will be noticed that all members are bound to ship their fruit through the Association. In some associations those violating this agreement are compelled to pay a penalty on every box, bushel, or barrel sold outside. Notice should be taken, too, of the right of the association to reject any unsatisfactory fruit. The association also must be in position to guarantee a certain amount of fruit and of a certain quality. The reasons for this are obvious. It is because of some of these regulations that I said earlier in this paper that the coöperative idea in actual working went against the "grain" of the New Englander.

Through these organizations, members of the associations have been able to receive $2.25 a barrel for their fruit, while many growers outside only obtained a dollar, and some not more than fifty cents.

Other advantages of coöperation over the ordinary way, are obtained by the Canadian grower as follows:

"It is proposed to substitute for the ordinary methods coöperation in packing as well as selling, and incidentally in any other phase of apple growing that will lend itself readily to this mode of operation. The following advantages will be gained by the adoption of coöperation:

(1) Large stocks will be controlled by sellers who will act as a unit.

(2) Uniform packing, grading and marking will be practiced.

(3) A reputation associated with a permanent brand or trade mark will be established.

(4) The cost of picking, packing, and marketing will be reduced.

(5) Fruit will be picked and packed at the proper time.

(6) Less common varieties will be utilized.

(7) Storing facilities will be better provided for.

(8) Direct selling at the point of production will be encouraged.

(9) Packages will be bought in large quantities or manufactured on the premises with a material reduction in cost.

(10) The placing of the purely commercial part of the industry in the hands of competent men whose interests are connected with those of other members of the association.

(11) Spraying by power outfit, co-operatively, will in most cases be adopted.

(12) The manager and the better growers among the patrons will have every inducement to stimulate the less progressive members to better work."

I have tried to present to you in this paper some of the essentials necessary to the business success of coöperative enterprises. I hope I have not said discouraging things, but feel strongly the need of a careful consideration of these before you take any plunge which may mean much to you individually, and to the fruit interests of the state. There is an old Italian proverb which reads: "Those who go slowly go far." I feel that this is good advice to follow in the organization of a coöperative fruit growing and marketing association.

The preface to Bulletin 18, of the Ottawa Department of Agriculture, contains the following statement: "The true spirit of coöperation must be recognized and accepted by those who propose to embark in the enterprise. The mere form of coöperation will not be sufficient."

The spirit of the movement is evidently upon us. Coöperative organizations are on every hand. The tendency everywhere is to form societies which shall secure for the man who produces, a just share of the profits from his labor. The "new farmer" must be a business man and not a waster of resources given to him to handle and develop and to do this he must join forces with man and nature. Study coöperation, analyze every phase of the movement, compare the different plans now in operation before you begin, and then go ahead and perfect an organization which shall be of such far reaching results and of such lasting good to the community that anything yet started in this State will not begin to compare with it.

MR. MERRILL: Mr. President. I have been interested in coöperation for a good many years. What Prof. Hurd had to say has simply confirmed me in the opinion that has been growing upon me for years past. I would like to have some man assign to me a good reason why men whose interests are identical should not act together. It is a policy that has formed combinations of great business interests, but it is difficult to adapt to all conditions in country life, where there are so many men engaged in so many different operations. For instance, in this state there are 60,000 farms, and you can well see the difficulty in bringing about coöperation between all these people. Yet in different neighborhoods, where it could be compact in its operation, there is every reason why we should coöperate. As I think of the fruit business, I have come to believe that coöperation could be applied to that business very readily and profitably.

We are applying it in our dairy business, through organized effort in cow testing work and in the Coöperative Breeders' Association work. We have five of each of those kinds of association in this state at the present time.

Another work which to my mind is more important and far reaching, so far as its financial interests are concerned, we are about to take up, and that is the work of seed improvement through organized effort. The legislature at its recent session passed an act directing the commissioner of agriculture to undertake this work, and made an appropriation to carry it on. I am quite safe in saying that all the agricultural interests of the state will coöperate in the work. I have been assured of the assistance of the experiment station, and of the bureau of farm management at Washington, and I am equally positive that the agricultural college will do anything in their power to aid in this work.

I have been over the work that has been done by the different states, and to my mind that work which most closely unites the experimental and the practical business world of coöperative effort is the one most likely to succeed. I think all experimental work that is done by farmers, and I am not sure but I might equally say by the experiment station, so far as its immediate benefit to the great mass of agricultural people is concerned, should always be done with the commercial end of the proposition as a basis. Sometimes I feel we disregard this.

But let us come down to the possibilities of fruit growing for a moment. I am not a fruit grower, but there is something besides the dollars and cents to this question. There is a matter of education that comes into all associated work. And wherever you find associated work, there you find increased interest, better conditions and a better understanding of the business. To my mind one of the greatest advantages coming from an organized fruit growers' association will be through the educational benefit the members derive from the work, independently of the financial benefit. It is the happy combination of the two that will enlist and hold the interest and support of our people.

I think, Mr. President, the Pomological Society should take an active part in the organization of a fruit growers' association in this state. And right in here, I believe that the Department of Agriculture should and will, with sufficient funds at their disposal, give you just the man that Prof. Hurd outlined, a fruit growers' instructor, who should travel from community to community in our state and assist the people who are growing fruit.

This idea of governmental assistance is growing everywhere, and wherever it is practiced most, there we get the greatest benefit from it. For instance, just across the line in Canada, during the past summer, and during every summer for years, there are many dairy inspectors traveling from cheese factory and creamery to cheese factory and creamery, until uniform methods are adopted, and you can hardly tell the product of one factory from that of another. The same thing holds true in other rural countries. I thank you very kindly for the invitation to say a word on coöperation.

ORCHARD TILLAGE.

By V. R. Gardner, Prof. of Horticulture, Orono, Me.

Some of us may be in the fruit business because our fathers were before us, some of us may be in it because we like the kind of work, some because of our health—we've got to be out in the open—but most of us are raising fruit because of the money there is in it. Our first object is to make it pay—and not only pay but pay well. For us it is not the system of management that with the least amount of labor will make the account just balance, but the system that will give the greatest possible *net returns* that we want. If we can invest $5 per acre per year in care and attention and get $10 in return, it is a good investment; if we can invest $25 per acre per year and get back $100 it is a better investment. In the first case there is just

$5 net profit; in the second there is $75. It costs money to plow and cultivate and till an orchard. Is it a paying investment? The object of this paper is to point out what tillage costs and what it brings back.

There are at least two ways of determining the value of any proposal that involves the outlay of any money. One is to reason out the matter as best we can; the other is to actually try it.

Suppose we first reason out this question of orchard tillage in the light of what modern science and agriculture have taught us about the cultivation of the soil. In the first place cultivation loosens up the top 3 or 4 inches of soil and largely prevents the escape of the moisture beneath. This moisture is needed for the growth of the trees and their fruit. The amount of tree growth and the relative size of the fruit are almost directly dependent upon moisture supply. When trees are in sod the grass roots remove large quantities of this water from the soil and evaporate it through their leaves. This robs the trees of their rightful supply and seriously checks the development of their fruit.

The excellence of western fruit is a matter of common knowledge. It sells because of its color, freedom from blemishes, uniform large size, and the way in which it is packed. It is often imagined that its size is in most cases due to irrigation. In some sections it is true that irrigation is practiced; yet in some of the best regions where irrigation is available and there is a moderate rainfall, irrigation is not practiced, continuous cultivation being preferred.

Cultivation not only conserves moisture but it sets free plant food in the soil. When the soil is stirred it is aerated and the bacteria and other organisms have a much better chance to multiply and act upon insoluble plant food and make it soluble. I do not mean to say that cultivation will entirely take the place of fertilizers for many of our orchard soils are deficient, but there is much unlocked, unavailable food in nearly all of them. Cultivation is the key which unlocks it. What little plant food becomes available in sod covered land is largely absorbed by the grass roots and the tree gets only a small proportion.

Not only does sod in the orchard rob the fruit tree of its food supply and its water but recent investigations tend to show that grass roots secrete substances which are actually poisonous to tree growth.

So much for the theoretical side. How does cultivation work out in practice? I can do no better than call your attention to a chart showing the results of cultivation in a New York orchard.*

The orchard in question is located in Monroe County. It consists of nine and one-half acres of trees 32 years old. In the spring of 1904 this orchard was divided into two equal parts by a line run through the middle. One-half was plowed and cultivated. In the other half the grass was allowed to grow and was later cut and left as a mulch. This afforded much better conditions for the trees than the method commonly practiced of cutting the grass and hauling it off, for what was removed from the soil during the summer was returned in the fall. This treatment was kept up in the two halves of the orchard for six years with these results:

	Sod	Cultivation	Difference
Average yield per acre	73 bbl.	109 bbl.	36 bbl.
Cost of maintenance	$18.00	$24.50	$6.50
Income at $1 per bbl.	73.00	109.00	36.00
Net profit	55.00	84.50	29.50
Income at $3 per bbl.	219.00	327.00	108.00
Net profit	201.00	302.50	101.50

The average cost of maintenance per acre in the uncultivated part was about $18 per season. In the cultivated area it was about $24.50 per season. It cost just $6.50 per acre per year to plow and harrow and till and sow cover crops in the one part of the orchard. The average yield per acre per year from the part in sod was 72.9 barrels, from the part that was cultivated 109.2. The average difference per acre per year in favor of cultivation was 36.3 barrels. At $1 per barrel the orchard in sod would bring back a return of $73 per acre, giving a difference in favor of tillage of $36. In other words at that price an investment of $6 an acre was made each year and 5 months later $36 was returned. I ask you, does it pay? $1 per barrel is a very low price for apples, however. Suppose they averaged $3 per barrel. The cost of cultivation would be the same, the net return from cultivation 3 times as large or $108 per acre per year. Again I ask you, does it pay? How

*Hedrick: Bul. 314, N. Y. Agr. Exp. Sta.

about some other characters of tree and fruit in these two halves of the same orchard? The fruit from the sod land ran 434 apples to the barrel, that from the tilled ground 309. Our markets today are demanding larger fruit. It is juicier and better. Oregon growers who pack only in boxes say that the demand for 3½ and 4 tier apples is increasing. Consumers want it in place of 4½ and 5 tier fruit. When we grow fruit for the market we have got to reckon with the consumer. In common storage fruit from the cultivated orchard kept 4 weeks longer than that from sod land. Here where our best prices come late in the season 4 weeks difference in keeping quality counts for a great deal. Fruit from the trees in sod was more highly colored than that from tilled land. The average gain in diameter of the trunk during the 5 years the trees were in sod was 1.1 inches; of the trees in cultivated soil 2.1 inches. The average annual growth of branches for the sodded trees was less than 2 inches, of the tilled trees 4. The leaves of the tilled trees came out several days earlier and remained on nearly two weeks longer than those on the others. They were larger and of better color indicating better health. The roots of the sodded trees were nearer the surface where they are more subject to drouth and winter killing.

"But," you say, "this is only one New York orchard. Is what is true about tillage and sod in this instance true generally?" The answer is "Yes;" and at this point I can do no better than call your attention to a set of figures presented at our Pomological Society meeting last year by Professor Craig.*

Yield in bushels per acre—a 5-year average.

			Orleans Co. Yield	Niagara Co. Yield
Tilled	10	yrs.	327	280
"	5	"	274	254
"	3	"	225	239
Sod	3	"	222	209
"	5	"	204	197
"	10	"	176	194

*Rept. Me. Pom. Soc., 1908-9. P. 96.

This chart shows the average yields per acre per year for 5 years back of orchards that have been in sod and those that have been cultivated for various periods of time. The average in each case is the average for the whole county. Those of you who are acquainted with the fruit industry of New York will recognize two of the largest fruit producing counties of that state. In Niagara county the average yield per acre in those orchards that have been in sod for at least 10 years was 194 bushels; in sod 5 years or more 197; in sod at least 3 years 209; on the other hand the yield in those orchards that have been cultivated at least 3 years was 239; cultivated 5 years or more 254; and cultivated 10 years or more 280. In Orleans County the difference in yield was much the same, being 176, 204, 222, 225, 274, and 327 bushels respectively under 10, 5, and 3 years of sod, and 3, 5, and 10 years of cultivation.

These results are especially significant because they are the results of experience, not experiment,—the experience of the fruit growers of two large fruit producing counties. Note that these "experience" figures seem to show that the beneficial effects of cultivation in the orchard are cumulative and that the injurious effects of sod are likewise cumulative. In these counties experience would seem to demonstrate that it is profitable to invest $6 in cultivation and get back the value of 86 bushels of fruit(the difference between 194 and 280) in the one case and 151 (the difference between 176 and 327) in the other. Again I ask, does cultivation pay?

Within the last few years several widely separated regions in the United States have become famous for the production of fine fruit. For apples probably no region has become more famed than Hood River, Rogue River, and Yakima Valley. I have the figures showing the status of orchard cultivation in only one of these districts—Rogue River.* In Jackson County where that is located there are nearly 10,000 acres of orchard. Over 98% of this area receives some cultivation and 70% receives good cultivation. Only a little over 1½% of the area is totally neglected and that is mainly in the small home orchards where no fruit is raised for the market. Other factors have

*Lewis: Bul. 101., Ore. Exp. Sta., P. 53.

contributed to make Rogue River Valley apples sought after by the big markets of the country, but I submit that cultivation is an important one.

We do not need to go west for evidence that cultivation is needed in the orchard. There is hardly a fruit grower here that would advocate setting trees in sod and leaving them there from the first to take care of themselves. Nearly everyone plows his land and cultivates about the trees for the first couple of years to get them started. They know that they will grow much better with cultivation than without. But when they get the trees once established cultivation is discontinued, the orchard seeded down and after that the trees must struggle along with grass for a scanty supply of food and moisture. Here and there in this state is one who believes in orchard cultivation and believes in it firmly enough to practice it. What are the results? I am sorry that I cannot present the evidence of each one who has been practicing it. This past season has been characterized by a light fruit crop all over the state. People say that it has been an "off" fruit year. Yet I have seen a few orchards with very nearly full crops of fruit. In each case these have been cultivated orchards. Ask these men what they think of cultivation as a practice, not as a theory, and they one and all heartily favor it. One grower expressed it in this way a couple of months ago: "You've got to keep the trees *coming*, the leaves dark and rich and healthy, if you get the fruit."

I do not want to carry the impression that fruit cannot be grown without cultivation. It can and is. Trees standing in sod will produce fruit, not because of the sod, but in spite of it. The struggle which they must make with the grass for food and moisture prevents them from doing anything like their best. Fruit growers cultivate their strawberries, raspberries, currants, gooseberries, plums, peaches, and grapes because they *must*. These fruit plants will be choked out and killed by grass in a few years if left uncultivated. Fruit growers neglect their apple orchard because that fruit is tougher, hardier, stronger than the others and will live along in competition with grass. Give it the same cultivation that is given the tenderer fruits and it will respond as promptly as they.

If there is one implement that is characteristic of modern agriculture it is the cultivator. Gradually we are learning the lesson that our crops are not altogether dependent upon what nature chooses to give us but largely upon what we direct that her sunshine, her rain, and her soil shall produce; and the 3 tools which we can use to control nature's forces in the orchard are the pruning saw, the cultivator, and the sprayer. I wish to close this talk with words that New England's most famous fruit grower—J. H. Hale—used in an address many years ago. I think he would reiterate them today: "Culture, culture, culture is the sure road to success, while any other scheme of handling the orchard is nearly sure to lead the other way."

MR. WASHBURN: I have been a farmer for a number of years, and I think I have learned one thing thoroughly, and that is that cultivation is the main thing in raising fruit or any other crop.

MR. ROUNDS: I do not usually prune my orchard much, but last spring I went out one morning when there was a good crust and pruned some of my Spy trees and about all the fancy fruit I raised this year grew on those trees. The cultivation was done by hogs. I had an acre or so fenced off where I kept my hogs, and about all the fruit I raised was in this portion of the orchard.

MR. GARDNER: The use of hogs in the orchard reminds me of what I have heard in relation to a country in Africa. There is a country there which is pretty nearly uncivilized. They have no tools for plowing the soil, but when they want to get the soil stirred up a little bit for planting their crops, they turn their hogs loose and they will root it up some. Now our methods of plowing the soil and cultivating it today, with modern implements, are somewhat ahead of the methods used in Africa, and I think that to just the extent that our methods of general cultivation are ahead of the primitive methods of plowing and cultivating, so the use of our best tools in the orchard is ahead of hogs. I do not wish to be understood that hogs are not good, but the use of the plow and cultivation will go ahead of the swine.

MR. LELAND: I wish to emphasize the remarks made by Prof. Gardner in relation to the work done by my neighbor, Mr. Washburn. He has tried cultivation, and good results are to be seen, and those who have been permitted to see his orchard the past summer cannot help seeing that it is a paying investment to cultivate, and as the professor said, the expense of some six dollars per acre in cultivation has been returned many fold in crops received this year, to say nothing about the benefits which will be received as the years go by.

MR. MORSE: I want to say we have two or three different orchards. Some we cultivate,—plow and harrow just as we do a corn field, and some we do not. And there are hundreds of acres of land in the state that will bear apples just as well if they are fertilized without being cultivated, as they will with cultivation. We have one orchard which we cultivated nine years in succession, and cultivated it well, and we had a nice crop of apples. I could take you to another in this location on one of these old rocky hills, too rocky to cultivate crops, but we fertilized it every year, and if anybody has raised a finer lot of Baldwin's than we have there I would like to see it. And cultivation, the way I understand it, for an orchard, may mean several different things. It may mean plowing and cultivating with a harrow. It may mean fertilizing and taking care of it that way. In my personal experience, apples can be successfully raised both ways.

THE CRY OF THE ORCHARD.

DR. G. M. TWITCHELL, Auburn.

Mr. President, Ladies and Gentlemen:

I never stand before an audience to discuss any of the great questions which are confronting us in farm life and work of today, but I feel the increasing consciousness of my own inability to clearly set forth the lessons which seem to be implied, or present truths which seem to be demanded.

Looking over these tables, loaded as they are with magnificent fruit, coming from Maine orchards, it hardly seems possible that it would be necessary for us to take up and discuss, with any idea of thoroughness, the questions of care and cultivation, of fertilization and treatment, or selection of trees, which have been presented today, or will be presented in the coming sessions of the meeting, yet the great fact faces us that the majority of our orchards today are sadly neglected. Not long ago I heard one of the best authorities in New England say, when speaking of the industry in New England, that the apple trees grow themselves. How far that may be true, I leave it for you to determine. That it is true to a larger extent than it should be, is a fact we all recognize.

Here is an industry worth to the State of Maine yearly from $1,500,000 to $2,000,000. Does that mark the limit? What is it possible for us to do to increase, first of all, the quality of our fruit? That is the question. This, it seems to me, is the problem which confronts us every one. We know that our soil and climate are peculiarly adapted to the growing of the finest quality of fruit grown in all the country. A grower from Seattle said to me, during the late Fruit Show: "We acknowledge the superiority of eastern fruit, and of your New England apples," and then went on to make the claim, of course, that they had us beaten all out in the markets, and could get a price which we couldn't even hope to obtain, simply through their system of packing.

How far is this necessary? Must we accept the situation and admit that while we can grow a superior quality, there are conditions which we cannot control, and that those conditions are a barrier to our progress in the work of today? I don't believe it. So the first cry that comes to me from the orchard is that there be no further increase in trees until we have provided the ways and means by which those now growing be given the opportunity to do their best. It seems to me that here is the first thing for us to do—put ourselves into the study of this question as it confronts us today with reference to the market demands of the day and the conditions which meet us in the markets now. All these things coming to us from different standpoints than they did formerly, force us to consider the question differently from what we did five or ten years ago, and therefore I think make it necessary that we first of all should see what can be done with the trees we now have living and growing upon the farms and in the orchards of the state. When we have so studied the question that we appreciate the situation and feel certain that we are giving those trees the best chance possible to perfect themselves and develop the fruit which we desire, then we can begin to discuss the question of extensive work in orcharding upon a larger scale than has yet been attempted. For it is a fact, given by those who claim to know, men who are selling the trees, that not one tree in fifty ever comes into bearing. That being so, if we stand by our position that soil and climate are natural here for the development of the highest quality of fruit, we must admit that, following the setting of the trees, there is great neglect in order to explain the situation, stated by those who are disposing of the same.

The next cry from the trees is for a chance to do something. Everywhere, while we are growing a fair quality of fruit, that lesson comes home. It was presented this morning ably by Prof. Gardner, and I want to call attention to his chart, as given there, showing the difference in yield of the trees in sod and those in cultivation, giving us an object lesson, it seems to me, of tremendous force. Yet, you will remember he had hardly finished when one of our best growers defended the sod conditions, and declared he was getting as large a yield and as fine a quality out of sod as Prof. Gardner had claimed possible out of cultivation, indicating, it seems to me, the wide range of study necessary in order that we may solve these conditions, and that the lessons applicable must be studied by the individual grower in order that he may know what is demanded in his own orchard.

The question of pruning and sunlight necessary for the procuring of fruit is one of the most important problems we have to consider. As I have been going about the state the last few years watching the work being done in our orchards, it seems to me we fail to enter into an appreciation of the conditions necessary in order to produce the best results with the tree, and that pruning should be mild and frequent to induce the best life and growth of the tree.

The cry of the orchard is for more food. The trees are hungry, and they should have food for the leaves and the trunk and the branches. Unless our trees, twelve or fifteen years of age, or more, are making a foot or more of wood growth a year, something is wrong in the work we are doing. Are they doing that? It may be, in a number of cases, but there is always that large per cent who fail to do the work they should and supply the food necessary.

Here comes in the question of food supply. I was hoping I might call attention to these rich looking Baldwins as indicating the use of ashes, or of potash indicated by the intense color, but I couldn't. The owner says that is due to cultivation. But then he did say his Spys obliged him to resort to potash in order to get the color on them. This question of feeding the tree, it seems to me, is one of the great problems confronting us, and we must feed where and when it will give the tree the most food and the best results, where we reach the feeding rootlets of the tree in the rapid growing season.

There are some photographs which I brought on the table, and if you care to look at them they show a bunch of trees which were condemned as worthless two years ago this fall, and where a man was sent to cut them down. I bought the little place a year ago last May and plowed and planted alongside the trees, working up within about eight feet of the trees. This year I applied ten pounds of Fisher's formula fertilizer to those trees. You know that fertilizer is criticized somewhat because of the amount and cost of nitrogen it contains, but for the starting of a neglected tree, I do not know of anything which will give a better wood growth. Those old trees made a wood growth this year of one and a half or two feet, or more, and were covered a few days ago with a very dense, firm foliage. While the other trees around the orchard were dropping their foliage, these leaves held firm up to about the first of November, and I don't know how much longer. That fertilizer is, I think, one of the best agents we can use to start an old orchard, to set it in motion, but I think the caution given us, which you will find in the report of this Pomological Society last year, in the address by Prof. Hurd, where he emphasizes the use of potash and phosphoric acid, and gives the formula which should be used the second year and thereafter on these same trees, should be carefully observed.

Next, is the cry for protection. I wonder how many of us are studying that. How many of us are seeking to get the right sprayer to give the most perfect results? How many are studying sprayer construction and the nozzles to be used and formulas to be applied, and are perfecting ourselves by practice in preparing those agents, the insecticides and fungicides, so we can go out and do that thorough work that must be done well to protect from the insect pests and fungous diseases? I say the orchards are crying for this all over the State of Maine. It isn't alone to be found in the potato crop, but it is also in the orchard.

I have been spending the last week in Aroostook County, and I tell you, friends, it is a sorry story which I might tell. Those farmers there that have been growing large crops of potatoes realized this year a larger crop than ever before, per acre, but for some reason those potatoes have been decaying badly. The statement has been made by Prof. Morse, who has been investigating the situation, that 95% of the work done in Aroostook County in spraying potatoes has been imperfectly done, and that he found only two fields in four days which give evidence of thoroughness in the application of the agents used for destruction of fungous diseases.

Does that apply as well to our orchards? I am not going to say it does, but I do want to urge as one of the most important steps in caring for the orchard, the insuring of protection to the individual tree. Every tree has a right to demand of us that we give it the opportunity to do the very best it is capable of; and no man is true to his orchard who is failing to do this. A tree, like a man, has a right to be judged from its best side; and we are not doing our duty unless we give every one of them the chance that comes not only from right setting and right care and right fertilization, but also from careful protection, and that protection means thorough spraying. We must do our duty in these respects if we are to meet the conditions of the market which are facing us today, and which are coming up to us with ever increasing force. The conditions which are facing us have changed radically within the past five years, and will change still more in the next five. If fruit growing is to be something more than a side issue,—something more than a pastime,—and if we are to consider this as one of the great industries of the state, as it well may be, then it becomes our most solemn duty to ourselves, our families and to the trees, that we set out those varieties which promise to be most valuable in the market, and then give them that care and attention which will help develop the most perfect fruit.

The presence of imperfect fruit must be eliminated to the largest possible degree. That we all recognize. And yet we fail too often to apply the lesson. I say it must be eliminated, because the doors are closing all the while more and more upon this class of fruit. Do you know that the state of Idaho, by stringent legislation, forbids the shipping of a No. 2 apple out of its borders. They allow nothing to go out of the state of Idaho except No. 1 fruit. That is pretty stringent legislation. It is a good deal more than the people allow in the State of Maine, where some are now criticising our law, yet growers in the West tell me that within two years they found it had been the greatest blessing they could possibly have had, and that the price of No. 1 apples improved so much that they were realizing more for their selected crop than they were getting before for the whole. The great bulk of the No. 2 and lower grades were being fed out to the hogs or destroyed and profits are being multiplied.

Now we don't propose any such legislation in New England, but towards that we are going to be forced—forced because of the conditions which confront us—forced because of the competition we are to meet—forced by the quality of apples which are coming into New England all the while from western states, where the conditions are so rigid and exacting that only the choicest quality of fruit can be grown, and because the orchards are multiplying rapidly. Do you not see that if we are to hold our own the standard of appearance and quality of our fruit upon the market must approach that from the West, for then we can hold our own and lead in the market as we have in the past. I believe, friends, that we can do this. I believe this is possible for us, every one, and also that we must adopt this matter of thorough spraying as an absolute necessity.

Another factor to be considered is the power of resistance on the part of an apple which has been carefully and thoroughly grown. I do not stand here to suggest that we can grow a resistant apple. Yet it is towards this that the study and investigation of our scientists of today are being directed. We know that some varieties and individual trees are more resistant than others to the insect pests as well as the fungous diseases, and this suggests a line of study. The care of the orchard lies along this line. The study of this question of resistance will perfect our trees and strengthen them, because it comes in this way, through the vitality of the tree we shall find that resistance to disease may be made certain, we all the time helping, as is necessary, by the use of outside applications.

Then comes the humane handling of the fruit. As I have been going about I have seen apples picked from trees and piled up in the orchards to lay two or three days in which they would "sweat out" as the owner said, and then be gathered up and carried into bins or cellars. Is it good business? Is this in line with the life of 1910? I am looking at this question from the commercial standpoint, first of all, and that is the point that touches us all. I am thinking of the dollars and cents which may be realized from our orchards. In order to do that we want to make certain that our methods of handling the fruit are humane—best for the fruit and its preservation—best for the conditions under which we are going to put it on the market.

Then comes the question of sorting and packing and branding. I believe in all sincerity that the law put upon the statute books of Maine last winter by the friends of good fruit is going to do more to bring about this better condition, this more uniform quality, evidence of which we have here on these tables today and which we will find in the markets, than anything which has come to the State of Maine for a great many years. I believe there is nothing burdensome in that legislation, that it will help insure the care of the orchard just so far as legislation can, and in the enforcement of the law we will come nearer to the wants of the tree and its best feeding and care, and protection and marketing of the fruit than we can come in any other way.

But there is something more necessary, and that has already been suggested this morning in that admirable address of Prof. Hurd. I wish it might be put into the hands of every man who ever thought or desired to grow an apple tree. Co-operation is the basis of success today through the West. We are fighting single-handed and alone in New England, some of the strongest unions—corporations you may call them, give them any name you please—but we are fighting some of the strongest organizations that could be perfected, where the product of the individual man is lost as soon as he delivers it at the central station, and where he is known only thereafter by a number, and where all his fruit is taken and carefully graded under the most rigid system. That fruit is put upon the market, and when the returns are made he then gets what is his due. I say we are fighting single handed and alone, and this great question of coöperation and of union among those who are interested in this subject is one of the most vital questions if we are going to undertake the care of the orchards and make them profitable in the largest degree.

The figures of Prof. Gardner this morning suggest, it seems to me, from the financial standpoint, what may be possible. What are those trees worth to a man, allowing forty trees to an acre? Why, upon the cultivated section those trees are paying him net about $2.10 or four per cent upon a valuation of $50 a tree. What does that mean? It means $2,000 an acre. Are we putting the right estimate upon our trees? Are we valuing them enough? It seems to me the higher value we put upon them the more likely we will be to appreciate their wants and meet the requirements of the situation as it confronts us today.

I don't believe that there is any successful future for a man in orcharding unless he has a love for the orchard. I question whether you can force trees today,—whether there is not needed that invitation which comes out of partnership. And for that reason this commercial work which is being attempted too often is a positive injury. It has been with us. It will be again. Let me cite a case. Among the many letters coming to my desk from men all over the country asking about farms in Maine (I have had two or three since I came here yesterday) or orchards in Maine, was one from a gentleman in New York who wanted to know about what varieties are best adapted to setting a large orchard, and I named two or three as adapted to that locality, being somewhat familiar with it, and considerable correspondence ensued, until finally he wrote and said: "I want to ask you one more question." I had given 40 feet to a tree as the minimum space, unless he wanted to use a filler. And then came this question: "If we should set 100 trees to the acre, wouldn't that orchard be worth $400 an acre in four years?" I replied: "You go on and set 100 trees to an acre and in four years your orchard will be worth four dollars an acre." I was dropped then as not good authority in orcharding. Just think of the business method which is involved in any such work. Isn't there any necessity for protecting our orchards? Isn't there any value in standing to protect the industry? Because you and I know it is only necessary that we make these hills all over the State of Maine, through the fruit belt, bright with apple blossoms,—that we cover these hills with the varieties adapted to the location, and then give them the care and fertilization, the attention, the pruning and the spraying necessary, in order to make every tree pay a yearly net return of more than four per cent upon a valuation of $50, after ten or twelve years old.

Now that is not an extravagant claim. I think any of you will justify it. It has been repeated so many times in the history of our growers, even under conditions which have existed, that it is safe to make that statement. That being so don't you see the importance of that illustration, and how safe an investment can be made today by any man who is in sympathy with trees and will see that they get the care and attention necessary?

I said in the beginning that some conditions were to be met that didn't exist before. We run right up against them involuntarily. This nation was founded upon the thought of individualism,—the individual's right to do about as he pleased so long as he conformed to the law. The conditions which face us today are away from that standpoint. It is the mingling of the individual thought, the destruction of that individual life, which has been so prominent in this country in years past—it is the coming together and the binding together and uniting for the carrying forward of the great industries of life, and what is true of Standard oil, what is true of sugar, what is true of steel, and what is true of woolen, or of cotton, or of any other great industrial line, applies as well and will apply with equal force along this line of fruit growing or any agricultural work of the future. We must study this question solely with reference to our necessities today, and prepare for the increasing demands of life tomorrow. In order to do that there must be a bringing together of individuals, and the coming together and massing of our products in the hands of men who are expert enough to handle and direct and control them so that the grower may realize as he cannot today in the market. Doing this work in this way we will meet the call of the orchards, and find our hilltops are gold mines, for while we may not draw the metal out of the depths with windlass or bucket, we will call it up through leaf and bud and branch and luscious fruit.

WHAT WE CAN LEARN AT THE NEW ENGLAND FRUIT SHOW.

(Stereopticon Lecture)
PROF. E. F. HITCHINGS.

Mr. President and Ladies and Gentlemen:

I was asked sometime ago to give you an idea of what was to be learned at the New England Fruit Show. Some of you were there, and I am very sorry indeed that you were not all there; because it seemed to us that it was an object lesson that ought not to be lost on any fruit grower in New England. I have prepared some slides that will be thrown on the screen, and will endeavor to give you a sort of a bird's eye view of what we held in Boston as a New England fruit show, the first of its kind ever attempted.

I will first go back a little and give you the history of this movement. Last fall, at the meeting held by the governors' conference, one of the principal speakers was a fruit man, well known to many of you. His address attracted the attention of the fruit men present, and especially the nursery inspectors of New England. So a meeting was called soon after at the State House, and at that meeting the inspectors proposed securing, if possible, uniform nursery laws for New England. In the discussion that followed, one of the members, Prof. Sanderson of New Hampshire, suggested a New England fruit show. Every one at the meeting was then enthusiastic over the proposition, and later on when we held another meeting and devised a scheme to secure, if possible, uniform laws for New England, this other plan materialized.

If you are not all familiar with the statutes passed last winter affecting the fruit interests, I wish you would become posted. There are several acts; the law that has been cited several times regarding our packing of fruit is one, but the one to which I wish to call your special attention is that relating to better nursery stock. You know that Maine has had the reputation of setting out the refuse stock of New York and other centers. You know, those of you who set trees forty and fifty years ago, that not one in a hundred of those trees lived, so you did not know whether they were true to name or not. In recent years some of you have, as the boys say, "got stuck." You have ordered nursery stock of certain varieties that you wished to set. The trees came, and you set them out. If they lived to fruit, you had all sorts of fruit; and where you ordered Baldwins perhaps you got Ben Davis, or some other apple of inferior quality. Now the new law requires that each agent, or each person, who sells nursery stock in the State of Maine shall have a license, that license to be issued from the Department of Agriculture. So if a man comes to you and wants to sell you some nursery stock, and you ask him for his license and he can't show you one coming from that department, you may put him down as being not legally in the business. I think you will agree with me that this is a step in the right direction. It originated with this idea of the New England fruit show.

Another lesson that we learned at the fruit show, I think many of you who visited the show will agree with me, is that we are planting too many varieties in Maine. I spoke the other day in a town not far from here, where a man had an exhibit of fruit, and I found in conversation that he had quite a number of varieties, so I asked him: "How many varieties of apples have you in your orchard?" He replied: "I have one hundred and forty-seven." Just think of it! A sane man in the State of Maine worrying over a product of one hundred and forty-seven varieties. He is a good deal like the young man that only a few years ago asked me: "How many varieties are there that I can grow in the State of Maine?" I said: "What on earth are you driving at?" "Why," he said, "I want to set all the varieties of apples I can so as to take them to the fairs and get all the premiums." If that is what our young men are going to do in orcharding for the next few years, they would better go into something else. We saw all sorts of names up there at Boston. A man from Maine entered ten leading varieties. One of those varieties was marked "The Schoolhouse Apple." Some of you may be familiar with it. I was familiar with a schoolhouse apple when I was a boy, that is, an apple tree near the schoolhouse. The apples didn't stay on it very long. It might have been a schoolhouse apple.

Now that is one mistake we are making; and if you have got forty varieties I would top work more than half of those. Those of you who were at the show I think learned that those apples which were not of the known varieties received no blue ribbons. The lesson ought to come home to us not to put on exhibition any apples that have gone by and have served their purpose, when there are so many nice, leading varieties that we can use to advantage.

This New England Fruit Show is an incentive for better fruit for New England, and our end of it means better fruit for Maine. Now are we in it for that? If so, let us touch elbows, and not only that, but grasp hands and agree that it shall be better fruit for New England hereafter.

An old gentleman came in with the secretary of the association and as he was viewing the apples I was introduced to this man. I had known him by name and reputation from boyhood. That man was James J. H. Gregory, of Marblehead, known to all of you, the veteran seed man, now eighty-two years old. And as I stood with him he gazed at the bank of Maine apples and this is what he said: "Do you know what I am going to do? I am going to deposit a one thousand dollar first mortgage bond with the secretary of the New England Fruit Show, the interest of which in five years shall go to the best developed acre of fruit trees in Maine, planted in 1910. The suggestion was made to Mr. Gregory that he deposit the bond with the Maine Department of Agriculture and a little later he carried out this plan. In the conditions he eliminated one apple, the Ben Davis.

Now that pleased me very much. I have always preached against the Ben Davis, although I had some co-workers with me up there at the New England Fruit Show who are growing this variety, and in fact, I introduced one of them to Mr. Gregory at the time just to show him that he was out of the race. But do you know that man, right from your own county here, was so much pleased over the offer that he said to Mr. Gregory: "I want to present you with my best box of apples in this exhibit. Select the box." He did so and it was not a Ben Davis.

Now there is an incentive for each one of us here in Maine. It shows that men of means are interested in the future of better fruit for Maine. Mr. Gregory said: "I fell in love with Maine people almost as soon as I started in business." And you know he has been in business since you and I were boys.

I want to give you a little idea of what that show meant as a direct object lesson. I have cited some of the different incentives that may come to us in other lines, but I want to call your attention to some few figures that I have here. I have been asked the question how Maine stood in the New England Fruit Show. I will give you the figures. In one room, in the division called "G,", where the plate varieties were exhibited from all over New England, there were about one thousand plates of apples on the table—straight apples— and about five hundred more of unnamed varieties of apples, and grapes, pears, peaches, etc. How did Maine stand? Massachusetts was on her own fighting ground. Her exhibit came from her pomological men, and I am sorry to say Maine's did not except in a few cases. Of the premiums offered, three hundred dollars on those plates of apples was given by Worcester County. And the men who entered were Worcester men, who had entered in competition with each other for years, the old members of the society.

Maine was handicapped as the Massachusetts fruit matured and colored two weeks ahead of ours. And yet I want to give you the result.

In this one class Maine had 247 plates, New Hampshire 102, Vermont 27, Massachusetts 290, Rhode Island 16, Connecticut 107. How about the ribbons? Maine, under all those difficulties, received 43 ribbons to Massachusetts 7. How is that? I was proud of Maine. If we could have entered in competition with that Massachusetts fruit, this fruit shown on the tables today of the leading varieties, that score would have been different.

Now you say, "Well, Maine took all the fourth premiums and Massachusetts the first." Let us see. Maine out of that number took 16 blue ribbons, Massachusetts took 2, and so on down the list. In the fourth premiums, Maine took three and Massachusetts two.

I will show you the hall in which were the state exhibits from New England. There were ten from Maine and eleven from Massachusetts. New Hampshire had 9, Vermont 2, Rhode Island 5 and Connecticut 6.

In regard to Grange exhibits, nine granges from Maine made exhibits, three from New Hampshire, none from Vermont, only one from Massachusetts, one from Rhode Island and one from Connecticut. So Maine led all of the others put together.

Now for a total. A good many have asked me how we stood as to the amount of fruit carried. Maine had 588 boxes, New Hampshire 54, Vermont 16, Massachusetts 74, Rhode Island 22, Connecticut 132. In other words, we had over 500 boxes more than Massachusetts, and almost 500 more than any other state. We had 28 barrels, New Hampshire 18, Vermont 5. Massachusetts only led us by 3. Rhode Island had 24 and Connecticut 25. So you see we led in barreled fruit all the states except Massachusetts, which had three barrels more than we did.

I want to say one thing in regard to the scoring of some of this fruit. We must get hold of the idea of getting our fruit in a better condition—more perfect fruit. I am sorry to say that some of the Maine fruit wasn't up to standard, and wasn't up to what you would ordinarily expect in some of our grange fairs or our state fairs or county fairs, and that was one thing that scored against us heavily. Another thing which told against us was the admission of the Ben Davis. I had to fight to get this and I suppose I was too firm, and yet I know that the men who are backing the interest here in Maine would have been rather sore if the Ben Davis had been left out entirely. The committee when I first mentioned the Ben Davis, laughed at me. I fought to get it on the list and now I am sorry I did. I did it for the interest of some of the leading fruit growers of Maine. I wish you could have been there, some of you advocates of the Ben Davis, with those judges for a few minutes. I tell you, you would have certainly come home and top worked your Ben Davis trees. Now you may think I am rather radical and using too forceful language against the Ben Davis. It is a handsome looking apple, and sells well in some of the markets. But do we want to advocate a poor quality of apple just because it sells in the market today? How will it be ten years from now? "Yes, but," a man tells me, "it has been in the market twenty or thirty years. We have sold it across the water and we are going to right along." Possibly you are. But I tell you I would rather run the risk of the good old Baldwin, the king of apples, than to depend upon the Ben Davis much longer. They make nice trees to top work, and I would do it at once.

Every time those judges, where there was any competition, (of course in our state exhibits in Maine they had to count it) ruled out the Ben Davis. They may not have been right in doing it, and it might not have been just, yet they did it, and we lost the grange premium of one hundred dollars, which would have come to Maine if it had not been for the Ben Davis apple. Those twelve plates entered by one of the Maine granges stood next to the Worcester grange exhibit, and ours had the Ben Davis in it and was scored out on account of the apples in the Worcester exhibit being of better commercial standard. So you see we lost one hundred dollars on that score.

In remarks made here a short time ago, one gentleman referred to our apple trees here in Maine and spoke of an apple tree being worth fifty dollars. Well, let us take an apple tree thirty-five years old, for instance, as being worth fifty dollars. Now I will leave it with you gentlemen, if you have a fifty dollar cow in your barn, will you treat her as you have treated the fifty dollar tree in your orchard? Let us be honest with ourselves, and go home with the determination that we will give our orchards more care. We will cut out the dead trees and treat the diseased ones.

We have these orchard conditions today, and we know what to do; let us go home and do it. There are a few orchards in Maine to which this lesson need not apply, but there are very few of them. You can count them on one hand, perhaps. And on the 60,000 farms in the State of Maine, how many orchards are there? Why, I will venture to say not ten per cent that would go by the designated name of an orchard. We are neglecting our trees. We are allowing our orchards to go down just because they had a blow three years ago,—the winter killing. If we would eliminate those old dead snags, and give the sick ones good treatment, just the same as we go to a dentist and have our teeth fixed, we would see, in the next five years to come, or even less than that, some results.

I will now proceed to the pictures. This is the room where the largest exhibit of fruit was on the tables, showing you some 15,000 plates in all. This of course does not include the immense display of Baldwins. The photographer had to stand back to the tables where the Baldwins were. And those of you who went there remember that that was one of the greatest object lessons of the whole exhibit, the immense table of Baldwins from all over New England. I am sorry to say that Maine was cut out on the Baldwin question for the reason that our fruit was not matured. It had not the color, and it would not have reached the size in many cases, on account of being grown in sod rather than in cultivated land. The judging of the Baldwins there was quite a task. There were five premiums. After the judges placed the blue ribbons they were obliged to remove them by our request on account of the apples having on the blow end of them the San José scale, every specimen containing some of this scale. That was strictly excluded from our exhibit whenever detected. The judges had overlooked the fact, and had to remove all the ribbons and replace them again. That was done on the state exhibit in Connecticut in the same way after the ribbons had been placed. After that the judges were more careful where they placed the blue ribbons, so far as the San José scale, or oyster-shell scale was concerned. I found the oyster-shell scale on some Maine apples. Look out for it.

Here is a comparison of the largest apple and the smallest, the largest measuring about seventeen inches in circumference, the smallest about a quarter of an inch in diameter. The smallest apple shown there was taken from a tree that was brought in in a flower pot, and I will show you later on a dwarf pear, a tree that was grown in the same way, only the fruit is a little larger. The large apple is the Wolf River.

The next view shows one of the special baskets of fruit that took a blue ribbon. In that room marked "G" there were a large number, some thirty or more, fancy baskets of fruit. We also see some of the finest grapes that were exhibited at the show. There were 161 plates of grapes exhibited.

We here see one of the cups presented by the International Fruit Growers' Association, and Governor Dresser's cup, a seventy-five dollar cup, that was given for the best display of Baldwins.

As we enter the other main room from the one I have just shown you, we come to the exhibit now on the screen. To the right you will see a portion of the bank of Maine apples. In the center you notice the immense apple, made onto a frame work and covered with crab apples. The school children of the city were allowed to come in each day between the hours of ten and eleven, free, and men distributed apples to each of these school children. I heard some of the remarks made by those children as they came and looked into this room. "Why," they said, "what an immense lot of cranberries it took to cover that apple." They called the crab apples cranberries. They had never seen an apple outside of the market, possibly, and some of them had never tasted one. Their eyes glowed, and our president got some extra smiles for extra apples.

In this view we see the pump that was won by one of your townsmen here, Mr. Herrick, for his display of excellent fruit, and beside it Mr. Herrick's box of fruit that took the grand sweepstake. And I wish to say that Oxford County won many prize laurels. The fifty dollar premium offered by the state grange was won by Oxford County, and Mr. Herrick of your county brought home many dollars besides this machine, a hundred and thirty-five dollar machine, donated by the Douglass Company.

He would have had the one hundred dollar premium on his barrel, but it lay between a barrel of Gravensteins and a barrel of McIntosh Reds, and the committee decided in favor of the McIntosh Red, claiming that was a better commercial variety.

We have a view here of the sweepstake box and the barrel.

This view shows the Maine bank, 333 boxes in one bank of Maine fruit, Mr. Cummings, of West Paris, having a block in there of one hundred, and the secretary of your association another block and so on. Mr. Morse and several others who are present are represented there.

This was the cider press that was run day and night. The product was called apple juice, five cents a glass. This was made from the apples contributed by the secretary of the association and others who furnished apples for the undertaking.

We now see the exhibit that won the governor's cup. You notice the cup is sitting on a barrel of apples. That was for the best barrel of Baldwin apples and it was an elegant display. There should have been a display from every New England state, but this was the only one.

The next slide shows another plate of Baldwins that took the blue ribbon, the first prize on Baldwins. It gives you only a slight idea of what the apples really were.

This shows one section in room "F," so called, where the state exhibits were displayed, and also the grange exhibits. The one on the upper shelf you will see is marked "Class F." The display of twelve plates on the upper one was the one that took the $100 cash premium for the best grange exhibit, by Worcester Grange.

Here was the Connecticut display just on the opposite side of the hall from the Maine display, right across the way, showing the arrangement of their fruit and their bank of fruit, with the fancy baskets and crates of peaches. Connecticut, of course, has the peach, and Mr. Hale, the man who was to have been here to speak, is the peach king of the United States.

We have next a nearer view, showing the basket in the foreground with the prize ribbon, a basket made up of pears, grapes, peaches, etc.

This view, I wish you all could have time to study and understand just what it means. If you read the chart you will see what it says. Those circular lines show the diameter of the trunks of the trees upon which fertilizer has been used. You see the smallest one marked, "no fertilizer," the one at the left, "ashes," and so on, and the piles of apples that correspond to them.

The next slide shows an elegant display of fancy fruit.

This is that dwarf pear tree I told you about, and just in the background, at the right you see the dwarf apple tree. The size of the fruit is very large compared with the tree, as most of you know if you have grown a dwarf tree. It was one of those trees set in a pot with the fruit growing on it. Many thought the apples were stuck on or wired on, but they were genuine articles.

This slide shows two plates of contrasted fruit. The fruit was taken from the same orchard, one from trees sprayed, the other unsprayed; the one covered with San José scale, the other free. Those were Baldwins and were exhibited by Dr. Fernald of the Massachusetts Agricultural College. There is a true example of the effect of the San José scale when left to run riot. Massachusetts is full of San José scale, as is in fact almost every other state but Maine. We have a little of it but we are going to exterminate it, if we have to cut down the tree.

Some of you may have had your orchards stripped this last year by the forest caterpillar, so-called. In October, in preparing the entomological exhibit, we had occasion to see the effect of that caterpillar. I had Mr. Yeaton go to an orchard that I know had been thoroughly stripped by this pest, with the result that we found the trees in bloom, blossoms all over them, where nature had tried to do her best to counteract the effects of that caterpillar, the trees leaving out and blossoming again in the fall.

The last slide shows the grand sweepstake barrel to which I have referred. You can see the blue ribbon on the barrel. It gives you an idea of the first-class condition of the fruit in every way.

REMARKS BY DR. GEORGE EMORY FELLOWS,

President of the University of Maine,
At the Annual Banquet.

Ladies and Gentlemen:

I have been devoting something over thirty years to the preparation of what I may say here tonight, and I can hardly condense it into five minutes. I want, however, to call attention to the possibilities of development in such an association as this.

I was visiting at the University of Wisconsin last year, and I learned there that the farmers in Wisconsin who were growing corn had formed themselves into a corn growing association, an experiment association they called it, very much like these dairy cow testing associations that are being formed throughout the East, and about which you know something. The result has been, from the co-operation of farmers who are interested in growing corn in that state, that corn which would not mature above the forty-second parallel or thereabouts, has now been made to grow as far north as Lake Superior,—Dent corn, solid and mature, such as is grown in central Illinois. This is practical. That means hundreds of thousands of dollars in the pockets of the farmers who belong to that association. The same kind of work may be done by the members of this association, if you organize in such a way. Without doing anything new, each person becomes aware of the work of every other person who has been successful. Just a word on that, to throw out as a hint.

It takes fifteen or twenty years, I understand, to bring an apple tree to such maturity that it is profitable. Is an apple tree, or a field full of apple trees, any more valuable than another product of the farm that it takes about fifteen or twenty years to bring to maturity? The young men and the young women that grow up on our farms are worth more than many apple trees. They have not the opportunities in modern life that some of you have had to learn the practical workings of your everyday business. A short statement of what I might take hours or weeks to get at is this, that in the present complicated life of the modern world it is absolutely necessary that we have special training in our work to compete with others who have had it elsewhere.

To give a practical illustration: Germany was said to have conquered France in 1870, and thus redeemed the great humiliation which Germany suffered under the great Napoleon at the beginning of the nineteenth century, through the work of the German schoolmaster. Twenty-five years ago I suppose it could be said that Germany was the best educated nation on the face of the earth. But it was educated in a kind of philosophy and literature and science that made scholars only—intellectual scholars, but not the practical men that Germany now produces. What is the difference, and why the change? A simple incident will illustrate the whole thing.

In 1876 we held our Philadelphia Centennial Exposition, and the German commissioners came over here. And they had been here but a day or two, looking over the exhibits, before they cabled back to the new chancellor of the German empire: "Our German goods are cheap, but wretched." That is all they said, and all that was necessary. If German goods were wretched, something had to be done to make them better. And you know the result. You can hardly pick up a piece of cutlery or manufactured article in your own homes without finding it stamped "Made in Germany."

And why is it? Because Germany, on account of the humiliation at such a despatch about its goods, immediately set to work to train all the workers in Germany to do first-class work, through the use of industrial schools. And in twenty-five or thirty years (not thirty years since the schools were established, only twenty-five years since they were running) Germany stands in the forefront of all this earth in manufactured articles. And we must look to our laurels if we maintain a successful competiton in any part of the world. That is on the industrial side.

Now let us get at the agricultural side, which this body more particularly represents. Twenty years ago there was no nation in Europe so low agriculturally as Denmark, that little Kingdom away up in the corner of Europe. And today, if you read your farm papers, and the literature bearing upon agriculture, you know there is no nation in the world that stands higher in agriculture than Denmark. And what is there to account for it? Just the same kind of thing that accounts for the industrial superiority of Germany, except that Denmark has done it agriculturally.

Denmark, all told, is about one-half the size of the State of Maine, not over that, and in it are an agricultural college and twenty allied agricultural schools,—special agricultural schools. And in those schools are four thousand students. And in addition to that, there are seventy-eight people's high schools in which agriculture is taught. Without going into details, you can draw your own conclusions. I repeat, that agriculturally, Denmark stands highest on the continent of Europe. There is enough to account for it. There are six thousand pupils in these seventy-eight schools, in addition to the other four thousand. There are ten thousand pupils at one time in the little kingdom of Denmark, half the size of the State of Maine, studying agriculture.

We have only one institution in this state that is definitely teaching agriculture now. Others are beginning to do something. We are very glad of it, and hope there will be more. But we have only to look around this room, and around the exhibits that you have here at this pomological meeting to see some of the effects of agricultural instruction right here in our midst. Half a dozen of the leaders in your own work are right here among you. We don't want to brag about ourselves, but we are proud of some of these young men. I think there is not one of them who has been three years away from the agricultural school, and yet they are making their mark in the management of farms, in the department of agriculture, and in other walks of life connected with agriculture.

The State of Maine, in its legislature last winter, appropriated a small sum of money for the purpose of investigating the needs and advisability of some kind of industrial instruction; and the state superintendent of schools, together with a committee composed of the president of the State University, the master of the State Grange and two or three other gentlemen, representing large interests, educational and industrial, are going to commence the investigation of that subject. And I believe we can count upon every person here, who is engaged agriculturally or industrially, when he fully understands the scope of it, to support any movement that may be made for the establishment of technical instruction in your own communities for the education in practical lines which will make the young man and young woman work more effectively in their life work. May we not count upon you, and feel sure that we can?

If Denmark, half the size of the State of Maine, has more than a hundred agricultural schools, and if Belgium, less than half the size of the State of Maine, can support, with its agriculture and its industry, six millions of people, and support them well and happily, what may not be done in our own state, with its wonderful facilities, not only in manufacturing of all kinds, through its water powers and its forests, but agriculturally? There are enough resources here in the State of Maine to support a population of five million people.

Let us join together in the movement that is now beginning for the education of the young people in the practical affairs of life, so that they may have all the force behind them that has accumulated from the experience of others in the past, plus the technical training which will help them to bring about such results as you have seen illustrated this afternoon on the screen. It is a proud thing for us, is it not, that that immense exhibit in Boston, which attracted more attention, I am told, than any other exhibit there, was packed by University of Maine students. Those students have had very little experience. Some of them, I dare say, have hardly had a month's instruction in horticultural work and in the packing of apples. And if those results can be accomplished with such little instruction, how much more can be done, not only for the few but for the whole state, by a careful system of instruction.

ADDRESS TO YOUNG PEOPLE.

PROF. V. R. GARDNER.

Mr. President, Girls and Boys:

I suppose all of you boys and girls have in mind some day to be famous. I doubt if there is one of you but hopes to be a big man or a big woman some day. Some of you perhaps are hoping to be big lawyers. Some of you are hoping to be big business men, and handle some of the big business interests of the state. There may be some here who want to own a railroad, or a steamship line; or there may be an aspiration to be governor of the state. And who knows but some here may be governor of the state or President of the United States?

But I want to say to you that it is not only the commercial and political positions that count. There are other lines of work. There are other fields in which you can be just as big men and just as big women as you can in political life or in the so-called commercial world. I refer especially to some of the various branches of agriculture at the present time. If I were to ask you students here who is the biggest man in the United States now, probably you would say William Taft; or you might say Theodore Roosevelt, who is soon coming back; or you might name someone else. You might name your own Senator Hale; or Senator Cummins of Iowa. There are, I presume, a number of men that different people would pick out as among the biggest men in the country.

Now those men may be the biggest men in the country, but I think there are men just as big as William Taft in the country at the present time, just as big as Theodore Roosevelt, just as big as some other men that have been mentioned, who haven't labored in exactly the same lines that those men have, but who have done just as much toward building up the general commercial and industrial welfare of the United States. I know some of the big moneyed men like Harriman and Hill have been criticized, but nevertheless these men have done wonders for the United States. There are a number of men in positions in agriculture, like Secretary Wilson, of the U. S. Department of Agriculture, like Gifford Pinchot, who is running the forestry department of the United States, like Dr. Webber, or Dr. Swingle, who are really doing as much for building up the welfare and prosperity of this country as any men in the so-called commercial or political life.

If I were to ask you who is the greatest man in New England, I can hardly guess whom you would mention. New England has produced many great men, and there are a great many famous New Englanders at the present time. You might point to your own senators in Washington. You might point to your own governor. You might point to Aldrich, of Rhode Island. You might point to some Massachusetts great men. But I am here to say this morning that there are farmers in New England that are as famous the country over as any politician in her limits.

I am thinking of one man in particular now, and that is J. H. Hale. I came from the West, and I heard of J. H. Hale, the big fruit grower of New England before I heard of Aldrich. I heard of that Hale before I heard of Eugene Hale of this state, the senator. And J. H. Hale is a farmer.

If I were to ask you who are the biggest men, the most looked-up-to men, in Oxford County, I cannot say who would be named. There are a number of men of state reputation, at least, in the County of Oxford at the present time. There might be some dry goods men among them. There might be some grocery men among them. There might be some proprietors of planing mills, or of lumber mills, or shoe factories, or representatives of other industries among them. But I dare say there would be a good liberal proportion of farmers among them, men who are raising apples and potatoes and cattle.

I mention these things because young people often get the idea that to be famous they have got to be in politics, or that to make big men out of themselves they must enter one of the commercial lines. That is not the case. The men who can grow apples like those on exhibition here in a twenty acre orchard or a fifty acre orchard (and it is within the power of any one and every one of you) is destined to be more famous at the end of ten years, or twenty-five years, when you will be right in the prime of your life, than the man who is ward boss or county politician, or the man who is running your biggest shoe factory, or biggest lumber mill. For this is the kind of industry that is developing at the present time.

You hear much about the West, and many people tell you to go west if you want to get rich, and want to make a big man out of yourself quick. But lots of people in the West are telling their children to "go east, that is where you will have the best chance." And you do have just as good a chance here in the East as can be had anywhere in the United States.

Do you know who the biggest man in Iowa is at the present time? There are a few men there who raise five thousand acres of corn each year. Those are the big men of the State of Iowa. Do you know who the big men of Oregon are? They are men who have orchards worth two thousand dollars an acre, and not the men in the legislature. I call your attention to a few of these things so you can see there is an opening for you right here at home, on your own hillsides, and in your own valleys. I am putting up a plea for you to stick closer to the soil, and solve its problems. I tell you there is a great satisfaction in being able to take hold of nature's sunshine, nature's rain and nature's soil and make products out of them which are really worth while. And I want to call the attention of you students to the possibilities of farming, and especially fruit growing, right here in the State of Maine, in Oxford County.

PROGRESS IN THE STUDY OF APPLE DISEASES AT THE MAINE EXPERIMENT STATION.

By Charles E. Lewis.

During the past two years, the Department of Plant Pathology of the Maine Experiment Station has devoted considerable time and study to the diseases of the apple, making this one of the chief lines of investigation. At the meeting of the Pomological Society last year, Professor Morse gave a paper in which he outlined the work which we were doing and told you something of our plans for this year. The work has been continued and we feel that we have obtained results which cannot help being of value to the apple growers of the State.

In taking up this work, one of the first things which we have had to do was to become acquainted with the orchard conditions and with the diseases present in the State. In traveling through Maine, it becomes evident even to a casual observer that there are many apple trees which are unhealthy. It is not always so easy to determine the exact cause of the unhealthy condition. We have tried to become familiar with the diseases by visiting orchards, by having material sent to us for examination, and by careful laboratory study and inoculation experiments.

There are a number of things which may give an apple tree an unhealthy appearance or may even cause its death. Among these are: winter killing, poor drainage, lack of nutrition, failure to cultivate, and attacks by fungi and insects.

It is readily seen that the most of these causes of diseases are directly under the control of the apple grower. This control should begin early, in the selection of a good location for the orchard, and in properly preparing the land before the trees are set. This should be followed by giving the young trees the same amount of care that would be given to other growing plants. It is rather unusual in our experience to find a man who is giving as much attention to his young orchard as he would give to a crop like corn or potatoes from which he expected to receive returns the same year.

By practicing what might be called good orchard management, many of the causes of unhealthy trees would be entirely removed and others would be partially controlled.

The control of diseases caused by fungi requires in some cases special knowledge of the fungus concerned but in most cases the apple grower could protect his trees and fruit by simply following the methods of treatment which have been recommended by Experiment Stations, Agricultural Colleges, and successful orchardists even though he knew little about the causes of the disease. It is natural, however, for us to take greater interest in things of which we have some knowledge and it is easier to fight an enemy if we know its methods of attack. For this reason it seems well in this paper to discuss the characters of fungi before taking up diseases caused by fungi.

Fungi are low forms of plant life, they do not have the green coloring matter with which we are so familiar in the higher plants, and for that reason they are unable to manufacture organic food. There are many thousands of species of fungi which differ widely in form and manner of life. All fungi, however. agree in certain characters. They are all composed of little threads called hyphae. This structure can be seen very easily in such a fungus as the common bread mold. Fungi differ from higher plants in being reproduced by means of spores instead of by seeds. Spores are very minute bodies which are invisible to the naked eye but are easily seen with the microscope.

A few examples of fungi with which you are familiar will help to make the characters clear. The common toadstools which we find in the woods and fields are fungi of large size. The part of the toadstool which we see above the ground is called the fruiting portion because it is the part which bears the spores. The spores of a toadstool are borne in large numbers on the gills on the underside of the cap. The part of the toadstool which appears above the ground is not the entire plant. There is a network of fine threads of hyphae called the *mycelium* which grows through a considerable area and absorbs food from the organic matter contained in the soil and it is only when this mycelium has stored up a sufficient amount of food that the fungus fruits and we have the toadstool.

The large shelf fungi which occur on old trees and logs are quite hard and woody in some cases but they have all the essential characters of fungi in that they are devoid of green coloring matter, are composed of threads, and reproduce by means of spores. The spores of these fungi are borne in the little pores on the under side. The mycelium in this case spreads through the wood getting food for its growth and causing decay.

In the fruiting part of a toadstool or shelf fungus, the thread-like structure is not very evident unless the body is torn apart and examined because the threads are woven together in very compact masses so that the individual threads cannot be easily seen.

We all know that if a piece of bread which has been exposed to the air is put in a moist place it molds. The spores of the mold fungi are very small and are present in the air of almost any room. When the spore of the mold falls upon the bread and finds suitable conditions of warmth and moisture, it begins to grow. A little tube grows out from the spore. Later this tube branches and continues to grow until a much branched mycelium is formed. When the mycelium has stored up sufficient food, the fungus fruits by sending up little stalks each of which bears a sac called a *Sporangium* which contains a large number of spores.

We have seen that fungi differ greatly in form and in their manner of reproduction. They also differ in the source of their food supply. Some fungi are able to get their food only from dead organic matter and are called *saprophytes*. The other class is able to attack living organisms and they take their food from that source and are called *parasites*. It is with *parasitic* fungi that we are most concerned in the study of plant diseases. However, in many cases it is only possible to determine whether a fungus is a *parasite* or a *saprophyte* by carrying on extensive inoculation experiments.

Several lines of study have been carried on at the Station in connection with apple diseases. In the summer of 1908 cultures of fungi were obtained from apple leaf-spot from orchards in a large number of different parts of the State. In all, 13 species of fungi were isolated from the leaf-spot, several of which have been regarded as causes of the disease by Experiment Station workers in other parts of the United States.

Inoculation experiments which were carried on in the early part of the summer of 1909 show that only one of these fungi is capable of causing the leaf-spot on uninjured leaves. When spots in the leaves are killed in some other way, the other fungi are able to grow upon the dead spots as *saprophytes*. The one fungus which has been found to cause leaf-spot is the same one which causes a rot of the fruit known as "black rot" and also causes one form of *canker* on the branches. The fact that a single fungus is able to cause disease of leaves, fruit, and wood throws some light on methods of treatment. An old tree which has a large number of cankers on its branches caused by the black rot fungus is almost certain to show a large amount of leaf-spot, and of decayed fruit. The best treatment in such a case is to remove the source of infection by cutting out and burning the dead wood upon which the fungus is fruiting. This followed by thorough spraying should control the leaf-spot and the decay of the fruit.

Another line of investigation which has been carried on is in determining the number of fungi which we have in Maine which are capable of causing diseases of the wood which are usually called *canker.* In this work it has been necessary to isolate fungi in pure culture and then to inoculate trees in such a manner and in such number as to insure that the interpretation of the results was correct.

There can be no question that much of what the orchardists of Maine are now calling *canker* had its origin in winter killing. The fungi which cause disease of the bark and wood are very rarely able to enter through uninjured bark. The bark killed by cold gives just as good an opportunity for a fungus to enter as a wound made in any other way. But whatever the origin of the trouble may have been, it is necessary to try to check the spread of that part of it which is caused by parasitic fungi. This may be done to a considerable extent by removing and burning dead branches on which the fungi occur. In the case of branches which show injured regions much may be done by carefully removing the dead bark and the part of the wood which is injured, disinfecting thoroughly with copper sulphate solution, and then painting over with white lead in oil. The main thing to keep in mind is the destruction of the living fungous material which is capable of spreading infection wherever wounds occur. *It is not enough that the diseased branches be removed from the tree. They must be burned to destroy the fungus because in many cases fungi are able to grow and produce millions of spores on wood which has been removed from the tree.* When the orchardist realizes that the fungi which cause the diseases of his trees are living plants which are able to grow and reproduce he is better able to understand the reasons for taking certain measures to prevent the spread of fungous diseases.

So far in our work we have found that what is usually called canker of apple branches in Maine is due to only two general causes. One is injuries due to weather conditions of which winter-killing is the main one, the other is attacks of parasitic fungi of which there are at least 4 in the State which are known to do considerable damage and there may be others. We have not found any case in which we considered that canker was caused by the organism which causes fire blight of the pear. It is well known that this organism causes disease of apple trees but we have not found it in Maine either on pears or apples, although we have searched for it in widely separated localities. However, the fact that we have not found this disease does not necessarily mean that it does not occur.

The black-rot fungus, *Sphaeropsis malorum* Pk, which is very common here and is known to cause canker in other states has been tested as to its effect on apple trees under Maine conditions and has been found capable of doing great damage as it spreads and kills the bark of regions several inches in length in one season. The results with this fungus have been of value also for use in comparison with some other fungi which have been studied which have not been reported as causing disease in other places.

The bitter-rot fungus, *Glomorella fructigena* (Clinton) Sacc. has been found in Maine for the first time. First in a decaying apple which Professor Gardner secured at the Pomological meeting last year and later from both apples and cankers from an orchard in Oono. This fungus which does so much damage in some of the great apple growing regions has not been found to do very much damage here so far as we have been abie to determine. There are two forms of the fungus, northern and southern, which in some of their characters are quite distinct and it seems from our study that the northern form is not so active a parasite as the southern form.

Besides these two which are usually regarded as the chief fungi which cause canker, in the eastern part of the United States, 8 other fungi have been used in making inoculations. In making these inoculations small incisions have been made in the branches of apple trees with a sterilized knife and then material of the fungus from pure cultures has been placed in the incisions.

If the fungus which is used in making the inoculations is a parasite, the mycelium grows and spreads rather rapidly, killing the bark and in some cases girdling and killing the branch. The bitter rot fungus and the black rot fungus are capable of killing small branches in 3 or 4 weeks and may kill large branches in a longer time.

Of the other 8 fungi with which I have inoculated apple trees during the past summer 2 have been found to be parasites. When branches of young apple trees or small branches of large trees, are inoculated with either of these fungi, the fungus spreads into the uninjured bark and in a few weeks may kill a region 1 to 3 inches in length. In some cases the branch is entirely girdled and the part above the inoculation is killed. These two fungi begin to fruit on the dead bark in 3 or 4 weeks after a branch is inoculated and produce spores in great numbers which are capable of causing disease of other branches in case they are carried to wounds.

These two fungi are of special interest to Maine apple growers because this is the first time that they have been proved to be able to cause disease. They may cause disease in other parts of the United States or they may not. It may be possible that conditions here favor their development and that they are not capable of causing disease under other conditions.

One of these is of importance because it causes an apple rot which has never been reported before so far as I can determine. This fungus causes almost as rapid a decay as the black-rot fungus.

As we have seen, we have in Maine at least 4 fungi which can cause canker. Three of these are causes of decay of fruit. Every dead branch on trees in your orchard or on old neglected trees along the road may produce millions of spores of these fungi in a season. These spores may be carried to wounds on living branches by wind, water, insects, or by man himself, and there cause disease. The spores which have developed on the dead wood are present also when the fruit matures and in many cases the fungi which grow on dead apple wood are able to cause decay of the fruit. There are a number of fungi which grow on the dead wood in the summer as *saprophytes* which would do no damage if it were not for the fact that they are present in the fall and are ready to find entrance to the fruit and may do very great damage.

When we understand that most of the fungi which cause canker also cause decay of fruit and that several other fungi grow on dead wood which also cause decay, we can understand the importance of removing and burning all dead wood. If there is one point which needs emphasis it is this one. It is a common thing to see old neglected trees along the road or in old fields. If these trees are not of enough value to justify you in giving them the same care which you give the trees in your orchard, you should cut them down and burn them as a protection not only to yourself but to your neighbors who are trying to protect their trees from disease. One old diseased tree is capable of producing enough fungus spores to infect all the trees in an orchard provided they are carried to injured places on the trees. At the present time there is much dead wood in the orchards of Maine. There is no other one thing unless it is spraying which is so important in controlling the fungous diseases of the apple as the prompt removal and burning of dead and diseased wood. In removing dead branches, care should be taken to cut back to the living wood in order to remove all of the fungus mycelium, because if any remains it will continue to grow and will spread the disease. This care in removing the source of the material for infection should be followed by thorough spraying. Spraying of apple orchards in Maine is not nearly so generally practised as it should be, although it has been demonstrated many times that it pays.

I have already mentioned a number of the fungi which cause apple rots. It is a fact too well known to all of you that apples sometimes rot on the trees and that when they are placed in ordinary storage there is great loss. It is not so well understood, I think, that most of this loss is caused by the attacks of fungi. When we understand that this decay of ripe apples is caused by living growing plants which are able to propagate themselves in such a way that one rotten apple may produce enough spores to infect all the apples in a barrel, we are better able to make plans to prevent this loss.

During the past year, I have studied the fungi which cause decay of apples in Maine. The work along this line is not completed but enough has been done so that I can say that Maine has a large number of apple rot fungi. In this work we have found practically all of the fungi which cause decay of apples in other parts of the United States or in Europe and some others which have not been reported in either country. One fungus has been found which was described for the first time as a cause of fruit decay in Europe a few years ago. This fungus causes a rapid decay of ripe apples and also causes decay of green fruit upon inoculation. It has not been reported from any other part of this country, but probably occurs. One other fungus has been isolated from decaying apples which belongs to a group of fungi never reported in America and this species is new, never having been described from any country. This fungus does not cause much decay of apples but is mentioned as a matter of interest as showing that it is possible to find new and interesting things in this study.

One of the worst of our decay fungi is the black-rot fungus, *Sphaeropsis malorum* which I mentioned earlier as a cause of leaf-spot, canker, and decay. This fungus may cause decay of fruit either on the tree or in storage. I have seen trees on which practically the entire crop of fruit was destroyed by this fungus. In some cases the spores of the fungus may be either on the stem or calyx end of the apple and when the apple is placed in storage if the temperature is not so low as to prevent growth, the fungus begins to grow and causes a rather rapid decay of the fruit. On October 5, 1909, I purchased 12 Rolfe apples from a grocery in Orono and placed them in glass jars in the laboratory. Within 3 weeks all but one of these apples had decayed, the cause being the black-rot fungus. In each case the fungus entered at the stem end.

Another bad decay fungus is the ordinary blue mold. This fungus, however, is not able to do much damage to uninjured apples. It must enter in most cases through a wound of some kind, it may be through an insect or fungous injury or it may be through a bruise or cut which has resulted from careless handling. The blue mold fungus is a very common saprophyte. It will grow on almost any dead organic matter. It may be seen on jelly glasses, on old bread, even on old leather. The spores are practically everywhere present and are ready to fall into or upon injured places on apples where they begin to grow and cause decay. This fungus causes a great part of the soft rots of apples in storage.

Another fungus which is a very common saprophyte and which does not do much damage under ordinary conditions, causes pink rot when the conditions for its development are favorable. This fungus usually enters at places injured by apple scab. Here we see that if the scab were prevented by proper spraying the pink rot fungus would not be able to do much damage.

The bitter rot is present in Maine but has not been found to be common.

The fungus which causes brown rot of the peach and plum has been found as a cause of apple decay.

At least 12 fungi have been found in Maine which are capable of causing more or less rot of apples. The rots caused by part of these fungi have no common names. It may be that in some cases the damage done by them is credited to some of the other better known fungi, as it is sometimes difficult to determine just what fungi are present without making cultures.

To prevent loss of fruit from these causes it is necessary to raise good apples which are free from insect or fungous injuries through which decay fungi may enter. To do this requires that the orchardist give careful attention to all the details of good orchard management, including thorough spraying. Care must be taken in picking and handling the fruit to prevent bruises and cuts through which fungi may enter. Any decayed fruit should be carefully sorted out at the time of storing, as one diseased apple may produce enough fungus spores to infect hundreds of apples if the conditions are favorable.

In closing this paper, it may be well to point out that while we have in this State a large number of fungi which cause apple diseases it is not necessary in most cases to give special treatment for each disease but that the treatment which answers for one will in a large measure control the others. For example, thorough spraying to prevent apple scab will at the same time control the fungus which causes apple leaf-spot and indirectly if there is no scab there is little possibilty of decay by the pink rot fungus. The importance, however, of keeping up a constant fight against fungous diseases cannot be over-emphasized.

The Department of Plant Pathology of the Experiment Station is preparing a bulletin on apple diseases which we hope to issue before another season in which the diseases of the apple as they occur in Maine will be described with practical directions for their control.

STARTING THE ORCHARD.

E. CYRUS MILLER, Haydenville, Mass.

Ladies and Gentlemen:

I have come a long distance to see you. I have enjoyed being here; I have enjoyed the people, and the beauty of your country; but I really came down here to bring you a message. You remember the little story that was so much in vogue a few years ago, the message to Garcia, that had such a wonderful circulation. It was a simple story, but still a story of wonderful truth. It was a story of taking a message to Garcia, in Cuba, and the adventures of the one who took it, showing the spirit of the man who took the message.

I believe I have a message for you here today. I have a message for every farmer and for everyone that is interested in agriculture in New England. I have been preaching this for years, and I believe I have this to do, and so I have come down here today to give you the best that is within me, out of my years of experience in establishing an orchard and studying the problems that underlie it, and its different phases. I have come down here to try to be helpful to you, and ask you now to just give me a few moments of your time.

I have brought with me a few photographs which I shall now take the liberty to start in circulation, and which will give you an idea of some of the points on which I propose to touch.

I have spoken about the charm of the people and the beauty of your scenery. Yesterday, instead of attending your meetings here, I wandered away over the fields to visit and enjoy the hospitality of one of your most successful and prominent fruit growers. And I want to assure you it was a most delightful day to me, a day of pleasure, and also a day that widened and broadened my experience, as far as understanding the natural conditions as they exist in your state, as applied to the growing of the apple.

My good friends, you do not comprehend the wealth of these hillsides that are spread out over your beautiful State of Maine. I wish you might see how those naked fields might be clothed with orchards, not only beautifying your landscape, but becoming a source of profit to the individual owners, and adding fame to your already glorious state. There is no crop, with perhaps the exception of the hay crop, which can be more generally and successfully grown in the State of Maine than the apple. It is your most permanent asset, next to the hay crop.

The other evening, through the slides thrown upon the screen, I showed you something in regard to the renovation of old orchards. That is a necessary step—the care of the orchards that you already have. But I shall assume that you are going to do something for them, that you are going to wake up, take a new lease of life and do something for those old trees that have been started by the wayside and in the fence corners, and still live, and give you some apples every fall. The apple crop brings in hundreds and thousands of dollars and I shall assume that you will take care of the trees you already have.

Now how about starting the young orchard? I presume that I am talking to three classes of listeners here today. There are first the farmers and fruit growers, in which class I am. I am a farmer, and am simply making a specialty of the growing of the apple. Then there are the business men here, who may desire to take up the growing of the apple as a business proposition. I find that class of people greatly increasing throughout New England. I have a great number of clients whom I am serving in helping establish orchards and get things into business shape, because they realize that sometime they want to leave their business or their profession, and they want some place to go, and it seems to be their choice to establish an orchard and so provide for the future. And I am glad to see that class of people increasing. It is a gratifying sign for the uplifting of agricultural conditions in New England, because that class, as a rule, bring to their work and into this life methods which they have followed, and habits which they have acquired, which among our farming people are perhaps too many times lacking. Then again, there is the class which I may call the capitalist. I long for the day when capital may become interested in agricultural projects in New England, and when capitalists may take hold of these things and conduct them as our manufacturing establishments and our large banking establishments are conducted—along business lines. I long for the time when the capital that is made here on the farms and in business shall be invested here, and not sent west. I know of hundreds and thousands of dollars that have been sent out of New England to develop these western countries. The bank treasurer in your village told me that if the money that had been sent out of this little town alone could be calculated, any man possessing that would be the wealthiest man in the section. I have talked with bank men about these things, and know that an immense amount of money has been sent out of New England into all kinds of schemes, and the owner has frequently been fortunate if he has received back a very small proportion of the original amount he sent out. These are the three classes of people I am going to assume to be here, which I think will be interested in starting the orchard.

Now regarding the choosing of the varieties. This may seem a rather delicate matter for a Massachusetts man to come down here and talk to you about. But I think you will agree with me on one point, and that is that the number of varieties should be few and well chosen; chosen according to your location and according to your markets. If you are growing them for home use, that is one thing. You can have a succession of fruit that will supply yourself and your friends and your immediate markets throughout the season. But if it is a matter of commercial variety, just tie up to two, three, four or five kinds. On seventy-five acres planted, I have nothing but the Baldwin at present. The Wealthy is my second choice. I do not say this to influence you here in Maine, but my own individual choice has been narrowed down to two varieties. A red apple, if we are to decide by the color, is the most desirable apple. We know that the great majority of apples that are called for today in restaurants and stores and fruit stands everywhere are red apples. As beautiful as the yellow and white apples may be to look at, as luscious as they may be to eat, it is the red apple that sells. And we want to grow the apple that is going to sell the best, and of which we can sell the largest quantities.

I believe that in the long run the Ben Davis, if well grown and properly handled, may become and may be continued as one of our most important commercial apples. But I will simply say just this one thing, and that is, if you do grow it, grow it well. Grow it as well as Bro. Cummings grows it, which is good enough for anybody. He needn't be ashamed to put up a box of his Ben Davis apples and send them to the King and Queen of England, or the President of the United States. But he should put a ticket in them telling when to eat them—not before Thanksgiving or Christmas, but next spring, next summer perhaps.

There are half a dozen leading varieties,—the Baldwins, the Northern Spy, the Wealthy, the Greening if you will, but don't get in too many kinds.

There are three kinds of land which we can utilize for orchards. There is the best land on our farm, by which I mean the land that has been tilled, and is in good heart, and which may be the best suited at the time being for an orchard. Then there is the wild land, such as pastures, where the land has been partly cleared, and has more or less fertility. The third class is the forest land.

I am going to advise you first to take your best lands. Now I suppose you will call me right down on that, some of you good farmers here who think a great deal of nice slopes and well-tilled fields. But I want to tell you this,—that there is no acre of land that you have on your farm, however good your tilled land is, that will compare in results with an orchard. I have an orchard which has been planted twenty years, and ever since it was ten years old it has been yielding five or six per cent on a thousand dollars an acre. Now I don't say that to bring myself into the matter, but I simply want to call attention to the value that you can give to your land by putting trees on to it.

You can talk with any of your banking men, and let them tell you how much more money they will loan on your farm if you have apple trees planted on it, if they have any experience in this line. Of course I do not mean to say that if your best lands are low lands, running beside creeks, with clay soil, you should set apple trees on them. But you have enough good land. Some part of the average farm here in Maine is usually suited for growing apples. Of course you must consider that the uplands, the hillsides, or even the hilltops, are most desirable. We find on those locations usually between a light loam and a heavy loam; and in the long run that medium loam is the best suited for the growing of the apple. Then of course the better location you have as far as protection from the winds of the west and north the better. Our friend, Bro. Cummings, has the most ideal location, or one of the most ideal, that I ever saw. We have a location in Massachusetts, Apple Valley, that is similar to it. Where the land lies up against the hills and mountains that protect it on the north and west, where the orchards get the full benefit of the sunshine, which is especially desirable along through the late summer and early fall in ripening up the fruit and putting on that beautiful finishing touch, it is one of the greatest things in the world. But that is not material. Select your best soil, and as far as you may, the upland soil which is well drained, both by natural and atmospheric drainage.

Now as to the nursery stock. I don't know about the condition of your nurseries in the State of Maine, but I do believe it is a grand opening for any one to establish nurseries here and grow trees; and to grow good trees and charge a good price for them, because they are worth a good price. It is a well-known fact in horticulture that plants and shrubs thrive best in the section where they are grown, and I believe that is true in regard to apple trees. Certainly get your stock, as far as you can, from the same latitude. Don't go south for your apple trees, because you will be pretty apt to find that unless you keep them growing thriftily and vigorously, they will have black hearts and deteriorate. Buy of a good nursery house, specify what you wish, be willing to pay for it, and buy good two-year-old trees, if it is possible to obtain them. If it is impossible to get them and you are all ready to plant, you may possibly accept the one-year-old trees. I know there is a difference of opinion about that. But from my own experience and talking with the best nursery houses, I am thoroughly convinced that a two-year-old tree is the best tree to set that we can get from the nursery, to transplant in a way that there will be the least possible break in its growth. We might take a young tree, a yearling tree we will say, and perhaps train it more to our ideas; still, by getting two-year-old trees we gain a year's time. We buy a year's time in the growth of the tree for usually about ten cents, and I consider it a poor business proposition to get a one-year-old tree and take the difference in size for the sake of saving ten cents.

Now I am in the apple business for two reasons. Primarily, because I love it. In the second place I am in it to make money, and I propose to make money, and propose to make money through recognizing all these details which to many people may seem unreasonable and of no great importance.

Now about preparing the land, and what crops to grow in the young orchard. You are a good class of farmers here. I know that by looking into your faces. How do you prepare your land for the ordinary hoed crop? You prepare it by plowing and giving it a good dressing of fertilizer, and giving it a good harrowing. And those of you who grow the best crops are those that give the greatest attention to the preparing of the soil. That is a well-recognized fact in agriculture. The men who are growing the best crops today in any line whatever are those that pay the greatest amount of attention to the preparation of what we might call the seed bed. And what does it mean? It simply means that we are providing an environment where the plant is able to get hold of the plant food. That is just what we want to do in regard to the apple. We just want to fix that soil so that the mass of fibrous roots that come to us from the nursery, when we place them in the ground will be able to get hold of the plant food in the soil. And unless we do prepare the soil in some such way as that, we are going to get a stunted tree. And when we get a stunted tree, we get a poor tree and become discouraged apple growers.

Now the only way to continue our interest in this young orchard is to get a good healthy tree and plant it in soil that is well prepared so that it will start to grow and continue to grow.

And, by the way, I do not advocate to farmers and business men large operations. I say go slow. Learn the business. Begin at the bottom, even if you have got an ordinarily large orchard established. Start your young orchard in a small way and take good care of it, and let it be a source of inspiration to you to take better care of it every year and put out more trees. If you put out an acre this year and take care of it, it will be pretty safe to assume that you will put out another acre next year, and in a very few years you will have an orchard that is large enough for you. With the capitalist it is an entirely different proposition. Your capitalists, in the corporate form of management, can put out just as many acres as they have the capital and the ability to manage.

Now as to the crops to grow. You can grow any hoed crop to good advantage, like corn, potatoes and market vegetables. Even asparagus and small fruits come in to good advantage, the strawberry, the raspberry, the blackberry, and the currant. If you want to utilize those crops to help pay your bills as you go along it is a perfectly legitimate proposition. In our own operations I have used the regular farm crops, like potatoes and corn, and a portion of the time tobacco, because we are just on the edge of the tobacco belt. Market vegetables, like cabbage and tomatoes, are good, and the more intensively you grow them, the better your orchards will be. The best block of trees I ever grew was a block that was started with tobacco, because there is no crop we grow in Massachusetts, or perhaps that is grown in New England, that calls for such intensive fertilization and such a large amount of stirring of the soil to continue the growth of the crop; and the more attention we give to the crop that is planted on the section the better the trees will grow.

Set the trees a good distance apart. Two great fundamental troubles have been in the past, in orcharding in New England, that the trees have been planted too close together, and too many varieties have been planted. We can now realize by glancing around us and seeing the mistakes that have been made in the past, how important it is to set our trees so that we may allow such a growth as they are to make. Of course thirty or forty feet seems a long distance apart to plant trees no larger than your finger or thumb. But we know by experience that a few years brings a great change in the appearance of the tree, and we know that if we are to succeed in the largest measure, our trees must have ample space in which to expand and develop.

I think the best plan in establishing an orchard today, where we desire to utilize the largest amount of the surface of the land possible, is to plant some standard variety for a permanent tree, a Baldwin, or a Spy, or a Greening, and interplant with some smaller growing variety which bears earlier than our standard varieties do; and when the standards come to that estate when they need the entire area of land, simply cut out the other trees. Many an orchard has been planted with the idea of cutting out every other tree when they encroached upon each other, but it is very rarely that that has been done in the past. I think this will be more likely to be done if we utilize a different type of tree, and plant it with the definite idea that when the time comes those trees are coming out.

The distance apart our standard trees are planted is forty feet between the rows, and thirty-five feet in the row. If planted with some other variety, it would be thirty feet in the row and thirty-five feet between the rows. That form of planting will as a usual thing give the trees ample space for at least a generation.

Plant the trees carefully and head them back when you plant them. Let us try to change the form of our tall trees to the more modern, low headed type. In order to do that we must get a reasonably low-headed tree in the first place; not too low, but if you take my judgment you will get an average tree headed about three or three and a half feet high for a standard tree. It is necessary to get a certain length of stem to your tree if you are to have a tree of good bearing capacity; and you all know that you cannot get a good class of apples unless you have a tree that is capable of producing them. So I say get a stem of moderate height, so when your tree comes to its proper size you will have a tree of good bearing capacity.

When the trees are planted, my idea in regard to the pruning of them is to prune each little branch back to within about two or three buds of the parent stem, leaving those buds in a way that they may make a frame work in the air. If you don't you will get something away up in the air, unless you cut it off, and the best time to cut it off is when it is young. Just build a frame work around an open center. Sometimes you find a tree in bad shape, and it is pretty difficult to do this, but with the average nursery tree and the average variety you can do it.

See that the tree makes a good growth the first year. That gives you a chance to head it back again, heading back about half or one-third of the growth that it has made that year, and continuing that heading back as long as you can reach the branches. It gives a more compact, solid form of a tree. It is a better business type of a tree and after it begins to bear and spread, the shape of the tree will always be so that it will help you in all your operations. I do not care how old it may be, I do not want a tree that will require more than a twenty foot ladder to pick the apples. With a tree like that the time can be reduced one-half or more, as compared with one of the high trees.

Ques. Do you cut back those trees in the spring or fall?

Ans. In the late winter or early spring. In fact, I do all my pruning at that time, before the sap starts, or about the time it does start, unless there is some special reason for not doing so. I do not believe in summer pruning. You know the best time to cut out brush in the pastures is in the summer, because it devitalizes the roots in the plant. That is just the idea. When we trim our apple trees in the summer it devitalizes that plant, and unless there is some special reason for it, unless it is a tree that is over vigorous, we should not do this. And we all know the average New England apple tree isn't over vigorous. Prune in the spring, or just before the sap starts, and it will get over it much quicker than if pruned later.

In regard to spraying: Some may think it isn't necessary to spray a young tree, but it is certainly necessary to spray it for one thing, or for one class of troubles. I suppose you have all heard of the San José scale, although Prof. Hitchings says there is but one case of it in Maine. Now this San José scale is a hard proposition. In southern New England it has increased more rapidly this year than any year I have known If you are to keep it out of your state you must watch out, that is all there is to it. We talk about climatic conditions and all those things. I do not believe, personally, that climatic conditions will keep it from your State. But you can do a great deal to help control it. In the first place, I believe that when you plant your trees or before you plant your trees you should dip every one of them in a mixture that will be sufficient to kill every scale on the tree, if there happens to be any. That is my rule. I use Scalecide and sulphur of lime. The one is what is called an oil solution; the other is a lime and sulphur spray which is advocated by our entomologists, and is used perhaps more than any other form of mixture. Either one will be effectual. Take a barrel of the mixture and treat your trees before you set them. Dip the trees into the barrel away down to the roots, and by so doing you give those trees the most thorough spraying they can possibly have, and they start right, and have received protection for that year. After that I advise an annual spraying with one of these two mixtures. It is good for the San José scale; it is good for the oyster-shell scale, which I know you have. It is good for every scale. It is good for all forms of disfigurement and discoloration on a tree. It makes the trees look healthy and vigorous. After you have done it once, if you have got an interest in the business you will not omit it. It adds much to the vigor of the tree, besides insuring the control of all these insect pests. We have an immense number of insect and fungous pests, and we should get right after them from the start.

I want to say just a word about the borer, because that is an insect that begins to trouble us after the first two years, and probably does more injury to the young apple orchard in New England than any other one thing. The best way, in my opinion, to get the best of the borer is just to keep after him all the time. Make periodical rounds through your orchard and among your trees, and just the minute you see any signs of the borer working, which is manifest by the throwing out of little chips, simply take your pruning knife or pen knife and cut into that tree, and if you are there quick enough you can very easily remove the borer. While there are a great many proprietary remedies suggested for applying to trees, do not experiment with any of them. Get busy with your knife and dig out the insects, if you have any. And if you give your trees clean cultivation you are not going to have very much trouble with them.

Young trees should have, in my opinion, three years at least of cultivation. Then if you desire to make a quick rotation of oats and grass, oats the first year and grass the second, and then back to some hoed crop, I don't know as your orchard will be materially injured or the growth stopped. But remember always to learn to read your tree. See what those trees are saying to you every day in the year. There is no absolute rule in horticulture. It is the man behind the method that brings success. I will not quarrel with any man, whatever his method is, if he will show me results. All I am trying to do here today is to make suggestions along certain lines. If they do not appeal to you, do not accept them. But do something. Do not plant your trees and go away and forget them. You will never get profitable returns in that way. You will never get trees that will be admired by yourself or your neighbors by any such treatment as that. You have got to do something to them all the time, and they will tell you what they want. If the leaves are yellow, they need some nitrogenous fertilization. You want a good, dark, healthy, green foliage, and a good healthy growth, varying from six to eight inches in a tree. You do not want to make that growth too late in the fall, because your climate is liable to be severe and they are liable to winter-kill.

There are two fundamental causes for winter-killing, one is the starving of your trees to death, and the other is giving them so much food that they have not ripened the wood so they can go into the winter in good condition. Remember those things.

Of course when your trees get old enough to bear, you want to put on a spraying mixture for insects and fungous pests. There are two classes of spraying mixtures for these. One is what is called Bordeaux, which is for fungous troubles such as Dr. Lewis told you about. The other is Paris green and arsenate of lead, for the chewing insects. Then there is still another proprietary remedy that has just come out, called Sulfocide. It is claimed that a great deal of Bordeaux will injure the fruit and foliage. This Sulfocide is supposed to take the place of it, and I believe it is a very promising thing. I did not however, come here to exploit any proprietary medicine.

Spraying is easy to do when you come to a realization of the purpose for which you are doing it, and the benefit you are going to get out of it. It should be thoroughly done.

Question. When would you spray?

Answer: My own personal opinion is that the trees should be sprayed thoroughly with Bordeaux or some other fungicide, and arsenate of lead, immediately after the blossoms fall. I believe there will be very little reason for a second spraying, but still, if any one desires to still further protect the fruit, it is perfectly feasible to spray a second time, from three to five weeks after.

Question. How do you protect the trees from mice?

Answer: We protect the trees from the very start, by putting a strip of either tin or very fine wire around them. Mice are the next serious pest to the borer.

Question. How about tarred paper?

Answer: That is all right, if you do not put it too close to the tree. If you do it is liable to kill the tree.

REMARKS BY D. H. KNOWLTON,
Farmington, Maine.

Mr. President, Ladies and Gentlemen:

I can assure you it is a special pleasure for me to be with you here tonight. I was very sorry that I was unable to be present with you last night at the banquet. I have had a special interest in that banquet. I think it was largely through my influence, while I was secretary of the society, that it was instituted. I regretted very much that we did not have something of that kind last year, because I think there is nothing that will bring a lot of fruit growers together in a better frame of mind than a good banquet, and I hope that your successors in office may continue that practice.

I have been very much interested in your program, and I wish to congratulate the retiring officers upon its excellence. Mr. Wheeler's talk was particularly enjoyable. I am reminded in hearing him and seeing him of a visit which I made in the vicinity of his home some ten or a dozen years ago. I think it was on that occasion that I got my first real impression of the possibilities of the New England soil. We went out to the home of Mr. Samuel Hartley, who then lived in the town of Lincoln. He had one hundred acres of land, in tillage and in pasturage, etc. And he was, it seemed to me, a very skillful operator. From that one hundred acres of land he had stored in his barn, in the month of October, one hundred and twenty-five tons of hay. He had two heavy teams, weighing nearly 1500 each,—very large horses. Well, he told me that commencing with the first of May he had sent five two-horse loads of produce from his farm to the city of Boston up to the middle of October. When I was there he was at work conveying to the city 1200 barrels of apples which he had in storage; all from that one hundred acres of land. I was surprised. And, as I say, it was the first real idea I ever had of the possibilities of New England soil. The conditions here in the State of Maine, it seems to me, are quite the equal of that.

In the month of July, I had the pleasure of visiting for a day and a half Benton Harbor in the State of Michigan, a point through which, as you may know, a larger part of the fruit product of the State of Michigan goes to market. I was interested in everything I saw there, and I studied the situation with the keenest delight. Everywhere the land seemed to be appropriated either to some kind of fruit growing or some market garden truck. Acres and acres of grapes were spread out before me, and as I stood on an elevated place at one time it seemed to me I could see more than a thousand acres of grape vines. I met one man there who had been a railroad engineer all his life. His wife thought he had been in the business long enough. She wanted to get her children away from the associations by which they were surrounded, and she prevailed upon him to give up his work on the railroad and go to Benton Harbor and purchase a farm. He purchased a twenty acre fruit farm in Benton Harbor, for which he paid in cash the sum of $10,500. That is how much a fruit farm is worth on the shores of Lake Michigan.

Now in my county, in the town of Temple is an orchard which I think is one of the best orchards in the State of Maine, of its size. This year the owner of that orchard has harvested about 1200 barrels of apples. Within sight of that farm, almost, there are thousands and thousands of acres of land that are just as good as his. I don't know but the land is just as good as it is in Benton Harbor. It can be bought for from $5.00 to $10.00 an acre.

So much has been said about the possibilities of fruit growing in Maine that I feel like calling attention to this and drawing the contrast. Now at Benton Harbor the price of fruit was remarkably low. I didn't see how they could grow strawberries as cheaply as they sold them and make anything on them. I didn't see how they could grow raspberries and cherries and other fruit so they could make anything out of them. But they told me when they got around to the close of the year they found that a good balance was in their favor all the time, because there was always a ready market for everything they could produce and get started for the city of Chicago. I believe there are many opportunities for doing a similar work here in the State of Maine.

The difficulties in the growing of fruit are very great, but these difficulties, or similar difficulties, are peculiar to success in all the walks of life. Sometimes I think they seem greater than ever. The insect hosts seem to multiply, and the fungous diseases, etc. Our fungous troubles seem to be greater than ever, but it is one of the pleasures which we have in this life to overcome difficulties individually, yet we have all the scientific equipment necessary at the Experiment Station to aid us in carrying on this work, and they are always ready to assist us. Sometimes I blame the fruit growers for not intelligently studying and assimilating, if I may use that word, the instruction which they receive.

My occasion for speaking of this is that I very well remember the first exposition which we had of spraying, or the principle of spraying, and the results of spraying in the State of Maine. I think the first talk offered in the State of Maine anywhere, was that given at Bangor years ago by Mr. Samuel C. Harlow. You remember who were there. You remember the condition of the fruit which he showed upon the exhibition table. It was the best lot of fruit there was upon the table by far, because it was the most free from insects, scab, etc., no doubt largely or entirely due to the results of his spraying. From that time up to the present, in one form or another, we have kept this subject before the fruit growers of the State, and I am chagrined to see, Mr. President, that so few have taken advantage of what was certainly all in their favor.

Then there is another trouble. We go to the Experiment Station sometimes and seek advice from them. We get the advice but we do not understand it. We do not get hold of it, and we go to work and do the thing just wrong, and then out comes an outcry against just the thing they have been teaching there at the Experiment Station, and what practical men know to be true. At Benton Harbor I was reminded of this in a very forcible way, because there was a man who had an orchard of two or three hundred Moore's Arctic plums. The trees were beautiful trees. They were heavily loaded with fruit too, and the proprietor said he would like to have me come over and look at his fruit trees. He would like to know what the trouble was. I went over with a good deal of interest to look at them, and when I got there I found upon those trees there was hardly a single plum but that had suffered injury from some cause. I asked him what he had done for the trees during the year, and he said he had given them a good spraying. He certainly had given them too much spraying, because every plum showed the effects of the spray upon it. It was too strong, or there was some difficulty with the spraying. I told him I thought, if he would send his fruit up to the Experiment Station and let them pronounce upon it they would tell him next time to be a little more careful in spraying.

Well, that isn't true alone of fruit growers. After we came home I stopped over Sunday with my son in Massachusetts, and I found that in quite a large section of that village certain kinds of trees had been nearly ruined by spraying. They had sprayed the trees to destroy the caterpillar, and they not only destroyed the caterpillar but they had well nigh destroyed the foliage upon those trees. I felt particularly ashamed in Massachusetts, because somehow I supposed that those men were doing the thing scientifically, as they claim to do most things in Massachusetts.

Question. What had they sprayed with?

Answer. I don't know. I didn't investigate. But I noticed the condition of the trees. There was some trouble there. So in following the advice of the Experiment Station, you should be careful to do the work right.

Today the Pomological Society has made a change of management, or at any rate has elected new officers for its two principal positions, and I wish to congratulate the new officers upon the promotion which has been conferred upon them. I wish to congratulate them also on the grand opportunities for work which they have before them.

I hope that you may take hold one and all and join with them in carrying forward the work of this society. The profits from fruit growing have not been touched upon here in the State of Maine. You don't know what possibilities there are before you, if you will develop this industry. But it is with you to do it, and you will need to work with all the aids there are. There are several of those. There is the Experiment Station, the Agricultural Department, and you have your own society to carry it forward. Then again there is a strong sentiment all through the State and all through the country in favor of incorporating the teaching of agriculture in the schools. And one of the nice things you did today, was to get in the school of Norway.

I wish we might do that on all occasions of this kind, and that an interesting feature of the program might be specially arranged for them.

There are two things more to which I feel like calling attention. The first is in regard to the varieties of fruit to plant. Now while I wouldn't tell you just exactly what varieties to plant, because I don't know what your situations may be, it does seem to me that in view of the shortness of the season you should plant more marketable varieties than you are disposed to plant at the present time. Now don't take my meaning to be that I advise planting more varieties than are planted in the State, because I don't mean that at all. There are too many varieties already. But what I mean is that for market purposes you shouldn't plant all Ben Davis, nor all Baldwins, nor all Northern Spies. If I could have a large orchard just to suit me and make orcharding my business in the State of Maine, I would plant some Duchess of Oldenburg, and then I would plant some Wealthies, and so on. In other words, I would plant varieties so that instead of waiting until the first of October, when the cold weather is right upon you, you could begin harvesting your fruit by the first of September. And if you can get a hundred barrels of apples, or two hundred barrels, into market before the first of September, or even more than that, you have got them out of the way of the frost anyway. You can pick fruit to better advantage then. The weather is warmer, the days are longer, and you can get more of it into the market. That is one thing, it seems to me, with the short season we have, which we ought to do. This year in my county, if the season had been as it was two years ago, the farmers wouldn't have been able to pick one-half their apples. Fortunately, the season was very mild, and the mild weather was extended over weeks, so they had no trouble in getting their fruit all in. But that is a trouble that is likely to come up every year. If you can't get $3.00 for your apples, per barrel, in the month of September, you can raise them at a profit and get them into the market for $1.50, when you don't have to store them. Perhaps you can get more than that. So I advise planting more marketable varieties and not so many of one or two or three kinds of the latest varieties in apples.

Now there is another thing which comes up and stares the fruit growers of this state in the face as one of the serious problems to be considered, and that is the matter of greater storage capacity. In my part of the State there are scores of farmers who, in an ordinary year, when fruit is abundant, cannot take care of it after they get it picked. They have to sell it. They have to get rid of it for just what they can get. The result is that they injure all the other fruit growers in the State, because it reduces the price by the quantity of fruit that is thrown upon the market before it is ready to be sold. Those matters I feel like briefly calling attention to. I am very glad to meet you and want you one and all to give the new officers of this society a better support than you have ever given the former officers. I assure you they will appreciate it, and I can assure you that their work in the State of Maine will be much more effective than it has been in the past. I think you.

THE GYPSY MOTH.

By Capt. E. E. Philbrook, Portland.
(Stereopticon Lecture.)

Ladies and Gentlemen:

Before attempting to show you any of the pictures, I will try to give you a brief history of the gypsy moth work that has already been done.

The gypsy moth was first introduced into this country by one Louis Trouvelot, a French astronomer, who resided in the town of Medford, Mass. He imported from the old country some of the gypsy moth caterpillars, with the intention of crossing them with some of our native insects, in the hope of producing a silk-bearing caterpillar of commercial value. But by accident the caterpillars escaped and took to the woods of Medford, where they remained about twenty years before the work was taken up by the Massachusetts Department of Agriculture. The work was carried on for ten years, and at the end of that time the department had been so successful in their efforts to exterminate the gypsy moth that the politicians of the legislature decided that no more money was needed,—that there were no more gypsy moths, and therefore the work stopped, and from 1898 until 1905 no work was done. In those few years the caterpillars had increased to such an extent that now Massachusetts has nearly two hundred towns infested with the gypsy moth.

In August, 1906, a gentleman at Kittery Point, Maine, took from his orchard what was supposed to be a gypsy moth. The same was sent to Prof. Hitchings at Augusta, and he immediately decided it was a gypsy moth. This fact was communicated to the department at Washington, and on the strength of that the government agent, Mr. D. M. Rogers, sent to the State of Maine, on the 20th of November, 1906, twelve men to scout the State for the gypsy moth. They came to Kittery, and continued along until they got to Biddeford, which was on the 28th of January, 1907. By this time the snow had become so deep and the weather was so cold that it was necessary to discontinue the work, which they did, going back to Massachusetts and returning on the 14th of April and remaining until the 4th of May.

They found during their scout, up to that time, 518 egg clusters of the gypsy moth in the towns of Kittery, York, Eliot, South Berwick, Wells, Kennebunk and Kennebunkport. In the meantime, the Department of Agriculture at Augusta, which had in its employ several young men, had sent them to Massachusetts to take up the work of the gypsy moth there, that they might be able to cope with the same in the State of Maine. They were placed on the government pay-roll, and after remaining there a month or so, were sent to this State to scout the cities and towns between Portland and Bangor, which they did. The only infestation which they found was at the Soldiers' Home at Togus, which has been fought for two years or more, and I am happy to say that the infestation there has been entirely wiped out.

Our appropriation, made by the legislature, had then become available, and nine men, or ten men I might say, consisting of myself and nine others, were hired for the work, and we began in earnest. Believing that something had been left behind by the government scouts, owing to the severe cold and storm, we were sent over the same territory that had been covered by them, with the result that 462 egg clusters were found in these various towns. By that time the burlap season had come. We commenced burlapping, and burlapped 2121 trees in the different towns, which were attended very faithfully by the men during the summer, with the result that we secured some 30,000 caterpillars.

In the fall of that year scouting was again taken up with an increased force, both by the government and by the state, until at the end of the year we had fifty-two men on the force, part of them being government men, and part of them state men. We continued scouting through the winter, and about the middle of January we again increased the forces so we had seventy-five men. The scouting was continued until it came time for burlapping.

In the first of the year very severe infestations were found in the towns of Kittery and York. These were handled in the usual way, by the cleaning up of the trees and by the cleaning up of the ground, burning the ground over, and so when the spring came we were able to take up the work of burlapping and spraying. We burlapped 60,000 trees this year, and they were attended in the same manner as the 2121 of the year before, with the result that 77,850 caterpillars were taken from under the burlaps. In addition to this, millions of the caterpillars were destroyed by fire, in burning out the stone walls and burning over the ground and over places where refuse was to be found. We continued the scouting again in the fall of the year, carrying it along until the first of January, with the result of finding 16,228 egg clusters in this year. We had then expended our appropriation. Pending the matter of another appropriation by the state legislature, the government took up the men and the work was carried on through the months of January, February and March. The work has been carried on this year in a like manner, practically. In some places we have increased our use of lead arsenate. In the year 1908 we used 1728 pounds, and this year we have used over four tons. Over one hundred thousand trees have been burlapped and attended; and it is almost impossible to state the number, but the supposition is that at least 2,000,000 caterpillars have been destroyed in this year's work. The number of egg clusters found will not be known until we receive the history of the men in the field.

This is a brief history of the work that has been done in the State by our men. And right here I beg to say that in no kind of business anywhere has there been such a lot of men brought together. We have the most intelligent, the brightest and the most gentlemanly set of men engaged in the work that are hired by anybody. Every one of them is a native of the State of Maine. In our work in the last two and a half years we have had representatives from every county in the State on the pay roll. Every college in the State has been represented,—Bowdoin, Colby, Bates, University of Maine; also Hebron Academy, etc. This is the class of men which we have tried to hire and which we will continue to hire as long as we have charge of the work.

I have made a few slides which possibly may be of interest to you, which will show the character of the work and the process which is gone through by the men in the field. The first picture shows a woodland and an apple tree on the estate of John Thaxter at Kittery Point. This apple tree is the tree from which the first gypsy moth in the State of Maine was taken.

The next picture shows the first gypsy moth crew in the State, the original gypsy moth crew. They are all in the work at the present time with the exception of three, Mr. Hale, who is now in the Harvard Law School, Mr. Baker of Portland, who left the work to take a situation which pays him more money, and Mr. Hamilton of Norway, who was obliged to leave the work in July on account of his health.

This picture represents the method of putting the burlap on the trees. A strip eight inches wide is put on the tree and tied in the center with twine, and the upper part turned down. The gypsy moth caterpillar is a night feeder. During the sunshine of the day it comes down from the tops of the trees. This burlap is put on the trees so that this will be the first hiding place that it reaches. It goes up under this flap. The burlap is turned every day and sometimes twice a day, and the caterpillars taken out from underneath and crushed by the men.

The next picture shows the method of burlapping an apple tree on the limbs above the crevices, which keeps the caterpillars from going down and hiding in the crotch of the tree. This is on the estate of John Thaxter of Kittery Point. This is what is known as one of the best government crews in the State, called in our work, "Soule's Government Crew."

The next slides show the scouting for egg clusters, thinning out of trees, the work in the underbrush, the method of burning out a wall with crude oil to destroy the caterpillars, and the work of turning the burlaps.

We now have an orchard on Gerrish Island, known as the Goodwin orchard. Here is one of the finest jobs in cleaning up an orchard which we have ever done. This is what is known as Pike's crew.

The next slide shows a gypsy moth infestation in a stone wall. It is no uncommon thing for the men to turn over 300 to 500 yards of stone wall, and then put it up again in the manner in which they found it.

This is what is known as the Farwell infestation in the town of York. These rocks were taken from the underpinning of the house. They were badly infested with the gypsy moth. The underpinning was all taken out and afterwards put back by the men.

We have here an infestation on the Haley place in the town of York. This tree marks the greatest number of gypsy moth egg clusters found in the State of Maine, in one place, there being 1,034 on this one tree.

Early in the year 1909 the men discovered on what was known as the Moulton place in the town of York a very serious infestation, under a pile of lumber. In this pile of lumber are 480,000 feet of boards, and nearly every board had more or less egg clusters on it, which necessitated handling over the entire pile. This is one of the worst infestations we have ever found. This lumber was destined to be sent to the State of Connecticut, and had it not been for our finding this infestation, that entire lot would have been shipped to Connecticut and there bred an infestation of the gypsy moth.

This shows the winter work in the woods, the cleaning up of the trees and the cutting out of the dead wood, and clearing away of the underbrush. These woods are around this pile of lumber we have just shown.

Another winter scene, 7.30 in the morning, showing the men just about to commence work scouting the apple trees. One man is in an apple tree and another man on the ground is attempting to build a fire to keep warm.

The next picture that we will show is that of an infested tree that it was necessary to cut down. After cutting down the tree the wood was piled up. There were six and one-half cords of wood and nearly every stick of wood in the pile contained a gypsy moth cluster.

Our work has been visited several times during each year by Mr. Gilman, the Commissioner of Agriculture, and this picture shows Mr. Gilman in the field, and the inspectors pointing out to him the egg clusters of the gypsy moth.

This is what is known as the Bragdon orchard in the town of York. The slide shows the orchard before any burning or trimming had been done to it. The next picture shows the crew in the orchard trimming, and afterwards the trees were scraped and pruned in fine shape. Then we have a view of the spraying of the orchard by the barrel spray in the early spring, and another view of the barrel spray in action.

During our work in the town of York the people there were so satisfied with what we had done towards clearing the woods and orchards from the gypsy moth that they wished in some manner to show their appreciation, and several of the citizens of the town, with the help of the summer visitors, raised one thousand dollars with which they bought this spraying machine and turned it over to the Department of Agriculture, for their use in York. This machine has a four hundred gallon tank, a ten-horse power engine, and is one of the finest machines made in the world, and that is saying a great deal. It is known as the Woodland sprayer. The slide shows the machine spraying the woods in the town of York.

The next view is a woodland sprayer used in the streets of Newton, Mass., spraying a spruce tree 71 feet high. You notice the spray is being carried over the top of the tree. From 200 to 300 pounds pressure is used. I will also show you the same machine spraying in the woods in the town of Newton, with 1500 feet of hose. These slides were loaned me by the Frost Insecticide Company.

This finishes my slides, and I want to take this opportunity to thank the officers and members of the Pomological Society for the many courtesies which I have received here in the last two days. I feel very grateful to you all.

GROWING AND MARKETING FRUIT.

By R. L. Cummings, West Paris, Me.

Mr. President, Ladies and Gentlemen:

The subject I was asked to speak upon a few minutes tonight is the growing and marketing of fruit. By that we mean apples, of course, and I look at it from a commercial point of view, that is, as an investment for profit. And if we are going into any business for that purpose, we ought first to compare our qualifications with those of other people in the same business. Now if I said the apple is the leading fruit of the civilized world, I don't think anyone would dispute it. And if we were to compare the American apple with any other apple grown in the world, we should find it as the Englishman did when he was inquiring about the position of the yachts in the race for the cup. He asked who was first, and the observer said laconically that the American was first. "Well, who is second?" "Nobody." It is the same with the American apple. It is first, and there is practically no second.

Well then, let us see how we compare in our position with other sections of this country. I think that there is no section of the country that can lead us. There may be others perhaps as good, but I think there are none better. I do not believe we would find a Wolf River apple in the State of Washington any better than we have it here. It may be better in some respects, but I am very sure that we have the advantage in many others. That is practically the only large fruit growing section that I haven't visited personally, not as a mere pleasure trip, but to handle the apples myself, for a profit if I could get it, and to see the conditions under which they were grown and packed by the people. And I know from personal observation that no section of the country that I have been in can go ahead of us in natural advantages.

I was very much interested in Mr. Knowlton's remarks. They were very much to the point, but still there is a point that was not touched. We have all of us heard it said, time and time again, that all the people lack is to see the opportunity and have the energy to go forward and develop this industry. But I consider there is something else necessary, and that one great trouble why we are holding back is simply this,—the lack of capital. A man in this vicinity who engages in fruit growing starts out to do something. He is at once criticized and doubted and considered a sort of adventurer, and everybody has an opinion, and it is almost always against his success. That is the most serious handicap in this fruit industry. I can tell you today that the fruit industry of this state is capable of being its leading industry. In every section of the world, the finances and the prosperity of that section must ultimately be gauged by the prosperity of its agricultural interests.

We will say that in a certain section each farm is producing perhaps a carload of products to be shipped over the railroad. Well, the result of that shipment is what the largest part of this whole community has to do business on. The only way we really get money is to produce something and send it off and get some money back. Then that goes through your channels of trade, and they all get a commission out of it. When that shipment of products is cut off your trade is curtailed, and people cannot pay their bills, and half of the people do not really understand what is the matter.

You say to a man. "Why don't you put in more trees, and cultivate them, and furnish fertilizer and grow this fruit?" Well, the man does not always tell you just why he does not do it, but if he has no capital it is a pretty hard proposition. If he buys the land, or phosphate, and he has not the cash to pay down, people are very much in doubt about that venture. And the very doubt and the very attitude that is taken towards those things are a serious matter.

Just to illustrate that point: I started in the fruit business sixteen years ago. To begin with, I was simply an apple buyer. I looked over the situation as a man will when he has gone into a business. Perhaps I looked at it more seriously after I got into it than I did before. I could not see that apple buyers ever got very rich, and I made up my mind that I didn't want to tie myself entirely to the apple business as a buyer. I had bought a great many apples around the country, and paid out a lot of good money, and I made up my mind that the growing industry was much better than the buying, so I bought a farm, and if ever a man was worried about it, I can assure you I was.

My friends nearly all were doubtful of my success. But I went to setting out trees, and when people would go along the road, I would sometimes hear their remarks. They would say: "If that fellow thinks he is going to get a living by growing fruit on that place, he will just starve to death. That is what will happen to him." And again, "Don't that man know better than to set trees up on that side hill? They never will live." And the best business man in the section said that the venture would be a failure. He said: "I have owned a farm myself, and I have capital enough to run it, and I have run it for eight years, and that farm and stock are now for sale."

But I was in a different business from that in which he was engaged, and I knew several points about the business. I didn't know as much about growing fruit then as I do now, but from the dealer's standpoint I knew it, and the idea came to me about the Ben Davis. When I was buying apples I drove into Mr. True's door-yard one day, and he was packing a very nice looking barrel of apples. I saw that they were Ben Davis apples, and I asked him how they happened to grow so large and fine. "Well," he said, "that tree grew where I cultivated." I mistook the apple at first for a King of Thompkins. It was larger than any Ben Davis I had ever seen. And it struck me that if one tree could be made to produce Ben Davis apples like that, there was no reason why a thousand could not, and I have followed, as best I could, that suggestion in regard to the Ben Davis, and in regard to others. I do not confine myself strictly to Ben Davis. In fact, today I have a great many more trees of other varieties than I have of Ben Davis. But the idea of cultivation has proven very good. I have since then added two more farms to the original purchase, and have now about five hundred acres, and as many trees as I can take care of, and perhaps more.

But we come here and talk about these things, and then we go home and do something else. We say: "It is a safe investment. It is all right." But we are not willing to invest our money that way, or to loan it to others for a like investment. A man with whom I am well acquainted has a farm with a thousand young trees on it. It is a hundred acre farm, with a good wood lot, close by a village. And among the other nice things that he had on that piece of property was a mortgage of

$1200 that was due. Well, that man simply couldn't raise money to pay that mortgage and if another man and myself had not chipped in and used some money we wanted badly ourselves and put in four hundred dollars on a second mortgage, he would have lost that farm for the mortgage of $1200.

Now that is the difference between theory and practice. We say these things are good, but we don't take hold of them. There are a great many men today out on the farms, with an orchard in a run-down condition, who, if they had the capital, or if they could get it, would put this orchard in first class condition, and it would pay them more than twenty per cent on the extra investment that they would be obliged to make. And right there is one of the serious handicaps of the fruit industry in this State. There is lots of capital in Maine; there is enough to carry on our business, but it is invested in something out of sight. If that same capital were invested right here at home in these things that we know are safe, it would pay twice the dividends it does where it is now. But a great many people have settled in their minds that these things are not safe and will not pay much.

Now in regard to taking care of the orchard. I am going to say that I have been looking seriously for sixteen years for a substitute for cultivation. I do not like to cultivate all this orchard ground, but I have utterly failed to find what I consider a suitable substitute for cultivation. I will tell you of a little work which I did myself. Seven years ago two sections of my orchard needed cultivation. I didn't feel as if I could cultivate it all, so I took one section and I plowed that and let the other stay in grass. The next year, after the first plowing, I took one hundred and twenty-five barrels off from that section of orchard, while I had sixty from the sod orchard. The next year I took one hundred and fifty barrels from the cultivated orchard, and sixty from the sod orchard. But the next year I seeded down the first cultivated orchard and plowed the sod orchard. The year after that I took about one hundred and twenty-five barrels from the orchard I had seeded down and I think about fifty from the one I had recently plowed. The next year, which was this year, I took about one hundred barrels from the orchard that I seeded down, and over two hundred from the orchard I had plowed recently; and the Ben

Davis which I have exhibited here were apples that came from the last plowed section. And the orchard which I kept in grass has been well fertilized. I have fertilized it with hard wood ashes, with stable dressing, commercial fertilizer, ground bone and potash fertilizer, but it is impossible to keep up that high quality of fruit.

Now the mere statement of the number of barrels from each orchard does not tell all the story. The rest of it is this: When the first plowed section bore the one hundred and fifty barrels of apples, just before we picked the fruit there was a severe gale. On that section of orchard I picked up about forty barrels of dropped fruit that I put by itself in the cellar. It happened that I shipped this dropped fruit from that orchard in the same shipment, the same day and in the same sale with a full carload of as good Ben Davis as you can buy through the country—a fair quality of Ben Davis, No. 1 and No. 2. They sold the same day, and the dropped apples from this cultivated orchard sold for eighty-seven cents a barrel more than the number ones and twos from the other lot. The cultivated orchard produces fruit that will sell for a full dollar more per barrel than the Ben Davis that are grown on my sod land, and they will keep better. There is only about half the shrinkage. Then, if you compare the expense of producing this high grade of fruit with the expense of producing a low grade of fruit, I can assure you that the high grade of fruit can be produced, at a moderate estimate, at fifty cents a barrel less than the other, as you produce so much more upon the same ground. It has cost you the same to set out one tree that it has the other. You have that whole investment to be borne by your crop of fifteen to sixty barrels a year, while you have the same investment to be borne by the crop of a hundred and fifty barrels a year. That may seem a little doubtful, but it is an absolute fact that you can produce this high grade of fruit cheaper than you can the lower grade.

I am going to say just one word in regard to the Ben Davis. I am perfectly willing that everyone should remain silent in regard to the Ben Davis. I am not anxious that other people should set out Ben Davis orchards, because it could easily be overdone. But today in the United States there are more Ben Davis raised, in my opinion, although I have not the figures, than there are Baldwins. From the point in Illinois where the apples begin to grow, clear down through Illinois, Missouri, Arkansas, Nebraska and Kansas, the leading variety is that much despised Ben Davis. It is only despised here in New England, and by those who do not know it. I have been there and talked with the fruit growers myself, and while the Jonathan is raised down there in its highest state of perfection, I heard only one man say that any variety paid better than the Ben Davis. One man who had eighteen thousand trees, said: "I get my Jonathans off early before I get at the others, and I think they pay me about the best of any." Most of them say that their best money-maker is the Ben Davis.

But here in New England, I am sorry to say some are prejudiced against the Ben Davis. I do not believe there is a man in the State of Maine today who has put out an orchard of Ben Davis and half taken care of it, but has found it a very profitable variety to raise.

We are here for the purpose of promoting the fruit industry. That is our object. That is what we went to Boston for, and that is the purpose for which I attended the meeting of the Pomological Society a year ago. It was to see if we couldn't get together and do something for our mutual benefit. Well, we grow Ben Davis. Why not let them grow? They have been put in the market for more than thirty-five years, and they haven't yet found any market that does not want them. The Ben Davis has always sold among the best varieties across the water. But since so much has been published in the papers and said in relation to its quality, lots have turned against the Ben Davis. I think it is a very poor policy for us to run down a product that we have ourselves, that is one of our best paying varieties. There might be more Ben Davis set and taken care of if we told people to set just what they saw fit and did not try to educate them not to use the Ben Davis. The two last shipments of Ben Davis I have sent across the water, of my own growing, netted $3.97.

The fruit in those countries is not as soft and juicy and nice flavored as ours, and they do not appreciate that in an apple. Also, the common people there use most of their fruit cooked, and they do not appreciate the difference in flavor as a great many Americans do. So I say let us produce and ship to them what they want. I do not care to study so much what a man ought to eat and what he ought to buy in that line as what he wants and is willing to pay for. I want to supply that which he wants and is willing to pay for rather than spend my life trying to educate him to eat something that he does not want, unless what I want to sell is harmful, which we cannot say of the Ben Davis apple.

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The Abbreviation "Pom." signifies the Pomological Report.