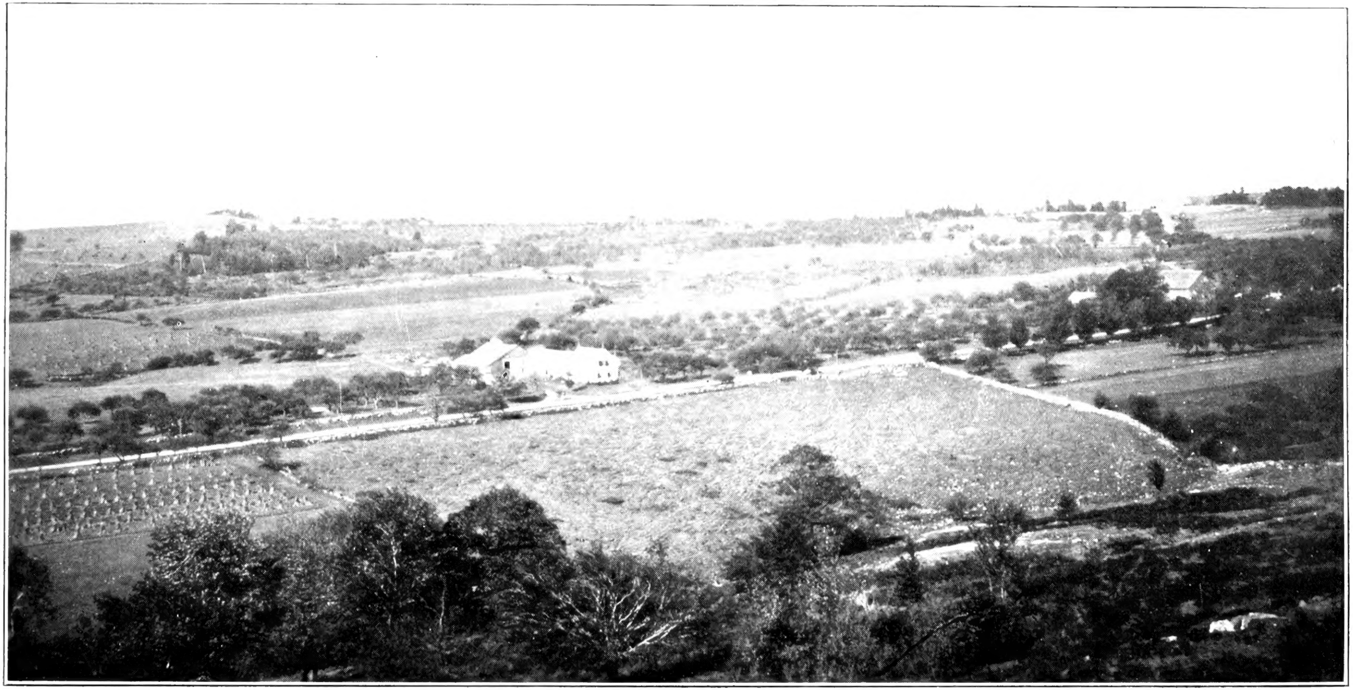
REPORT

OF THE

AGRICULTURAL COMMISSIONER

MAINE 1913



Typical farm scene in Maine (Minot).

AGRICULTURE OF MAINE

TWELFTH ANNUAL REPORT

OF THE

COMMISSIONER OF AGRICULTURE

OF THE

STATE OF MAINE

1913

WATERVILLE
SENTINEL PUBLISHING COMPANY
1914

DEPARTMENT OF AGRICULTURE.

To His Excellency, William T. Haines, Governor of Maine, and Council:

I herewith submit my first annual report as Commissioner of Agriculture of the State of Maine, for the year 1913, in compliance with chapter 204 of the Public Laws of 1901.

JOHN A. ROBERTS, *Commissioner.*

Augusta, December 31, 1913.

ANNUAL REPORT OF THE COMMISSIONER OF AGRICULTURE.

In presenting this Annual Report, it affords me pleasure to say that the work of the Department has gone along very pleasantly during the year, and that harmonious relations have been maintained with all other agricultural organizations and institutions throughout the state. The work of the various bureaus and divisions in the Department has been carried forward with constantly increasing activity. This work falls into three general lines,—educational, organization and inspection. The work under each of these lines has been greatly increased during the year, due in large measure to new legislation. Work is done through bureaus and divisions as follows: Dairy Improvement; Dairy Inspection; Seed and Plant Improvement; Horticulture; Gypsy and Brown-tail Moth Work; Animal Diseases; Institutes; Markets; Weights and Measures; Apple Inspection. In addition there is considerable work of a miscellaneous character. The Department finds an increasing percentage of farmers awake to the necessity of conducting their operations in accord with scientific principles and business methods. The fast increasing attendance at the College of Agriculture, the establishment of agricultural courses in many secondary schools, the increasing demand for demonstration work, the call for expert speakers beyond our ability to supply them, all show a recognition by the farmer of the spirit of the age.

The city, too, is coming more and more to recognize the agricultural possibilities of the state and to show its willingness to assist in their development. Chambers of commerce and local farm organizations may well combine in efforts to increase the products of Maine farms, to put those products into better shape for the consumer, and to develop local markets and hold those markets for Maine products. While Maine farmers stand at the head of their occupation, it remains a fact that there are thousands and thousands of acres of land, yielding only light crops, that might be made to produce abundant and profitable harvests of fruits, vegetables, grains and potatoes.

FARM CROPS.

Weather conditions in the state during the year have been very unequal. While some sections have been blessed with an abundance of rain, other sections have suffered severely from the want of it. On the whole we find that while some crops have been light, others have been up to the average or even better than the average. One fact has been brought out very forcibly in the extremely dry sections,—that individual farms, given a high cultivation, have produced crops nearly, and in some cases quite, up to the average.

HAY.

Hay is the most important crop grown in the state. It is a product of every farm, and forms the basis of all our animal industry. The crop this year, taking the state as a whole, was probably 25 per cent less than that of 1912. According to Government estimates the hay crop of Maine was the lowest per acre of that of any New England state except New Hampshire, and the crop there was the same as in Maine. The average yield is placed at one ton per acre. Outside of limited areas Maine soil is adapted to the production of large crops of hay, clover and cereals and too little attention is given to their cultivation and fertilization. Fields are left for a long term of years without reseeding and without fertilization. Thus the crop becomes very meagre, weeds come in and choke out the grass, and so the quality becomes poor. Maine has thousands of acres of such lands. Instead of producing three or four tons of fine quality hay and clover, their yield is a half ton or less of very poor quality; and in turn the gradual reduction of the hay and grain crops on so many farms has been due in large measure to the practice of keeping a lessening number of cattle, horses, sheep and swine. We believe a too large use of commercial fertilizers has had much to do with the bringing about of this unfortunate situation. There is a quick and prompt market at our

Farm Garden, G. C. Wheeler, Waterville.

very doors for milk, cream, butter, beef, mutton, and, in fact, all animal products. We advise that more farmers specialize in the production of hay, corn and small grains, and feed the same to high quality animals upon the farm.

The total crop of hay for Maine in 1913 is estimated at 1,200,000 tons, worth at the farm about $17,000,000.

CORN.

Corn has always been a favorite crop throughout the southern and central portions of the state. Of late years sweet corn has largely displaced the old fashioned yellow corn. The crop this year, whether flint or sweet, is probably not over 50 per cent of the average crop, and varies little from the crop of 1912. Weather conditions have been very discouraging the last two years. Most of the flint corn grown is packed in silos and the same is true of a large percentage of the stover from sweet corn. Silos have increased in numbers quite rapidly in the last decade.

SMALL GRAINS.

About 3,000 acres of wheat were produced in the state in 1913, the crop averaging something like 25 bushels to the acre. About 5,000 acres were sown to barley and the yield is figured a little under 30 bushels to the acre. Buckwheat covered an area of about 13,000 acres, with a yield of 32 bushels to the acre. The most important grain crop in the state is oats. The acreage and the yield were above those of immediately previous years. The area was 140,000 acres; yield, 40 bushels to the acre. Oats have been sown largely on land to be seeded to grass, they serving to protect the latter during its early growth. In late years many farmers are seeding to grass in their corn. This method tends to reduce the oat crop. Also it has become a practice with many to cut oats green and feed them in the straw. We believe oats to be a very valuable crop and worthy of more extensive cultivation. Should future seasons continue to prove unfavorable to corn, it may be wise to make more of a specialty of oats, with greater care in the selection of seed, using varieties giving large yields. The present crop of 40 bushels to the acre may be very largely increased. In fact, it is possible to double it.

POTATOES.

In cash value the potato stands next to hay. The acreage for 1913 was about ten per cent larger than that for 1912, while the yield per acre was increased in about the same ratio. The report from Washington fixes the total yield at 28,000,000 bushels, an increase of 5,000,000 bushels over that of 1912. The area planted is 128,000 acres, and the yield above 200 bushels to the acre. Early in the crop season, reports from Washington indicated a large shrinkage in the potato crop of the country. This led Maine growers to anticipate a long price for their tubers, and the future for the potato industry looked very bright indeed. While the price has been good, it has not been so high as was expected. That, and more particularly other conditions affecting the crop, have had a depressing effect. In September, 1912, an embargo was placed on potatoes from most European countries, on account of potato diseases. As a result of a hearing before the Federal Horticultural Board in Washington, December 18, 1913, this quarantine was continued and was extended to Canadian potatoes. This Department was represented at this hearing by Mr. C. E. Embree of the Bureau of Markets. The purpose of the quarantine was to prevent the introduction of new and dangerous potato diseases, particularly Powdery Scab and Potato Wart. The fact that these dangerous diseases exist in most other potato growing countries, and the possibility of their introduction into our country, are causing unrest and uncertainty among our potato growers. Every effort must be used to keep such diseases out of the state. Should they at any time be found here, it would become the duty of the state to stamp them out.

ORCHARD CROPS.

The apple crop of 1913 was about 25 per cent of that of 1912. The quality was varied. On some farms and in some localities it was good, while on other farms and in other localities it was inferior. The difference in quality was not due to chance, nor to any favoritism on the part of Providence. Nowhere is it more true than in orcharding that "Whatsoever a man soweth that shall he also reap."

A cursory view shows that many orchards are left unpruned, uncultivated, and unfertilized,—a quick prey to disease and insect pests. Planted in hope, grown in increasing neglect, starving, scraggly, unkempt, a symbol of unthriftiness, many an apple tree stands today, by wall or in the open, doomed to an early and disgraceful end. And the armies of tent caterpillars and browntail moths are marching on, feeding, devouring, destroying! How long, Oh! how long, are orchard trees to suffer such neglect!

The price of apples by the barrel or box at the farm was about double that of 1912. An orchard Institute of two days was held in March in the city of Auburn, under the auspices of the Auburn Fruit Growers' Association, the Auburn Board of Trade and this Department. Expert speakers from without and within the state took part in the proceedings. The attendance was very large, the enthusiasm high, and the influence of the meeting was felt far and wide for better fruit.

The Maine State Pomological Society held its Annual Exhibition in Lewiston in November. It was pronounced the best meeting ever held by the Society. Considering the shortage of the crop, the exhibit of fruit was large and fine. The Annual Exhibition made by the Bangor Chamber of Commerce was large and contained much fine fruit. Reference is had to the report of the State Horticulturist and also to the report of the Maine State Pomological Society.

SMALL FRUITS AND VEGETABLES.

The soil and climate of Maine are adapted to the growing of small fruits and vegetables. In their season, all such needed to supply the home market might be and ought to be raised in Maine. The same is true of fancy apples for eating. Large shipments of vegetables, small fruits and fancy apples from outside sources are brought into the state and the importation seems to be on the increase. There is, however, an awakening interest among farmers living near cities in the value of the home markets and we believe the time will soon come when the large sums of money now sent out of the state for such articles of food will be paid out to our own people for our own products.

SEED AND PLANT IMPROVEMENT.

Soon after coming into charge of this Department the Bureau of Seed and Plant Improvement was abolished and its work transferred to the Dairy Division. This was done in favor of economy and to secure greater efficiency. A plan of work was outlined and carried forward by Mr. Adams and his Assistant, Mr. Leland, with results highly commendable. The exhibition held at Lewiston City Hall in connection with the Annual Dairy Conference, was the largest and best ever held in the state. Plans are being made to enlarge and make more valuable the work of Seed and Plant Improvement. Our farmers need to realize more forcibly the advantage accruing from the planting of superior seeds. Reference is made to the report of Mr. C. R. Leland, Assistant Dairy Instructor.

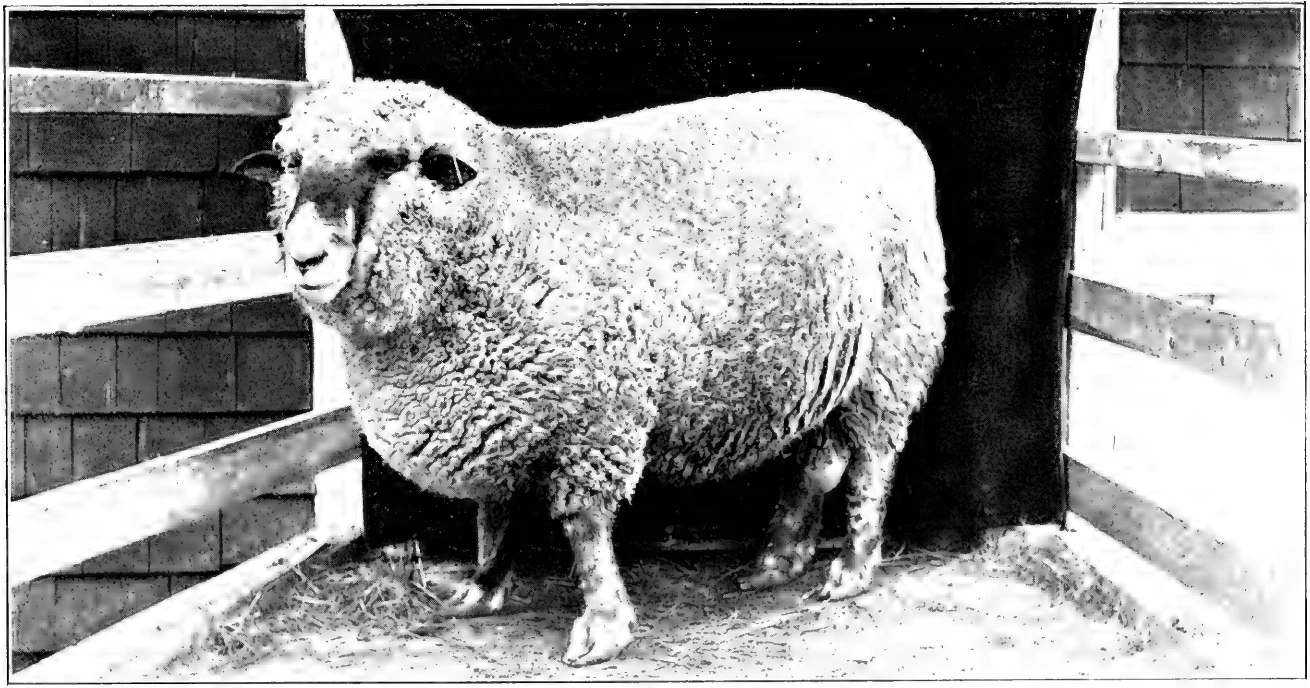
INSECT ENEMIES.

Gypsy and Brown-tail Moths.

The gypsy moth has spread over the larger part of the southern section of the state, having been found, at the present time, in more than one hundred and fifty towns. Its ravages are the greatest in York County, where a great deal of damage has been done.

The brown-tail moth is found now in nearly all inhabited parts of the state as far north as Houlton, and in the western and southern sections it has become a great scourge. Apple and pear trees, elm, oak, maple and other trees are loaded with the nests.

Under the law it is the duty of the municipal officers in towns and cities to clear the parks and highways, reckoning 60 feet from the center of the highway, each way. It is also their duty to notify private owners to clear their orchards and shade trees. The municipal officers in very many towns are faithful and their work is well done. There are, however, some towns in which the officers neglect their duties and do not properly superintend the work. I wish to note the fact that a few towns neglect or refuse to make sufficient appropriation to do the work.



2-Year-Old Hampshire Ram, owned by W. B. Kendall, Bowdoinham.

The expense of taking care of the brown-tail moths in some of the smaller towns has become so large that they are hardly able financially to do the work in the manner in which it should be done. Most towns depend upon picking and cutting to get rid of the insects, doing this in the winter season when the nests are easily recognized. We believe it would be better if they would spray about the time the eggs hatch, the latter part of July or the first of August, with a spray made up of 6 pounds of arsenate of lead paste to 100 gallons of water. This, if properly applied, will destroy by far the larger part of the insects. Towns should provide themselves with a power sprayer to care for their shade trees.

The brown-tail moths have taken possession of the woodlands as well as the orchard and shade trees and the main hope for the future lies in spraying and parasitic work. Reference is had to the report of Major Philbrook, and to Bulletin Vol. XII, No. 4, published by this department.

Tent Caterpillar.

The tent caterpillar was very abundant during the last season in some parts of the state. They were particularly noticeable on cherry and apple trees, by the roadside. Many orchards were completely stripped by them in the early spring. This insect is easily taken care of by spraying.

ROADSIDE IMPROVEMENT.

Attention was called early in the season to the unsightly and filthy conditions of miles upon miles of roadside caused by the multitude of brown-tail moths and tent caterpillars at work upon wild cherry trees and apple trees. Immediately a circular letter was sent to the municipal officers of the various towns calling their attention to this fact and that the law required them, under heavy penalty, to clean up and destroy all wild cherry trees and all dead and worthless apple trees within the limits of the highways.

Also a prize of $40 was offered, for the best essay upon Roadside Improvement furnished by any grange in the state. As a result of this offer eighteen essays were sent in to Hon. P. A.

Smith, Chairman of a Committee of Judges. The prize was given Mrs. Edward M. Lawrence of Lubec. This essay was read at the meeting of the State Grange at Bangor in December and has been printed and distributed among the granges of the state, with a recommendation that it be taken up for discussion; and it was also distributed among all farmers' organizations in the state.

The purpose of this work is to create a popular sentiment in the state in favor of the cleaning up of roadsides of all bushes and worthless trees and keeping them clean. We believe there should be legislation compelling towns to do this. Such action would reduce the cost of taking care of the brown-tail moths very greatly.

As a result of the letter sent out to the municipal officers, the officers in very many towns have notified us that they have cleaned up their highways of all wild cherry trees and dead and worthless apple trees. We are aware that very many other towns have taken no steps whatever to do this.

WEIGHTS AND MEASURES.

The Legislature of 1911 passed a law making the Commissioner of Agriculture the State Sealer of Weights and Measures. Under that law my predecessor purchased a new set of standards and installed them in the State House. The Legislature of 1913 made an appropriation for carrying out the purposes of the Act. Under it, Levi S. Pennell of Portland was appointed Deputy Sealer and immediately entered upon the work of the office.

It was found that very many of the towns had no standards whatever and many towns having standards were compelled to buy new ones as the old ones had become worthless.

As a result of the year's work, by far the greater portion of the towns in this state have provided themselves with a good set of standards. They had the same tested by the Deputy Sealer and have entered upon the work of testing out scales and weights and measures in their towns.

Reference is had to Mr. Pennell's report for details of the work.

MARKETS.

The Legislature of 1913 provided an appropriation of $3,000 to be expended under the direction of the Commissioner of Agriculture to study the methods and cost of marketing farm products and purchasing supplies. It is also provided that he shall work in conjunction with the Farmers' Union of Maine, the fruit growers' associations and other farm organizations, and that he shall have authority to employ agents and experts.

Under this Resolve C. E. Embree of Bangor was employed to work in connection with the Farmers' Union and the various local exchanges in this state. At the beginning of the year there were sixteen local exchanges which had been organized during the preceding year.

Mr. Embree has organized about as many more during the year 1913 and the work seems to be in a prosperous condition. Many of the exchanges are availing themselves of the advantages of coöperation in buying their supplies and selling their farm products.

The detailed work of Mr. Embree will be found in his report incorporated in this volume.

BEEF.

Considerable discussion is going on in the public press and at boards of trade and other places, in regard to beef growing in the state of Maine. This is due, no doubt, to the fact of the high price. There are a few people in the state who have the means and are in a position to engage in beef raising; and I have no doubt that they would be able to make it profitable. It would, however, be unwise to induce men who are engaged in the dairy business to change this over to beef raising. A man in the dairy business gets an income every day of the year while a man in the beef business must have a large capital and it is only after a number of years that he is able to receive any income whatever. No doubt the time will come when Maine will produce a much larger amount of beef than at the present time and we believe there are some sections in which men with sufficient capital could make the business prosperous and profitable.

There are in the state some very fine herds of cattle belonging to beef breeds.

SHEEP.

The number of sheep owned in the state of Maine has been on the decrease for many years and we find the same to be true throughout the country and also in Canada. In spite of that fact, we believe that the sheep raising industry is a good and profitable business. This has been demonstrated and is being demonstrated in this state every year by a few men.

Formerly it was the case that a large percentage of the farmers owned small flocks of sheep numbering from fifteen to thirty or forty. When the dairy business came into vogue these flocks were sold off for the most part. Dairymen do not like to be troubled with a few sheep. We hope that sometime in the future the sheep industry will be revived in the state.

THE DAIRY.

The dairy interests of the state are in a fairly prosperous condition. The standard of dairy cows has been raised considerably in the last decade. More attention has been given to breeding and feeding and also to dairy sanitation. The results are a larger and better product. A few new creameries have been organized during the year. However, the increased demand for milk in cities is leading many dairymen to sell whole milk, instead of separating and selling the cream.

There are several breeders' associations in the state engaged in more or less active work. Many of them are short of capital. It is hoped that some way may be devised whereby they may be assisted. With means to purchase more and better bulls, the work of these associations would be proportionately increased in value, and the results would be far reaching in their effect on the dairy interests of the state.

No one thing has had more influence upon our dairy interests than the dairy testing associations. They open up to their members many opportunities for improvement. Through discussion and experiment the most economical combinations of feeds are ascertained. The value of full blood animals as compared with grades is almost constantly under consideration, as is also the comparative merit of various breeds of dairy animals. The periodical meetings afford opportunity to discuss the many and varied problems arising in the business and also to listen to some of the greatest experts in the country. There is room in the state for the organization of several more of these associations.

THE LIVE STOCK INDUSTRY.

Very much is being spoken and written about the decadence of our live stock interests. Yet I understand the condition in Maine is no different from that in other states. There has been a shrinkage in the number of animals all over the country, and also, if I am correctly informed, in Canada. It is hard to say what has been the chief influence at work to cause a diminution in the number of our live stock. Undoubtedly this unfortunate condition is due to many reasons. One active cause has been the lack of farm help. A shrinkage in the size of herds has followed a shrinkage in the size of families. Also in late years new avocations have drawn boys and girls away from the farm in large numbers. It must be remembered also that thousands upon thousands of acres of land that were at one time fine grazing ground are now growing timber. Such lands provided an abundant forage in the summer for large numbers of cattle and sheep, which were grown principally for beef and mutton. Those lands for the most part were located in the hill country, were too rough for cultivation and so after a few years became depleted of their fertility and were allowed to fall back to their primal state, as a part of the wilderness.

The third cause for diminishing herds lies in the constantly increasing use of commercial fertilizers. In the growing of apples, potatoes and many vegetables, chemicals produce a smoother and better crop than animal fertilizers and their application can be made more easily, and with less expense. Many farmers find it more in accord with their tastes to produce such crops, that can be fertilized with chemicals, so there is not felt the necessity that once existed of keeping animals to maintain the fertility of the land.

Another cause of shrinkage is undoubtedly the fact that farmers have followed the advice of public speakers and writers and got rid of the "cow boarder." The teaching of the last few years has been to keep "better cows." It is easy to give such advice but it is not easy to obtain, either by breeding or by purchase, enough of the desired "better cows" to take the place of the "cow boarders" that have been eliminated. The number of "better cows" in the state is constantly on the increase, yet the fact remains that this increase does not keep pace with the demand for them. This statement emphasizes more fully the fact mentioned before, that the state needs a larger number of pure blood males of high merit.

Again, the demand for draft oxen is almost a thing of the past; and were it not for the almost prohibitive price of draft horses, there would be very few oxen on the farms today. Formerly large numbers of steers and oxen were raised for draft purposes as well as for beef. The displacement of oxen for draft purposes, combined at the same time with the low price of beef, resulted in a rapid diminution in their numbers. It is not reasonable to expect much further use of oxen for draft purposes, although it must be acknowledged that the ox has some very warm friends.

We also call attention to the fact that upwards of 700 animals were killed during the year 1913 for tuberculosis. In some cases entire herds have been nearly wiped out. The loss of so many cattle has a depressing effect upon the business, and on that account many farmers are led either to go out of the dairy business or to keep fewer animals.

These conditions, and possibly others, working together, have caused some decrease in numbers of live stock in the state. Some of these causes will continue operative in the future. On the other hand, the increasing demand for fine dairy products will serve to maintain high prices, and that means the keeping of more and more high class stock.

INSTITUTES.

There has been a call for institutes from all parts of the state, and a very large number of addresses have been made under the auspices of the Department. State of Maine speakers have been employed for the most part, and they have met good sized audiences. Many institutes have been held in connection with granges, who have opened their halls to us without expense to the state.

PUBLICATIONS.

Quarterly Bulletins have been published covering the work of the State Dairy Inspector, Mr. Russell S. Smith; a Bulletin on "The Need and Importance of Good Seed in Maine;" a Bulletin containing the Laws of the State relating to Agriculture; a Bulletin on Maine Apples, Grading, Packing and Marketing; a Bulletin on "The Brown-tail and Gypsy Moths and Parasites;" the Report of the Proceedings of the State Dairy Conference and Fourteenth and Fifteenth Annual Meetings of the Maine Dairymen's Association; and the report of the Commissioner of Agriculture, Hon. J. P. Buckley, for 1912.

THE FAIRS.

The annual exhibitions of the various agricultural societies have been up to the usual standard, with an occasional exception, while a few have attained a higher excellence than ever before. The officers of these associations devote very much time and ability to making their fairs successful and pleasing to their patrons. The associations at Lewiston, Waterville and Bangor receive special appropriations from the state, the amount given to Lewiston and Waterville being $2,500 to each, and to Bangor $1,750. The state pays a stipend to other regularly organized societies, numbering about 40. The sum received by a society is dependent upon the amount of premiums paid by it, compared with the amount of premiums paid to all societies. The total paid out for these fairs in 1913 was $14,-823.00; the largest sum paid to any society was $1,817.30 to the Northern Maine Fair Association, and the smallest was $18.68, to the Embden Agricultural Society.

There are also a large number of local fairs held by granges and other organizations that do not draw stipends. Some of these latter are real "cattle shows," while others confine their work to hall exhibits. The social spirit enters very largely into the conduct of these shows. Many of them secure speakers on farm questions. They are clean, healthy farm fairs and are of much value to the nearby community. One of these which I had the pleasure of attending had 175 head of neat cattle and a large number of horses and other stock. The hall exhibit was also very fine. Another one I attended had a large hall crowded with fruit and other farm crops of high quality. They held open for two days and had several speakers in attendance. Other fairs of this class have done equally well.

Of the fairs paid a state stipend, the most are doing good work. There are, however, a limited number that for one reason or another are in very bad shape. There are also a few fairs of this class that have no really good excuse for further existence.

We recommend to societies receiving state stipend that they give larger attention to farm crops. More and larger premiums should be offered. Whenever practicable, premiums should be offered on animals of either sex for work continued over a period of a year or longer; such animals, and the results of their work, to be shown at the annual fair. Inducements should be made to bring in work of schools as is now done by a few societies. Arts and manufactures should receive greater attention and encouragement, especially by the larger societies. We call attention to the fact that there are a few fairs that pay altogether too little attention to the stock interests of their section. The matter of proper sanitation should receive more attention on many grounds.

The midway is a much discussed subject. Many fair officials make it altogether too prominent a feature. We think that fair officials should see that there are on their grounds sufficient places where good food and drink may be obtained by all its patrons and that such places be maintained under proper sanitary conditions. We recommend that all shows shall be carefully scrutinized before they are admitted, and that all indecent or immoral shows be refused admission to the grounds *under any consideration.* The officials should also as carefully scrutinize each game that asks for admission to its grounds, and require a guarantee that it is not gambling nor a game of chance and that no gambling device or game of chance will be used on the grounds by it. The managers of a fair are very busy and we recommend that the larger fairs employ one or more persons, constables perhaps, whose *only* duty it shall be to see that the laws of the state in regard to gambling and the sale of intoxicating liquors are diligently enforced.

In case of a complaint, and evidence showing that the law against gambling, games of chance, or the sale of intoxicating liquors has been violated on the grounds of any fair at its exhibition, the managers of the fair should be in a position to show that they have been diligent in trying to keep their grounds clear of all such violations. They ought also to be prepared to have the violators of these laws promptly arrested, charges filed against them before the proper court, and evidence furnished the court to secure their conviction. In this connection we wish to say that all fair officials have shown a disposition to keep their fairs clean.

It might be well for the legislature to require an annual meeting of the fair associations to be held in connection with this Department, for the consideration of matters that are of common interest, the same to be held before premium lists are issued. The attendance at such meeting by a representative of a society might be made a prerequisite for obtaining the stipend, and to prevent this being a hardship upon small societies the expense might be taken from the appropriation for stipends.

ACKNOWLEDGMENTS.

At this time we wish to acknowledge the active assistance which we have received from the College of Agriculture, the Maine Agricultural Experiment Station, the grange and other farm organizations in the state, the press, and individuals all over the state. The friendly attitude of all the people of the state towards the work of the Department has been very encouraging and helpful.

REPORT OF STATE DAIRY ISTRUCTOR.

To Hon. J. A. Roberts, Commissioner of Agriculture:

I respectfully present my report as Dairy Instructor for the year 1913.

There was never a time in the history of Maine when the outlook for dairying was so good as at the present time. I am aware that a mere declaration does not prove anything, so I will briefly give my reasons for this statement. In going into the business the first thing to consider is whether there is a profitable market for the products and how the market may be affected in the future by competitions.

Dairy products, like milk and cream, must always be produced near the market or near the consumer. The State of Maine is within twenty-four hours of the best markets in the world. There are seven million people to be supplied, and the supply of milk and cream must come from this part of the country. Vermont used to make butter, but Vermont butter is not now known in the market. The products of the dairies in Vermont have all been absorbed for the milk and cream supply for the cities of New York and Massachusetts, and the larger part of Maine's product is shipped the same way. The creamerymen of Maine will tell you that the question is not so much that of a market, as it is of getting a good product for the market. That is where the dairy farmer has, and always will have, the advantage over those engaged in other branches of farming. The competition is limited to a given area near the market.

This state is naturally a dairy state. Beef raising to be successful must be in countries like Argentine, Australia and the southwest in this country, where there is a long season for pasturing. The countries where there is a long winter, like Denmark, Norway and Sweden in the old countries, are the countries where the farmers are dairymen and always will be, because conditions are such that it is a profitable business. The same is true of this state. You can find dairymen in this state that are making a good living with ten dairy cows, which can not possibly be done with ten beef cows.

The natural conditions in Maine are favorable for dairying. Maine is a grass state,—"Grass is King;" many varieties can be grown in Maine. I want to quote John J. Ingalls tribute to grass.

"Grass is the forgiveness of nature; her constant benediction. Fields tramped with battle, saturated with blood, torn with the ruts of cannons, grow green again with grass, and carnage is forgotten.

"Forests decay, harvests perish, flowers fade, but grass is immortal.

"Sown by the winds, by wandering birds, it softens the rude outlines of the world. It invades the solitudes of the deserts, climbs the inaccessible slopes of mountains, modifies climates and determines the history, the character and the destiny of nations.

"It yields no fruit in earth or air, and yet, should its harvests fail for a single year, famine would depopulate the earth."

This grass that grows from our granite soils, when fed to the dairy cow under favorable conditions, produces milk and cream of a fine quality. There is plenty of pure water from the springs and streams found in abundance all over Maine. Then to supplement the grasses, crops can be grown in rotation, like corn for the silo, oats, peas and the millets. It seems that nature has done her part to make Maine one of the best dairy states in the country.

To sum up, we have the markets at satisfactory prices, have not so much to fear from competition with other farm products, and can raise the feeds to produce milk and cream of a fine quality. This being the case, it seems as though farmers should have more courage and confidence and push this branch of farming.

I want to briefly state some of the reasons why farmers are not making a success of dairying as they should and these are conditions that can be changed. First is the man. Some men have a genius for taking care of stock; they are born cow men. Of course, they can make a success with less difficulty, but the great majority of us are just the common kind. We have to learn what we know and it is much better to learn this from the experience of others than from our own. It costs too much to learn by experience.

Take a good dairy paper, have the dairy bulletins from the Experiment Station and the Agricultural Department, get right yourself and then keep good dairy cows and you will be well started in the business.

The greatest improvement in Maine in the quality of the cows has been in the localities where there are cow test associations. We expect to organize two more in the near future. I wish it were possible for every dairyman in Maine to be a member of one of these associations. Grade up the herds by using bulls of the same breed from good families; do not change every few years from one breed to another. The farmers of Maine in all other branches of farming will have the most improved machinery and that is right, but when it comes to the cow, the most important of all the machinery to manufacture the raw material raised on the farms into the finished product, milk and cream, in many instances they show but little interest in the kind they keep. It would be just as businesslike for a farmer to try to raise potatoes with the machines used twenty-five years ago as it is for the dairyman to try to make milk and cream with the old native cow or a cow not of the dairy type.

Perhaps it would be well to take a brief review of the work for the past year. I was appointed to this office March 1, 1913, and soon afterward the work of the Seed Improvement Association was put in charge of this department. C. R. Leland, the Assistant Dairy Instructor, who is also the Secretary of the Seed Improvement Association, will report this part of the work.

Some of the first meetings I attended after coming into the office were meetings of the cow test associations. After attending a few of these meetings I became stronger in my convictions that the best kind of work for the immediate future would be to assist the associations already doing business and try to organize some new ones. With this end in view, I corresponded with the Dairy Bureau at Washington, D. C. Mr. A. M. Goodman of that Department came to Maine the first of

Ayrshire Bull, Maple Grove Gay Prince, 13642. Owned by W. H. and G. H. Dunn, Norway.

April and stayed two weeks, during which time we held meetings with the three associations in Maine doing business, viz:—The Waterville Dairy Improvement Association, the Androscoggin Valley Cow Test Association and the Norway and Waterford Cow Test Association. We also held meetings in Skowhegan, Lisbon, Dexter and New Gloucester, besides attending a meeting of the Holstein Breeders' Association in Auburn and two Farmers' Institutes at Windsor and Windham. Three associations have been organized the past year and the three old ones were never more prosperous. There is no one thing that has done so much to benefit the dairymen of Maine as the cow test associations. We are handicapped in three ways in organizing associations in Maine: First, on account of small herds; second, from difficulty in securing men for official testers; third, from lack of interest on the part of the farmer.

I believe that the introduction of milking machines— and there have been about fifty installed in Maine the past year—means larger herds. That will overcome the first difficulty. To overcome the second difficulty, the associations will have to pay larger salaries if they get competent men and hold them. Every association in Maine except one has had two or three different men during the year, for the reason that the salary, about $35.00 per month, is not satisfactory and as soon as these men prove their worth they get a position that commands a larger salary. The requirements of these official testers are very exacting. They must have some technical training and a lot of good common sense; they must be men of good moral character and be what we call good mixers. To overcome the third obstacle, it is necessary, as in every other institution that suffers from lack of interest, to keep all the time on the job; sending out literature, explaining the benefits of these associations, holding meetings, and having men at these meetings for speakers who are patrons of some of the associations and will tell of the benefits to them in increased production of their herds at less cost.

There are twelve breeders' associations in Maine, as follows: Four Jersey Breeders' Associations, four Holstein Breeders' Associations, one Shorthorn Breeders' Association, one Guernsey Breeders' Association, one Sheep Breeders' Association and the Maine Live Stock Breeders' Association. There have been two new associations organized this year. I have attended meetings of nearly all of these associations during the year. They are of great benefit to the members. Every man in Maine, who is breeding registered animals, should be a member of one of these associations. There is a great call now for pure bred animals. The farmers are interested as never before to improve their stock by using pure bred bulls. It seems to me as though some plan could be worked out by the help of the Maine Live Stock Breeders' Association so that more farmers could get the benefits of these bulls. A certain number of farmers could coöperate and buy a bull, or, if there were farmers owning about 180 cows, they could be divided into blocks with 60 cows each; each block to purchase a bull and when one block had used a bull for a few years, they could exchange with another block. By this method, bulls would be kept longer and if they were of merit, it would be discovered before they went to the slaughterhouse.

The dairymen of the state, with the exception of those in a few localities, have been receiving very satisfactory prices the past year for their product and I hear but very little criticism on the part of the patrons of the creameries. The patrons on their part must realize that in order for the creameries to hold the markets and be able to pay the highest market price they must furnish them with a good, clean product.

In Washington County, the dairy business is not well developed. In a great part of the county they have no market for butter except a short time in the winter and that is when they are not making much butter. Last summer when the dairymen of the rest of the state were receiving not less than 30 cents a pound for butter fat, the farmers in Washington County were bartering their surplus butter at the stores for 21 and 22 cents a pound and it was not wanted at that price. Some of the farmers in Cherryfield started shipping their cream to the Maine Creamery Company at Bangor, J. E. McEdwards, Manager. The result was very satisfactory and it looks as though it would increase another year. I believe that Washington County is destined to be quite a dairy county in the near future.

I visited ten fairs last fall. I am of the opinion that some changes could be made for the better. First, I want to say, the fair that is run as a money making proposition should not receive any assistance from the state. What I mean is that all the receipts should be expended in premiums, improvements on the grounds and paying debts. Also, I think that the premium lists of some of the fairs should be revised and I have suggested some changes to the trustees of the larger fairs; I also think that the judging should be more educational at some of the fairs. In other states they are inviting Pomona Granges located near to elect a young man between the ages of fifteen and twenty years to be the guest of the fair, with the understanding that he shall assist when wanted in leading the animals to the show ring and in any other way that he can be of assistance; and the judge shall explain in some of the classes the reasons for his decisions. This would make the fair more educational and more interest would be aroused on the part of the country people.

During the year I have attended as a speaker eleven dairy institutes, ten cow test association meetings, seven breeders' association meetings, twenty-five institutes and eleven Grange meetings, making a total of sixty-four meetings with a total attendance of 3,884, or an average of sixty at each meeting.

As a recommendation for the future, I would suggest more work organizing cow test associations and breeders' associations, and help along all the lines of dairy work. I believe that there is no question of a good market at satisfactory prices if the product is of a good quality. The State of Maine has a good reputation now for dairy products and we want to do better.

If the creameries in the state could advertise their goods and state that the product was all from tuberculin tested cows, that the stables and milk rooms had all been inspected by state inspection, and that the milk and cream are produced under sanitary conditions, there would be no question about the market at an advanced price. The question of quality is going to be of more and more importance in the future. While milk is a cheap food the consumer wants to know that it is clean and healthful. The time is coming when milk and cream that are too full of bacteria can not be sold in the market.

The question of profitable dairying is like all other business. It depends on efficiency and business principles, along all lines of work and it takes more intelligence to be a successful dairyman than in almost any other branch of farming. All over the state there are dairymen who are making a good profit and others who are just losing because they are not efficient in their work. This class is saying that dairying does not pay and that prices should be higher. In other words, they want the price so high that they can make a profit with inefficient management. That would be paying a premium on inefficiency that is contrary to all laws of trade or business. The price of any product for a series of years will be what that product can be produced for under business methods. Competition will regulate that and the man in dairying, or any other business, that is not complying with right and efficient methods along all lines had better get out or get right.

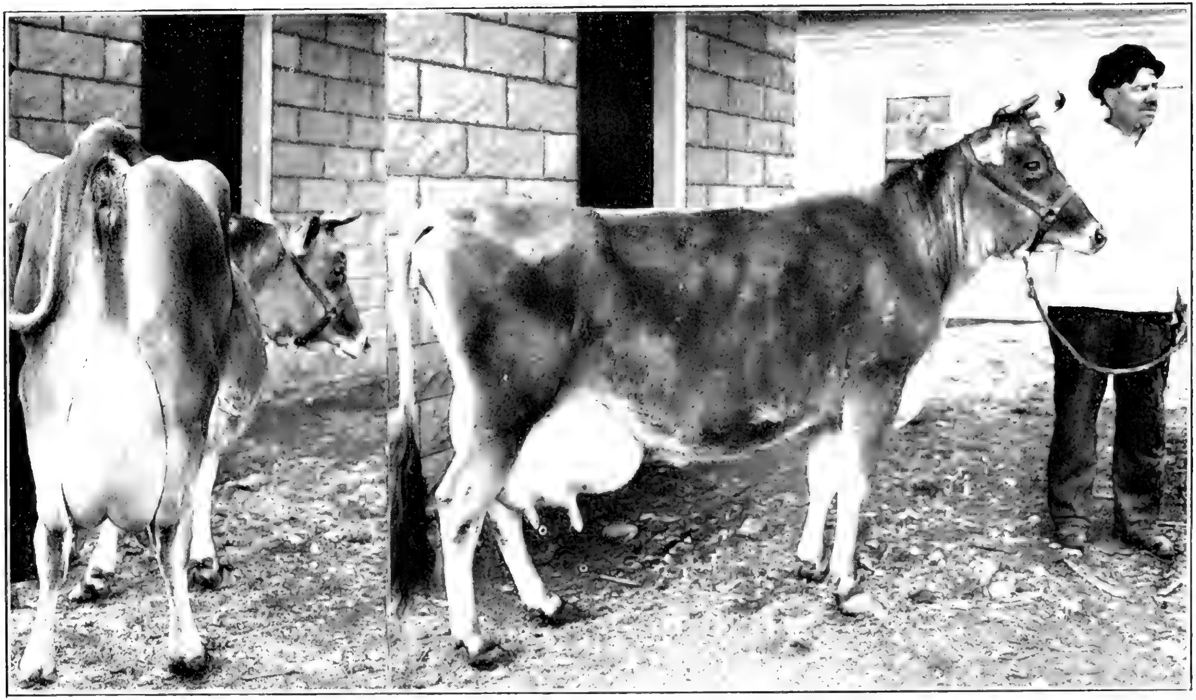
The number of dairy farmers in Maine who are keeping records of production and cost of production is very materially increasing. That, with the high price that cows are selling for, will account for the slight decrease in number of cows. The dairymen are weeding out their poor cows. The marked increase in young stock is very gratifying. There is an increasing demand for pure bred bulls in the dairy sections.

I notice there is a movement by the Chamber of Commerce in Waterville to work out some plan whereby the farmer can hire money to purchase pure bred bulls. I think it would be a good idea to get the breeders in Maine who are raising pure bred stock for sale to coöperate in this matter. We have a live stock breeders' association in Maine and if we could have a meeting of farmers with these different organizations, I think that something could be worked out satisfactorily.

Respectfully submitted,

F. S. ADAMS,

State Dairy Instructor.



Jersey Cow, Northern Beauty, H. R. No. 173352. Owned by A. E. Mooers, Houlton.

REPORT OF ASSISTANT DAIRY INSTRUCTOR.

To Hon. J. A. Roberts, Commissioner of Agriculture:

I take pleasure in presenting this report of the work done by me since taking up the duties of assistant to Dairy Instructor F. S. Adams, on the 12th day of April, 1913.

The "Improved Seed Interests" and the "Better Dairy Interests" are so closely allied that both for the past year have been in charge of the dairy division and I have been especially interested in the better seed movement.

Mr. Jones, who was with your Department during the first three months of the year, had already formulated some plans for seed improvement work and had issued letters outlining the season's plans to many of the seed growers of the state. To Mr. Jones, also, should be credited the excellent bulletin upon "Good Seeds" which was published by the Department in March.

As the official under Mr. Adams, who has had charge of the seed interests, I have carried out as fully as possible the plans outlined at the beginning of the year by Mr. Jones. About 35 men in different sections of the state entered their names as intending seed growers for 1913. These men were not confined to members of the Seed Association. Mr. Adams and myself have held ourselves ready to assist all who have asked for help in improving their crops and we believe some good has come from our efforts. We believe the slogan, "Better Seeds for Maine," is producing results and that the coming year will better prove that the time we have spent in educational campaigns and in field inspections of growing crops has not been wasted.

We have visited and inspected the crops upon more than 50 farms. Many of these we have visited twice and a few three times. Upon these inspection trips we have tried to carry to the grower some point which would help him to produce a crop more satisfactory than he would otherwise secure.

I have spoken at many meetings upon subjects allied to good crops; at grange meetings, dairy association meetings, field meetings and institutes. The subject of Improved Seed has held the close attention of the audiences, showing that the need of a better grade of seed for planting is recognized by the thinking portion of our farmers.

Owing to removal from the State of W. L. Slate, secretary of the Maine Seed Improvement Association, I was appointed by the executive committee in September to fill out Prof. Slate's unexpired term of office. The work of secretary of this association is very important and much of my time since September has been taken up by the necessary duties of the office.

I should consider this report incomplete without mention of the annual meeting of the Maine Seed Improvement Association held at Lewiston in connection with the Maine Dairymen's Association. In the opinion of many who have followed the work of the association this is by far the most important and successful meeting ever held by it. The exhibit was of excellent quality and large in size, notwithstanding the severity and difficulties of the season. The exhibitors were one and all enthusiastic. They proved to the satisfaction of all who saw the exhibit at Lewiston that it is possible by a wise and careful selection of seeds, aided by thorough and complete cultivation, to secure, in any year, a crop which will yield satisfactory financial return.

In this report of work done should also be included a mention of the Dinsmore-Kendall corn contest. In this contest, Thomas Dinsmore of China, Maine and W. B. Kendall of Bowdoinham offered prizes aggregating $150, to the farmers in Maine who should produce the largest amount of shelled corn per acre, over 100 bushels. Twenty-four contestants entered but owing to the difficulties of the season a large number of these withdrew before the completion of the competition. It is with pleasure that we record the yield of over 100 bushels shelled corn from two measured acres. Miss N. C. Burleigh of Vassalboro and Geo. C. Crocker of Manchester secured respectively 119.1 bu. and 107.6 bu. from one measured acre.

I hope the prizes may again be offered in 1914 as we believe such contests are of value, not only for the pecuniary aid re-

Potato Field of C. R. Leland, Minot

ceived by the winner, but in an educational sense. They arouse competition and stimulate interest in better methods of care and cultivation. They are a demonstration that the limit of yield is very much higher than it is customary for us to believe.

I also would recommend the contests conducted by the Bowker people in potatoes. The past season the three highest yields were secured by Maine growers. This will stimulate other farmers to apply the better methods to growing their crops and will aid in bringing up the average of production.

In this report it may be well to outline briefly the plans for 1914 seed work as far as they have been formulated at this time. The Maine Seed Improvement Association plans to coöperate with the Department more in the coming year than in the past. Certain of the association members are producing seed which is of very high quality. They desire this seed to be more rigidly inspected to the end that it may be certified as valuable seed by the state as well as by the association. A system of inspection is being planned with this end in view and it is hoped, while the amount of seed worthy of certification will necessarily be small at first, in a few years we may have large amounts of seed which may be sold under the association "Tag of Merit," accompanied by a certificate of quality from the State Agricultural Department.

I believe the seed laws of our state are inadequate and that a careful and comprehensive study of them should be made during the coming year to the end that such revisions of our present law, or such additions to the law as would improve the quality of seeds grown outside the state and sold within our borders and would foster the production of high class seeds in our own state, be recommended for the consideration of the state legislature at its next convening. Especially do I urge consideration of the needs of the Maine Seed Improvement Association. The possibilities for good service among the farmers of the state by this association are almost unlimited and we urge that the voters of the state see to it that substantial assistance and financial recognition be given them in their efforts to improve the quality and increase the acreage of the crops grown in Maine.

In drawing this report to a close, I wish to thank all who have in any way assisted us in our work. With the pleasant associations which have been maintained at all times and all members of the Department working in harmony with each other and the public, it has been a pleasure to do my humble share of the work of your Department.

C. R. LELAND,

Assistant Dairy Instructor.

REPORT OF STATE DAIRY INSPECTOR.

To Hon. J. A. Roberts, Commissioner of Agriculture:

I respectfully present my report as Dairy and Milk Inspector for the year 1913.

The majority of my time has been taken up with the inspection of milk supplies of the cities and large communities of the state. During the year I have secured from dealers 1,169 samples of milk and cream and 240 samples of butter or butter substitutes which have been analyzed and the results reported in the quarterly bulletins of the Department.

Prosecutions for violations of the laws regulating the production and sale of milk and cream number 38 and two prosecutions have been made for violation of the law relative to labeling renovated butter.

Dairy farms visited and inspected for sanitary conditions of milk production, number 115. This is a detail that I believe should be given much attention as the education of the dairyman at his place of business is the proper point to begin the sanitary improvement of our milk situation. Every opportunity to visit a dairy farm has been taken and I have found that many requests for visits have had to pass because of pressure of time for securing samples. I have endeavored through correspondence, newspaper articles and short articles in the quarterly bulletins to enlighten the producers and consumers of dairy products as much as possible.

City milk rooms where milk is received and bottled, numbering 62, have been visited. In the handling of milk in these rooms many dangers have been corrected. The returning and washing of milk bottles and cans is, in itself, a large influencing factor in the delivery of clean safe milk. On this point I have further suggestions to make elsewhere in this report.

Notices sent to parties shipping unclean cans to a producer or distributor of milk or cream, number 170. These notices served as a warning that another offence would result in a procedure under the law.

Creameries and shipping stations numbering 35 have been visited and special attention given to proper screening, ventilation and general sanitary conditions.

A tabulation of results of the inspection and analysis of milk and cream secured and the results of procedure for violations is as follows:

Samples.	Above Standard and clean.	Containing Visible Sediment.	Below Standard in Butter Fat.	Below Standard in Solids.	Skimmed.	Watered.
1169	379	519	20	142	9	21

Pleaded nolo contendere. Found guilty and fined	11
Pleaded guilty and fined	7
Pleaded not guilty. Found guilty and fined	3
Cases pending trial. Violator on probation	14
Cases appealed from convictors	3
Verdict of not guilty	3
Nol prossed: Failure to identify salesman	1

As the distributor's product was secured as it was being sold and delivered to consumers the results are indicative of conditions that exist in 18 cities and 22 towns, in every section of the state.

The preceding numbers and results of prosecutions are indicative that conditions relative to the milk and cream supply of our cities and towns must be improved.

When we note that only 379 or 32.4% of the entire number of samples collected were above standard and clean, we stop to reflect as to the reason. It is evident that many reasons can be advanced for the presence of sediment in milk but perhaps the most important one is the fact that not enough attention is given by the average milk producer to cleanliness of the cows, stables and utensils at milking time. The subsequent treatment of the milk, such as straining through many thicknesses of cheese cloth, sheet wadding or cotton, is the usual method employed for the removal of the sediment that is known to enter the pail during milking.

Why dairymen do this instead of eliminating as much as possible the chances for this sediment to enter the pail and milk, is not understood. It would seem as if the occupation of extracting this sensitive and valuable article of food, which nature never intended to be exposed to light or air, has indeed, become negligent.

The use of some form of a covered or hooded milking pail has been advocated and will continue to be advocated until dairymen see the folly of trying to produce clean milk without some effort toward clean conditions at milking time and with the chances for dirt entering the milk reduced to the minimum.

When I have visited milk producing farms in an effort to enlighten the producer along sanitary lines with a resulting better product I have always been welcomed.

To call attention to a few details which before may have seemed of little importance has, in many instances, resulted in some improvements.

With the education and gradual enlightenment of the producer, I believe, lies the keystone of clean milk production; but this cannot be perpetuated without the like education and enlightenment of the distributor and consumer.

On a very large percentage of dairy farms in this state the dual purpose barn is to be found and the usual methods of manure disposal are to pitch it out of a window back of the cows or allow it to pass through into the cellar.

Sometimes barns of this sort are found when the lighting and ventilation system is above reproach, but more often the builder had little knowledge of what constitutes a sanitary cow stable where milk is to be produced and extracted.

Changes that are practical but not too expensive are always recommended when possible, but it is given strictly to be understood that however expensive and elaborate an equipment may be made, if the essential details are neglected and the milking process is slack and uncleanly, due to the lack of knowledge, carelessness or lack of interest, the result will be negative.

INVESTIGATION OF COMPLAINTS.

The object of inspection is not to criticise when an honest effort is being made, but to help whenever possible. To this end complaints that have been received from milk dealers have been answered in person and help given.

Complaints have often been received from consumers and have resulted in samples of the product being secured in every instance and the fault corrected. These complaints are usually made because the milk received will not keep and this is due to lack of cooling the product by the producer.

Instances of ropy, stringy, and bloody milk, and very dirty milk, have been traced back. The causes for ropy and stringy milk were, in each instance, the lack of sterilizing the utensils, they being washed in lukewarm and sometimes cold water, allowing a bacterial growth in the seams. Bloody milk has been reported and traced to a cow whose udder had been injured on the bars of the pasture gate. Another instance was traced to an animal that had recently given birth.

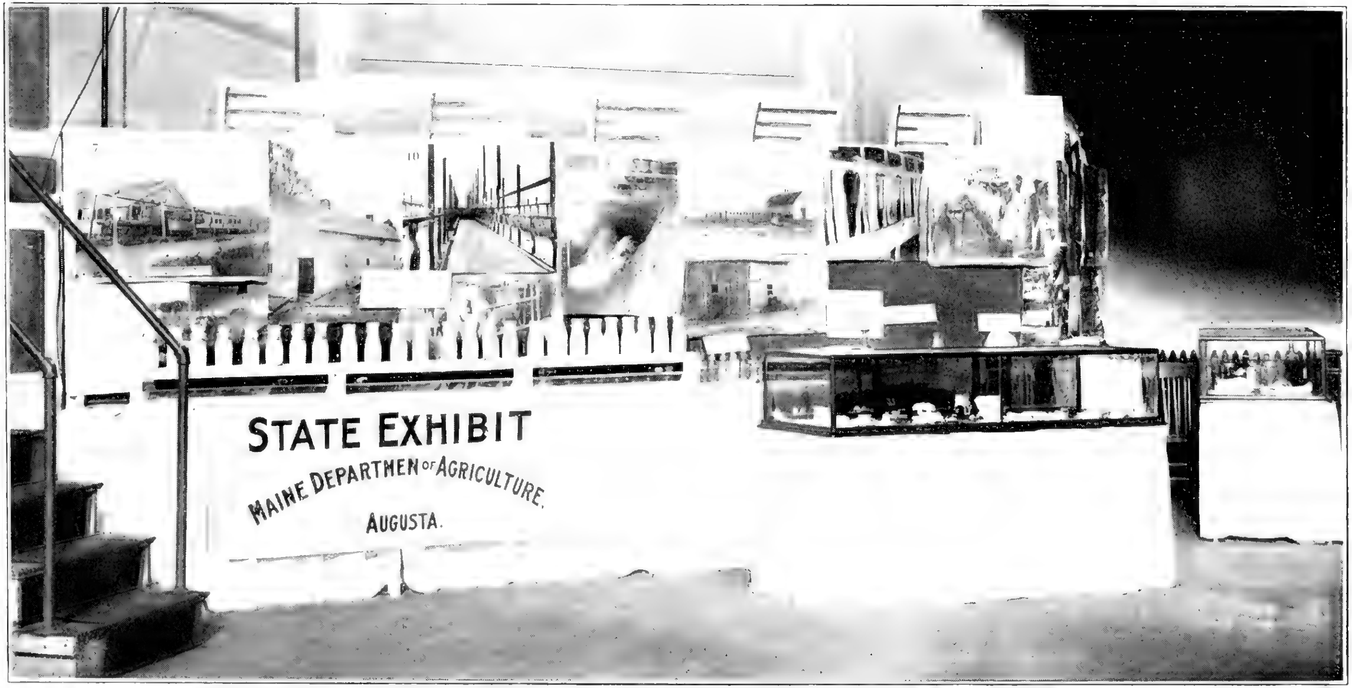
Very dirty milk has been traced back to ascertain the cause in many instances. The common practice of filling bottles that have not been rewashed, is a very unsanitary method. In one instance two pasteboard tickets were found in the milk, showing conclusively that the bottle was not rewashed.

Only one city has and enforces an ordinance prohibiting the filling of bottles on the wagon, and it is evident that more restriction is necessary if the practice is to be stopped. In visiting milk rooms I have observed that it is a common practice for some dairymen to not rewash the clean looking bottles but to pass them as being clean enough. It is needless for me to comment upon this practice, as it is plain that it is extremely dangerous and conducive to the transmission of disease.

The rewashing and sterilizing of all returned milk and cream containers are factors that cannot be neglected in the production and delivery of clean, safe milk.

The consumer must be taught to do his share by not returning bottles difficult to wash properly such as are frequently collected by the milkman.

I have often recommended that when in doubt of the washing ability of the milkman the consumer should have his own tagged



"Clean Milk Exhibit" at Portland Pure Food Exposition, March, 1913, by R. S. Smith, State Dairy and Milk Inspector.

bottles washed in his own kitchen as he wishes them to be, and covered until filled at the farm by the producer.

The sale of milk in grocery stores and bakeries from cans is a practice that is common and one which must be guarded against in many instances. The producer usually sets in a can of milk from which the clerk deals out pint and quart quantities into a tin measure. These quantities are in turn delivered into a pitcher, jar, pail or pasteboard bucket, depending upon which the customer brings. The tin measure, in many of the stores visited, is too often a source of attack from flies. Hot water for sterilizing after each use is not at hand, so if any rinsing is done, cold water is used. By the time the bottom part of the can is reached the chances are that it will not pass the standard for milk, much to the chagrin of the distributor.

In fairness to all concerned and as a safeguard against unsanitary and dangerous conditions an ordinance of some sort, either state or local, should be instituted and enforced that will prohibit the sale of this loose milk in stores where the chances for contamination are so great.

In restaurants and lunch rooms where milk is sold by the glass from dip tanks, the product has been found to contain much sediment. It is difficult to keep milk clean unless strict cleanliness is adopted in these places.

Much has been said in the past about the presence of sediment or in other words, dirt in milk. The collecting and examination of milk and the publishing of the result have had much to do with improvement in many instances but that it is a common occurrence must be admitted.

BACTERIOLOGICAL EXAMINATION OF MILK.

One of our cities has begun a bacteriological examination of the milk supply, based chiefly upon the reports of analyses of the milk made by this department. Such a course has been suggested as a remedy for dirty milk, for some time, and it is with satisfaction that we note it is to be adopted and made educational to the producer and consumer as far as possible.

Improvement must necessarily come from this work as each finding of a high count will be followed by an investigation, which will reach back to the original source of the milk. This usually discloses the cause for the poor condition of the milk and is sure to result in more precautions being taken in the methods of production and subsequent care. In this way the necessity for the better handling of the milk supply will be impressed upon producer, milkman, shopkeeper, and consumer.

The commencement of this effort for breaking away from old conditions in our state, to the end of safer milk supplies, is an important step in advance. It is hoped that the proper subsequent steps will be taken and these must necessarily be of the educational sort rather than militant or compulsory if the surest and best results are to be obtained for all concerned.

DATA ON MILK SUPPLIES.

The present system of granting licenses does not allow for an inspection of conditions where the milk is sold. Unfortunately licenses are granted in many cases when if actual conditions were known it would be far better to withhold them until better conditions were evident. The answers sent in on the application card are the only means we have to determine conditions, and because of a continued demand for information a new form of questions was prepared. This included questions as to the method of sale,—whether in bottles, cans, or both, the price received and whether the milk sold was from animals tested for tuberculosis, a factor that must be of concern to the health of any community.

Believing that each town and city should know of these conditions and legislate accordingly I have compiled the results in as complete a manner as possible from the answers received, as follows:

CITIES.

	Place of Sale.			Method of Sale.			Price.	Milk from cows that have been tested within a year for tuberculosis.	
	Wagons.	Milk depots.	Stores.	Bottles.	Cans.	Both.	Average.	Yes.	No.
							Cts.		
Auburn	43	2	32	18	12	32	7	21	51
Augusta	33	4	10	19	7	21	7	6	41
Bangor	54	6	65	26	40	59	7	34	91
Bath	28	3	30	8	30	23	7	8	53
Belfast	17	10	7	12	9	13	7	1	33
Biddeford	29	3	22	4	20	30	7	3	51
Brewer	18	2	7	2	10	15	7	3	24
Calais	13	1	5	3	7	9	7	–	19
Eastport	12	3	11	3	11	12	7	–	26
Ellsworth	10	4	13	3	6	18	8	–	27
Gardiner	24	7	3	12	13	9	7	–	34
Hallowell	17	10	7	18	5	9	7	4	30
Lewiston	34	7	41	44	18	20	7	6	76
Oldtown	7	3	4	4	4	3	7	–	14
Portland	82	23	249	332	8	14	8	263	91
Rockland	26	2	37	5	37	23	8	10	55
Saco	26	2	10	6	13	9	7	6	23
So. Portland	13	5	8	16	4	6	8	4	22
Waterville	25	5	10	7	14	19	8	14	26
Westbrook	19	2	6	6	6	15	7	4	23

TOWNS.

	Place of Sale.			Method of Sale.			Price.	Milk from cows that have been tested within a year for tuberculosis.	
	Wagons.	Milk depots.	Stores.	Bottles.	Cans.	Both.	Average.	Yes.	No.
							Cts.		
Acton	2	–	–	–	2	–	6	–	2
Addison	1	–	–	–	1	–	6	–	1
Alfred	1	–	–	–	–	1	7	–	1
Anson	9	1	1	4	5	2	6	3	8
Arrowsic	1	–	–	–	1	–	7	–	1
Ashland	2	–	–	1	1	–	7	–	2
Baldwin	1	–	–	1	–	–	8	–	1
Bar Harbor	12	4	10	11	3	12	10	9	17
Benton	2	1	–	–	–	3	7	2	1
Berwick	12	–	5	3	5	9	7	3	14
Bethel	3	–	4	5	1	1	6	1	6
Bingham	2	1	–	1	2	–	6	–	3
Bluehill	2	–	–	–	2	–	7	2	–
Boothbay	9	11	5	6	10	9	7	–	25
Boothbay Harbor	4	2	3	2	1	6	8	–	9
Bowdoinham	3	1	–	2	1	1	7	–	4
Bradley	4	6	–	–	5	5	6	1	9
Bridgton	6	5	–	4	4	2	7	1	10
Bristol	10	19	5	12	14	8	7	3	31

TOWNS.

	Place of Sale.			Method of Sale.			Price.	Milk from cows that have been tested within a year for tuberculosis.	
	Wagons.	Milk depots.	Stores.	Bottles.	Cans.	Both.	Average.	Yes.	No.
							Cts.		
Brooklin	2	1	–	1	2	–	6	–	3
Brooks	1	–	1	1	–	1	6	–	2
Brownfield	1	–	–	1	–	–	6	1	–
Brownville	2	–	–	–	2	–	7	–	2
Brunswick	22	5	8	16	10	10	7	9	26
Bucksport	2	1	2	–	4	1	7	–	5
Burnham	1	–	–	–	–	1	7	–	1
Buxton	2	2	–	–	3	1	6	–	4
Byron	–	1	–	–	1	–	5	–	1
Camden	29	14	8	12	16	23	8	5	46
Canton	1	1	–	1	–	1	6	–	2
Cape Elizabeth	2	–	–	1	1	–	8	–	2
Caribou	4	–	2	2	2	2	8	–	6
Casco	1	–	–	–	1	–	7	1	–
Castine	3	–	–	2	–	1	7	–	3
Chelsea	2	–	–	1	–	1	7	–	2
Clinton	–	2	–	–	2	–	6	–	2
Corinna	1	1	–	1	–	1	6	–	2
Cornish	–	2	–	1	1	–	7	2	–
Cranberry Isles	–	3	–	–	–	3	9	1	2
Cumberland	3	–	–	3	–	–	8	–	3
Cushing	1	–	–	–	1	–	8	–	1
Damariscotta	1	–	–	–	1	–	7	–	1
Danforth	3	3	2	2	3	3	6	2	6
Davidson	1	–	–	–	1	–	5	1	–
Dayton	1	–	–	–	1	–	7	–	1
Dedham	1	–	2	3	–	–	7	–	3
Deer Isle	1	–	2	–	2	1	7	–	3
Detroit	–	–	2	–	2	–	6	–	2
Dexter	6	3	2	4	1	6	6	3	8
Dixfield	4	4	1	3	4	2	6	–	9
Dover	5	2	–	3	1	3	7	4	3
Drew	1	–	–	–	1	–	6	–	1
Durham	–	1	–	–	1	–	6	–	1
East Livermore	1	–	–	1	–	–	7	1	–
East Machias	1	1	–	–	–	2	7	2	–
East Millinocket	4	–	–	4	–	–	8	2	2
Eden	8	2	3	7	3	3	10	4	9
Eliot	1	–	–	1	–	–	7	–	1
Fairfield	4	1	2	2	1	4	7	–	7
Falmouth	3	2	–	3	–	2	8	–	5
Farmington	10	5	4	12	2	5	7	4	15
Farmingdale	2	–	–	2	–	–	7	–	2
Fort Fairfield	2	–	–	–	–	2	8	–	2
Foxcroft	2	7	4	3	5	5	7	2	11
Frankfort	1	–	–	–	1	–	7	–	1
Freeport	7	2	2	3	3	5	7	3	8
Friendship	5	1	–	2	2	2	7	–	6
Fryeburg	2	–	–	1	1	–	7	1	1
Garland	–	1	–	–	–	1	7	–	1
Georgetown	6	2	3	1	5	5	8	–	11
Gorham	3	–	1	–	1	3	7	1	3
Gouldsboro	2	–	–	2	–	–	7	1	1
Greenville	1	–	–	1	–	–	9	1	–
Greenwood	1	–	1	–	1	1	6	–	2
Guilford	2	2	–	1	–	3	7	–	4
Hampden	4	–	–	1	1	2	7	1	3
Hancock	5	1	–	4	2	–	6	–	6
Harmony	1	–	–	–	1	–	7	–	1
Harpswell	10	13	5	8	14	6	7	8	20
Harrison	1	–	–	1	–	–	7	1	–
Hartland	7	5	2	3	5	6	7	3	11

TOWNS.

	Place of Sale.			Method of Sale.			Price.	Milk from cows that have been tested within a year for tuberculosis.	
	Wagons.	Milk depots.	Stores.	Bottles.	Cans.	Both.	Average.	Yes.	No.
							Cts.		
Hermon	-	1	-	-	-	1	6	-	1
Hiram	2	-	-	1	1	-	6	1	1
Hollis	1	3	-	1	1	2	6	-	4
Hope	2	-	-	-	1	1	7	-	2
Houlton	10	4	6	4	5	11	7	6	14
Island Falls	4	2	-	3	3	-	6	-	6
Islesboro	8	5	-	3	3	7	7	3	10
Jackson	-	1	-	-	1	-	7	-	1
Jay	4	2	-	2	2	2	6	2	4
Jonesport	2	-	-	2	-	-	7	-	2
Kennebunk	19	3	1	5	8	10	8	3	20
Kennebunkport	21	2	4	12	3	12	7	1	26
Kingfield	2	23	2	7	8	12	6	-	27
Kittery	8	9	3	9	2	9	8	2	18
Lebanon	8	3	-	2	1	8	7	1	10
Liberty	-	1	-	-	1	-	7	-	1
Lincoln	4	-	-	1	-	3	7	1	3
Lincolnville	2	1	-	-	1	2	6	-	3
Lisbon	16	2	3	2	8	11	7	-	21
Livermore	6	4	1	4	2	5	7	3	8
Lovell	1	1	-	1	1	-	6	-	2
Lubec	7	4	1	5	2	5	6	-	12
Lyman	2	-	-	1	1	-	6	-	2
Machias	4	3	1	1	1	6	8	1	7
Madison	8	2	3	6	2	5	7	4	9
Manchester	1	1	-	2	-	-	7	-	2
Mars Hill	1	-	-	1	-	-	7	-	1
Mechanic Falls	5	4	5	6	6	2	7	-	14
Mexico	10	1	-	2	3	6	7	-	11
Milford	1	2	-	2	-	1	6	1	2
Millinocket	1	-	-	1	-	-	8	-	1
Milo	3	-	-	1	1	1	7	1	2
Minot	2	-	-	1	1	-	6	-	2
Monhegan Isle	1	-	-	-	1	-	7	-	1
Monmouth	2	1	-	2	-	1	6	2	1
Monroe	-	1	-	-	1	-	6	-	1
Monson	1	-	-	1	-	-	6	-	1
Mt. Desert	5	-	1	5	-	1	10	2	4
Naples	3	-	-	1	1	1	6	-	3
Newburg	-	1	-	-	-	1	6	-	1
Newcastle	1	-	-	-	-	1	7	-	1
New Gloucester	1	-	-	1	-	-	6	-	1
Newport	6	6	-	6	2	4	6	2	10
New Vineyard	2	1	-	-	3	-	5	-	3
Norridgewock	4	1	-	1	3	1	7	1	4
North Berwick	1	-	-	-	-	1	7	-	1
Northeast Harbor	2	-	-	1	-	1	10	1	1
North Haven	6	1	-	-	3	4	9	-	7
Northport	9	9	1	8	3	8	7	3	17
Norway	7	4	7	4	3	11	6	7	11
Oakfield	1	-	-	1	-	-	6	-	1
Oakland	6	2	1	-	2	7	7	1	8
Old Orchard	8	-	6	2	7	5	8	2	12
Orono	12	6	3	6	6	9	7	3	19
Orrington	9	5	2	1	11	4	6	3	13
Otisfield	-	1	-	-	1	-	5	-	1
Owl's Head	-	2	-	-	1	1	7	-	2
Oxford	2	1	3	2	2	2	6	5	1
Paris	6	2	3	4	5	2	6	3	8
Patten	1	-	-	1	-	-	7	1	-
Peaks Island	1	3	3	6	-	1	9	-	7
Pejepscot	1	-	-	-	-	1	7	-	1

TOWNS.

	Place of Sale.			Method of Sale.			Price.	Milk from cows that have been tested within a year for tuberculosis.	
	Wagons.	Depots.	Stores.	Bottles.	Cans.	Both.	Average.	Yes.	No.
							Cts.		
Pembroke	3	5	–	1	5	2	6	1	7
Perham	2	–	–	–	–	2	7	2	–
Perry	–	1	–	–	–	1	7	–	1
Peru	–	1	–	–	–	1	6	1	–
Phillips	1	–	–	1	–	–	6	–	1
Phippsburg	4	1	–	3	–	2	8	–	5
Pittsfield	6	3	–	5	2	2	7	2	7
Poland	2	1	1	1	2	1	6	–	4
Presque Isle	4	–	3	3	–	4	7	4	3
Princeton	1	–	–	1	–	–	7	–	1
Randolph	4	–	–	1	1	2	7	–	4
Rangeley	5	–	–	–	1	4	6	–	5
Readfield	2	–	6	2	1	5	6	1	7
Richmond	4	1	–	1	1	3	7	2	3
Rockport	8	17	3	6	5	17	7	1	27
Round Pond	–	2	–	–	1	1	7	–	2
Rumford	6	4	3	5	3	5	7	4	9
Sabattus	1	2	–	–	–	3	6	–	3
Sanford	24	3	9	12	14	10	7	3	33
Sangerville	2	5	–	1	1	5	7	–	7
Sargentville	1	–	–	1	–	–	7	–	1
South Thomaston	3	8	–	4	3	4	7	–	11
South Berwick	7	2	1	1	5	4	7	1	9
Southwest Harbor	6	–	–	4	1	1	8	–	6
Springvale	3	2	2	3	3	1	7	1	6
Squirrel Island	1	1	–	1	1	–	12	1	1
St. Albans	2	2	–	1	2	1	7	–	4
Standish	2	–	–	1	–	1	7	–	2
Steuben	1	–	–	–	1	–	7	–	1
St. George	3	–	–	3	–	–	7	–	3
Stockton Springs	2	–	–	2	–	–	7	–	2
Scarboro	2	–	–	1	–	1	8	1	1
Searsport	2	5	–	4	2	1	6	–	7
Sebago	3	–	–	2	–	1	7	–	3
Sedgwick	–	1	–	1	–	–	7	–	1
Sherman	1	–	–	1	–	–	6	–	1
Skowhegan	14	2	8	14	3	7	7	7	17
Smithfield	–	5	–	–	3	2	6	–	5
Solon	4	–	2	3	1	2	6	1	5
Sorrento	2	–	1	3	–	–	8	–	3
South Gardiner	2	–	–	1	1	–	6	–	2
Southport	–	5	–	–	1	4	8	–	5
Stonington	8	6	1	3	4	8	8	2	13
Strong	1	–	–	1	–	–	6	1	–
Sullivan	5	–	–	3	2	–	8	–	5
Sumner	1	–	–	–	1	–	6	–	1
Thomaston	8	4	1	1	7	6	7	–	13
Thorndike	–	1	–	–	–	1	6	–	1
Topsham	11	–	2	3	3	7	7	2	11
Tremont	2	–	–	–	–	2	8	–	2
Troy	–	1	–	–	–	1	7	1	–
Turner	–	1	–	–	1	–	7	–	1
Unity	–	1	–	–	1	–	7	–	1
Van Buren	1	–	–	1	–	–	7	1	–
Vanceboro	1	–	1	–	1	1	6	2	–
Vassalboro	1	–	–	–	1	–	6	–	1
Veazie	1	–	–	–	–	1	7	1	–
Verona	1	1	–	–	2	–	6	–	2
Vinalhaven	16	5	–	5	13	3	8	–	21
Waldoboro	3	7	1	2	4	5	6	1	10
Warren	6	2	–	2	3	3	7	–	8
Washburn	1	1	–	2	–	–	7	2	–

TOWNS.

	Place of Sale.			Method of Sale.			Price	Milk from cows that have been tested within a year for tuberculosis.	
	Wagons.	Depots.	Stores.	Bottles.	Cans.	Both.	Average.	Yes.	No.
							Cts.		
Waterboro	1	–	–	–	1	–	6	–	1
Wayne	1	1	–	–	1	1	6	–	2
Webster	1	–	–	–	–	1	6	–	1
Wells	10	1	–	7	–	4	7	2	9
West Bath	7	–	–	–	5	2	7	1	6
Westfield	1	–	–	1	–	–	6	1	–
Westport	2	8	–	4	5	1	7	–	10
Wilton	5	3	–	3	1	4	7	2	6
Windham	5	–	–	1	2	2	7	1	4
Winn	1	2	–	1	1	1	6	–	3
Winslow	4	1	–	–	2	3	8	1	4
Winter Harbor	4	–	1	3	–	2	7	–	5
Winterport	2	1	–	–	–	3	6	–	3
Winthrop	5	9	–	7	3	4	7	2	12
Wiscasset	3	4	4	4	6	2	7	1	10
Woodland	3	–	–	2	–	1	8	–	3
Woodstock	1	–	–	1	–	–	6	1	–
Woolwich	3	–	–	1	1	1	7	–	3
Yarmouth	11	4	1	7	3	6	7	2	14

TOTAL.

	Place of Sale.			Method of Sale.			Average price.	Milk from animals tested for tuberculosis within a year.	
	Wagons.	Depots.	Stores.	Bottles.	Cans.	Both.	Average.	Yes.	No.
225 towns	816	417	203	471	431	533	7.12c	215	1,221
20 cities	530	104	577	548	184	479	7.20	411	800
Total	1,346	521	780	1,019	615	1,012	7.16c	626	2,021

Oleomargarine and Renovated Butter.

That the sale of butter substitutes is on the increase is very evident when we know that at the beginning of the year the number of licensed dealers selling oleomargarine was 704. Comparing this number with that of Massachusetts, 470, Vermont 234, and New Hampshire 19, we see that Maine is far in the lead, yet out of the 704 licenses none were granted for dealers in colored oleomargarine. A tax of 10 cents a pound is made if the colored article is sold, but no licenses were issued for that purpose.

The sale of oleomargarine for exactly what it is and not under the disguise of butter is of economic importance to the consumer. With the object of enlightening the consumers, a complete list of names of dealers selling oleomargarine was secured from the Revenue office at Portsmouth and published in bulletin form.

Dealers selling renovated butter do not require special licenses so that data in regard to the extent of its sale are limited to observation. Closed cartons containing oleomargarine or renovated butter are becoming the prevalent method of sale; still in many instances the substance is sold in small lots from tubs. Grocerymen are coming to regard the sealed carton as the most sanitary method and one which lessens the danger from failure to mark the package.

A number of samples of the product has been purchased in an endeavor to ascertain whether the dealers were complying with the law or not. These purchases were made as any consumer would buy and the following tabulation shows the results of samples secured in 16 cities and towns.

Samples.	Butter.	Stamped renovated butter.	Not stamped renovated butter.	Stamped oleomargarine.	Found guilty and fined.
220	69	42	2	107	2

Local Inspection.

I have endeavored to ascertain to what extent local inspection has been practiced, and while inspectors have been appointed in several instances the work is far from efficient because of a lack of knowledge or of equipment to work with. I have found that inspectors in but 3 cities and in but 5 towns make any examination of milk whatever, and that in but one city are the tests other than the preliminary tests for butter fat, made. In this instance a bacterial test has recently been included and made by a special officer. The time is not far distant when a limit will be established for the number of bacteria allowed in the milk of that city.

With these exceptions, all inspection of milk has been left to the state and during the warmer months when complaints become frequent, I have found some difficulty in visiting and inspecting as many supplies as I would like to, in order that the best results can be secured. If it were possible, monthly samples of the supplies of our cities should be taken, especially during the warmer months, but this is hardly possible under the present conditions.

Criticisms about the local inspector are many; but he is usually handicapped by lack of proper testing facilities or lack of training and does not care to give his time to learning the process, not knowing how long he is to remain in office, and is too poorly paid for the time required.

The placing of a man in a strange position and hampering him with lack of proper equipment, lack of proper milk ordinances and insufficient compensation for time required to do efficient work, is not conducive to better milk for our cities.

The need of men thoroughly acquainted with the proper methods of testing milk and who receive ample compensation to allow some time to be given to the work, is potent for our cities.

Public sentiment, rather than political preference, should govern such an office, which, in coöperation with the Board of Health, should stop any outbreak of disease that is liable to arise from an unsanitary milk supply.

Increases in the price of milk have been noted in many instances, in an endeavor on the producer's part to receive due reward from the business. Loss of animals, due to tuberculosis and a general failure of proper breeding to perpetuate the breeds, has found the buyer of good cows without a source of supply. Naturally the problem of securing enough milk is facing the dairyman and in these days of cow bookkeeping the cost of production is a factor that demands attention if he is to succeed. Knowing the cost of producing a quart of milk, the farmer is in a position to demand increases in price according to his expenses and while such a demand will always be just from the farmers point of view, still, the fact that the poorer people in our cities may be the ones that will have to pay the increase, causes us to reflect.

Boards of Health have made mistakes in some parts of the country in establishing rules for the producer, to the end of antagonizing them in general. As far as possible, some system whereby the public health will be protected and the price not too prohibitive, has been sought for. Eventually the proper education of the producer by means of visits from experienced men, schools of instruction, farmers' institutes and dairy meetings, and the enlightenment of the consumer by public lectures and demonstrations, courses in public schools, visits to dairy farms and reading of literature pertaining to the milk situation, will be the solution of this problem.

EDUCATIONAL WORK.

Education of the producer and consumer along the right lines, rather than the prosecution and payment of small fines, will eventually result in the most improvement, and with this object in mind, the educational factor has not been neglected.

At a Pure Food Show held in Portland under the auspices of the Civic Improvement League, I was given space for an educational exhibit on clean milk. The extensive preparation was amply repaid by the amount of interest taken by the many visitors to whom such facts as were demonstrated were little known. Unsanitary and sanitary conditions, sediment in milk, adulterants in milk and in stock food, food value of milk, the open, covered and hooded milk pail, constituents of milk, separator, slime, life history of the fly, and prepared specimens of disease germs occuring in milk, as seen under the microscope, were included in the make-up of the exhibit. Bulletins were distributed and names added to the mailing list for future issues.

At the Maine State Fair and at the Central Maine Fair, milk, cream and butter scoring contests were supervised by this Department. The samples were scored and the detailed results sent to the producer. Much interest was shown in the result of the bacterial count. An exhibit of sanitary and unsanitary conditions, sediment in milk, testing apparatus and fly breeding stages and growing bacteria from milk were shown and dairy bulletins distributed.

At these fairs contests with single cows and groups of four cows, for milk yield in twenty-four hours and butter fat, were supervised and the product tested. These contests, while fair to all concerned, are of but little actual value owing to the fact that the animals have to be judged the previous day in the show ring. General excitement, irregularities in milking and feeding to influence the result of the tests or amount of milk, have not the best effect on the animals and for these reasons many owners who would otherwise enter, refrain from so doing.

LECTURES.

I was privileged to deliver an address on "The Relation of Inspection to the Milk Business" at the Farmers' Week exercises at the University of Maine.

At the Pure Food Show in Portland a lecture entitled "Clean Milk and its Relation to Public Health" was given at an evening session.

At Thorne's Corner Grange an address on "Dairy Improvement" was given at an all day meeting. Early in the year Institutes at East Livermore and Minot Center were attended and addresses given.

During the fall Institutes at Pittsfield, Fayette, East Wilton, West Benton and West Bath were conducted by your direction and at each an address was included.

In December I was privileged to attend and address the Farmer's Night School at Greeley Institute at Cumberland Center where much interest was shown by the many questions asked.

From time to time during my travels I have written articles for newspapers relative to conditions of milk.

The results of the bacterial count of the 84 samples of milk and cream exhibited at the State Dairy Conference are as follows:

Bacteria per cubic centimeter.

Below 500.	Below 1,000.	Below 5,000.	Below 10,000.	Below 25,000.	Below 50,000.	Below 100,000.	Below 150,000.	Below 250,000.	Below 500,000.	750,000.	Above 1,000,000.
5	3	23	16	10	8	4	5	2	4	1	3

This variance of results is in accordance with the many methods used and when we note that only 8 of the samples received a perfect score on sediment it is not strange that the results vary. The use of the wide open pail was prevalent and it was only the immediate cooling and keeping of the product cold that kept the count from going higher. This exhibit is supposed to be indicative of the best methods of production and in the varied results there is food for much thought for our dairymen whose object is to produce a clean, sanitary milk.

It is planned to give the dairymen of the state an opportunity to have their milk tested for bacterial content by holding milk scoring contests in the communities where interest is evident. As a means of knowing exactly what degree of purity can be attained by the producer and as a basis for a fixed price for his product the bacterial test is conclusive. It is hoped that when the opportunities are given, dairymen, and especially those delivering milk to consumers, will endeavor to ascertain their standing as dispensers of a proper product.

The regular quarterly bulletins containing the results of analysis and inspection of dairy products and numerous articles have been published. The mailing list of these bulletins is gradually increasing as the consumers become aware that the problem of better milk is worthy of their attention and help.

In these bulletins the articles have been prepared with the object of enlightening all who are concerned in the production, distribution and consumption of dairy products under the following heads: "The Sale of Oleomargarine;" "Sanitary Dairying;" "Sanitary Conditions;" "Dairy Improvement;" "Facts about Milk;" "Sanitary Milk;" "Sediment in Milk;" "Price and Value of Milk;" "Consumers' Responsibility;" "Cleanliness in Milking."

Numerous fairs were visited at your request and reports made as to the extent and quality of agricultural exhibits and other attractions.

During the first two months of the year my time was given almost entirely to the examination and correction of weights and measures that had been received and to a complete rearrangement of and extensive necessary additions to the Weights and Measures law, which were eventually passed.

I desire at this time, to thank you for the courtesies shown in my endeavor to carry out the duties of this office. The members of the department and clerical force, court officials, prosecuting attorneys and newspapers in all parts of the state have rendered valuable assistance.

Respectfully submitted,

RUSSELL S. SMITH,

Dairy and Milk Inspector.

REPORT OF STATE HORTICULTURIST.

To the Hon. J. A. Roberts, Commissioner of Agriculture:

I herewith submit my third annual report as State Horticulturist, for the year 1913.

With the close of the 1913 fruit season, or at least that part of it which relates to the growing, harvesting and marketing of apples, we find many results which are of value in drawing our conclusions for the year. The most prominent and probably the most important is the relatively small crop, not only in this state, but through the entire fruit section, which puts at rest, for the present, the constantly increasing fear of overproduction.

Maine, with an estimated crop of 300,000 barrels for shipment as against 618,247 barrels for 1912-13, has an approximate shortage of about 50 per cent. The prices for the season, however, have been much larger, averaging almost $2.75 as against $1.50 for the preceding year, so that when the difference in the cost of production is deducted the net returns are as good if not better for the grower. Such will undoubtedly be the case where apple storage is good enough for fruit to be held over for the advance in the market price which at present is so surely indicated. A great part of the shortage in production may be attributed to the extremely cold and long continued stretch of lowery weather at the time of bloom.

On May 16th, at the Experiment Station at Orono, the thermometer registered 26 degrees F., and the average minimum temperature for the month was 38 degrees. In June the lowest temperature was 34 degrees F., with an average minimum temperature of 46 degrees. The mean temperature was 51 degrees for May and 61 degrees for June. Cloudy and stormy weather prevailed more or less throughout this period to the detriment of pollenization and setting of fruit. A drouth in most sections during the summer, fol-

Part of audience at the Oxford Bears Field Meeting at orchard of Homer N. Chase, Buckfield.

lowed by warm rains during the regular picking period, completed a season wherein the weather played an unusually important part in reducing what might otherwise have been a bumper yield. But for the consoling fact that conditions in other fruit centers were much the same, so that the total yield was very materially reduced, the season might have been very disastrous to many of the growers.

At hand is the last account of sales from Simons, Shuttleworth & Company of Liverpool, giving prices received from many Maine packed apples. The figures compare more than favorably with those received for apples from other sections and the following is a list of the best selling varieties from this state:—Fancy Spy, $5.64; Fancy Baldwin, $5.52; No. 1 Rhode Island Greening, $5.40; Fancy Golden Russet, $5.40; Fancy Stark, $5.28; Fancy Fallawater, $5.16; Fancy Benton Red, $5.04. These apples will net the shipper a handsome profit and demonstrate the fact that Maine fruit when well grown and packed commands a top figure on the market.

One feature of the report is the number of "slacks" received. It is difficult to pack fruit so that it will stand up on a long shipment and extra care should be given to this part of the work. Better grading for size, better barrels, and a clearer conception of the amount of fruit to put into the barrel, are controlling factors and can be greatly improved upon by our packers. If there are too few apples in the barrel, they will rattle about as soon as any shrinkage occurs, bruising many and seriously impairing the attractiveness. If too many apples are put into the barrel, they must be pressed very hard. The skin of the fruit is torn, they lose their elasticity and deteriorate into a mass of pulp. The middle course, putting in the right amount, is the only one which will insure uniform satisfaction.

FRUIT GROWERS' ASSOCIATIONS.

The work of the fruit associations has been very encouraging. Two new ones were formed at Hebron and Waterboro, respectively. The former was organized by Mr. Sweetser of the State Department and is called the Indian Head Fruit Growers' Association. The latter is known as the Ossipee Valley Fruit Growers' Association. Both are composed of keen, up-to-date growers, and have accomplished much in the improvement of their methods of marketing. That their organizations will do much to improve their methods of production is doubtless true.

Other sections have requested information as to the necessary steps in organizing such associations and will probably take up the matter in the coming year. We have advocated small organizations to start with as we believe they make a more rapid progress in securing a solid foundation upon which to build. Spirit is a big factor in the success of these bodies and large numbers do not tend toward good spirit. The older associations have maintained their interest, enthusiasm and progress and it is a matter of pride that they compare favorably with those in other sections of the East.

By location New England is an apple producing unit and if we secure a uniform series of local associations there is no reason why they can not be united later into a large exchange similar to that of the Northwest. The growers of Oregon, Washington and Idaho have demonstrated the practicability of such a selling agency for their fruit. The citrus growers of California have perfected an even better system of marketing and it is up to New England to put her fruit growing upon a similar basis. There is no reason to doubt that such an organization would be successful.

THE NECESSITY OF ADVERTISING OUR APPLES.

The improvement that has been accomplished in the production of a finer grade of fruit has been especially noticed in the last few years. In fact, our fancy apples compare very favorably with those of any other producing center. Maine apples have long been known for their fine quality and it is generally conceded that for certain varieties the natural conditions of our state are unsurpassed. The fruit stands up well under long shipments and will keep almost indefinitely when care has been taken in the production and when picked at the right time and properly stored.

The state law recently passed will go a long way toward promoting better grading and packing and will protect the shipper of honestly marked product. With the enactment of this law we are far in advance of most other states. One of the things that we need, then, is a better method of selling our fruit and a great amount of advertising. The success that has been attained with other articles of food, many of which are inferior to the apple, leads to the belief that the greatest success will follow a general advertising campaign.

Some time ago, 209 recipes, showing the different ways an apple may be prepared for the table, were printed in "Better Fruit," and presented in a striking degree the efficiency of this fruit as compared with other sorts. The consumption must be increased. To do this we must interest the consumer in the apple, not only as a fruit but as a food as well. Each housewife should have a copy of those recipes, so that she may obtain the greatest variety and efficiency from the one fruit which stands out above all others,—the apple. She must learn the value of a particular brand in apples as she does in flour, breakfast foods, etc., and to understand the differences in varieties, some of which are of exceptional quality and some of which are poor.

A year ago, the International Apple Shippers' Association appointed an Advertising Committee with U. Grant Border of Baltimore, Maryland, as Chairman. The idea was to devise means of raising funds for the purpose of advertising. After a good deal of investigation and conference with the leading growers throughout the country, they adopted the "Stamp Plan" for raising such funds. On August 1st, of this year, the stamps were placed in circulation and each shipper was asked to place one upon each package he sent out; a one cent stamp on a box and a two cent stamp on a barrel. This seemed to be the only plan whereby a shipper would benefit in proportion to his production. The success of the plan thus far points to an income with which a mammoth advertising campaign can be conducted and it is safe to predict that the results will exceed anything of the kind ever attempted.

Apple literature has been published in thousands of papers throughout the country and booklets containing "197 Ways f Preparing the Apple" have been sent into thousands of consumers' homes. Mr. Border wrote Mr. Merrill of the Auburn Fruit Growers' Association that these books could be purchased at ten dollars a thousand or one cent each, thus making it possible for grocers and fruitmen to supply them to their customers at a nominal expense. Growers also could put a copy in each of their Fancy and No. 1 barrels. Some such plan must be adopted to insure a greater consumption and one that will keep pace with the ever increasing production. Maine growers should take hold of this movement in earnest. It is a business proposition.

STORAGE.

A bill was presented before the last legislature asking for a small appropriation to investigate proper storage for Maine conditions. Unfortunately, this bill failed to pass, so that we will have to wait until later, before proper attention can be directed towards this most important question.

Many of the growers have good cellar storage and have succeeded in preserving their fruit with little loss, until such time as they see fit to put it upon the market. These cellars are usually some distance from the railroad and unless weather and road conditions are favorable, it is impossible to make shipments at the exact time desirable.

In Nova Scotia large storage houses have been built along the railroad and are operated coöperatively by the growers. These cost but a small sum,—from $3,000 to $8,000, according to the capacity of the house. The capacity varies from 3,000 to 20,000 barrels. The fruit is hauled there at the time of packing, put in the cellar and left until ready for shipment. It is then taken to the packing room, graded, packed and shipped. Such storage has its drawbacks, especially during a fall such as we have just had, when the weather was warm and some sort of cold storage such as brine or ice was necessary to maintain a low temperature. During average seasons, cellar storage has great value undoubtedly, and if houses could be put up at railroad stations in our towns where 5,000 to 20,000 barrels are shipped annually, they would give the growers more independence in disposing of their product. At present they are almost absolutely in the hands of local buyers, with only the business competition between firms to keep up the price. They have the option of selling to local buyers, or to commission men here and abroad. In the latter case, it takes years to understand the desirable methods of handling, to get an insight into market conditions, and to become acquainted with reliable firms.

Associations are not handicapped to such an extent, but even they have to dispose of the greater part of their crop before extremely cold weather sets in.

The passage of this bill would have set in motion the wheels of an investigation which undoubtedly would have proven of greatest value to the growers.

A committee on storage has been appointed by the Pomological Society to look into this question and find out as much as possible concerning a solution of it. Their report at the next annual meeting of the society should prove interesting.

ORCHARD INSPECTION.

Because of our lack of sufficient force, this phase of work has necessarily been more or less neglected. As much time as was possible, however, was devoted to this inspection, which often was done in connection with other work. The number of people who are spraying their trees has materially increased and the growers are showing a keener appreciation of the necessity and value of this work. They are also realizing that in order to successfully combat orchard pests of various kinds they must be more careful and thorough in their applications and the work must be done within a relatively limited period.

Great quantities of loose bark have been carefully removed from old trees this year and the work of removing canker has been more thoroughly and efficiently carried on. More pruning has been done, especially in opening up the trees so that there is better aeration, more sunlight and better shape to the trees.

Our orchardists are paying more attention to orchard fertilization and beginning to realize that in order to have our fruit well colored and of a clear, healthy finish it must be fully matured. The importance of proper fertilization cannot be overlooked in this accomplishment. Too much nitrogen delays maturity; too little nitrogen decreases size; a happy medium, therefore, is necessary and each man should do more or less experiment work in order to understand just what is required under his conditions. It is safe to say that the question of production is of far greater value to us at the present time than is the question of marketing and we must give our orchards better care if we are to produce fruit that will successfully compete with that of other sections in the future.

SCAB.

While it has been generally believed that early infections of scab have been due to the spores which come from the leaves under the trees, we know now through the work of Dr. Morse at the Experiment Station that such infection may also be traced to those spores which have gained a foothold on the twigs and water sprouts. In a great many places such infected twigs were discovered last summer, mainly on the McIntosh, Fameuse and Milding. Experiments have shown that the dormant spray of lime-sulphur is very essential under these conditions and that later applications without it are not entirely efficient. The general damage done this year by the scab is not as great as has been the case in many previous seasons, particularly that of last year. This may be attributed to a great extent to weather conditions which were not advantageous to its growth. Trees showing the largest amount of infection were usually in orchards where the damage last year was very great and where many apples, together with the foliage, were left on the ground. Trees that were thick and covered with numerous and large leaves suffered more than those well pruned.

Scab was present in some orchards where thorough spraying with lime-sulphur was done and it has led more or less definitely to the conclusion that lime-sulphur in itself is not sufficient and that it must be supplemented by some other material,—i. e., bordeaux mixture. Bordeaux mixture causes russeting of fruit and burning of foliage when applied after the petals fall or later in the season. Consequently we have recommended the use of bordeaux at the time the blossom buds are showing pink and lime-sulphur for the dormant spray after the petals fall and any applications thereafter.

SAN JOSE SCALE.

The appearance of new areas affected with San Jose scale, within the borders of the state, has been noted by this Bureau during the past year. A serious infestation has been discovered in a previously thriving peach orchard, owned by H. P. Abbot in the town of Eliot. In August, some twelve trees were found dying and the scale was abundant on both leaves and fruit, as well as on the woody portions of the trees. In this case, all infested trees were ordered burned at once and a careful watch will be kept on the fruit trees in that vicinity.

This infestation would seem to indicate that the fruit interests of the state were seriously threatened by this destructive pest, for there are several localities in the state where trees have been killed by this dreaded scale. A careful review of the cases which have come to the observation of this Bureau shows that all orchardists and nurserymen must be on the alert for the appearance of this apparently insignificant little insect.

However, there is an encouraging factor which needs to be brought to the attention of fruit men. So far as can be determined, all infestations of San Jose scale have developed from stock carrying the scale at the time it was shipped from the nursery.

In no instance where serious cases have been noted do we find that consecutive trees in a row are the ones that are affected. Invariably, the dead or dying trees are found scattered over an area represented by a setting of trees from some one particular shipment of stock. At Cornish, in the orchard of Roscoe Pease, two apple trees were reported as infested with scale, by gypsy moth scouts in 1908. This orchard was not visited by a representative of this Bureau until the summer of 1913. A careful inspection was then made and scale could be found on only three trees in the entire orchard. These trees set fifteen years ago were dying from the effects of the scale infestation, but no other trees carried even scattering individuals, as far as could be determined. The conclusion to be drawn is that these trees were affected when they left the nursery and that conditions were not favorable for the spreading of this trouble to trees not infested when they left the nursery. Other infestations, such as the one in the large plum orchard of George Wiseman, Lewiston, bear out these conclusions. There is every evidence that the scale is not spreading to trees that adjoin, but is developing on those trees which may have been infested when they left the nursery.

Seriously affected trees should be cut and burned, for there is little hope of making vigorous specimens from trees so handicapped, as are many of those which have come to our attention.

Temperature ranges seem to have some effect on the way the scale increases. While it is known that in the southern states, at least four generations are common in a single year, it is doubtful if we have more than two generations annually in the most of this state. Conditions seem to be much more favorable for the scale in York County than farther north and this might well be explained by temperature conditions.

San Jose scale has been found at Northeast Harbor, but it was dead when discovered. The infestation at Lewiston is the most northerly location of any living San Jose scale now being observed by the Bureau of Horticulture.

The orchardists are advised to make a most careful inspection of all nursery stock which they contemplate setting. All infested trees or plants should be destroyed by fire. The scale is so minute that the ordinary observer may not recognize it, so it is important to apply the dormant spray to all trees to help in the control of this elusive and destructive pest.

BROWN ROT OF PLUM.

This disease has been known for about 60 years and has been a cause of great loss of stone fruit in the east. It is especially bad when the weather is muggy and overcast. Practically no varieties are exempt from attack, although the smooth skinned fruits are more susceptible than the fuzzy sorts. Usually the damage is not done until the fruit is half grown, but during many seasons the injury occurs during the blooming period or shortly after. This is usually noticed by the mummified fruit remaining on the tree. The disease first shows itself by dark-colored spots which increase in size until the whole fruit is involved. Shrinkage does not usually occur until the rot envelops the entire fruit, consequently there is little change from the natural form. As the spores pass the winter on the mummified fruit, it can be readily appreciated that this fruit should be entirely cleaned up. If the fruit has been allowed to decay on the tree, without doubt many of the bud scales and twigs are infected with spores which will begin growth as soon as conditions are favorable. Spores may be blown for a long distance or carried by birds and insects.

A dormant spraying of lime-sulphur, followed by a summer spraying at the time blossoms are falling, using self-boiled lime-sulphur or a very dilute form of commercial lime-sulphur, will aid greatly in its control.

APPLE TREE TENT CATERPILLAR.

The general appearance of this caterpillar is so familiar to people in general, it seems hardly necessary to go into detail regarding it. However, the enormous damage to our trees this spring gives just cause for more or less anxiety concerning future depredations. Without doubt in the course of a year or so the parasites will once more have it under more or less control, but this is surmise. Indications at present point to an infestation even greater than we have had before.

The egg clusters extending around the twigs in an irregular band about one-half to one inch in length are so conspicuous that they are familiar to nearly every one. There are about 200 eggs in each mass and they are so glazed over with a brownish, gluey substance that they glisten brightly in the sunlight. These eggs are laid in the fall.

The caterpillars are from one-half inch to two inches in length and of a blue-black color. They are thinly covered with yellowish hairs and are distinguished by a white stripe down their backs. They hatch from the eggs during the last of April or the first of May and commence feeding upon the budding leaves at once, oftentimes being so numerous that the trees fail to obtain a start. They become full grown in from five to six weeks, after which they spin a cocoon and remain in this stage about three weeks. The adult moth is fairly heavy-bodied, of a reddish brown color, with two white bands obliquely across the wings. The females have about one and one-half inch wing expanse. They mate soon after they emerge from the cocoons and a little later they lay the eggs on the twigs.

It is generally considered that the use of two and one-half pounds to three pounds of arsenate of lead with 50 gallons of water, applied at the time that the blossoms are showing pink, will effectually control this insect on the apple tree. There is oftentimes, however, not enough foliage at that time upon which a sufficient amount of lead can be applied to poison the entire infestation. As we have found in demonstration work, the most efficient manner of handling this pest is to apply a dormant spray; either one gallon of lime-sulphur to ten gallons of water, or ten pounds of soluble sulphur to 50 gallons of water. When thoroughly done, this will completely control them and none of the eggs will hatch.

PEAR SLUG.

The skeletonized appearance of pear, cherry, plum and other fruit tree leaves is often due to this slug. It works on both the upper and lower surfaces of the leaves.

The adults appear in the spring and lay the eggs usually in June. The eggs hatch soon after and commence feeding upon the leaves. When present in large numbers, they soon cause the leaves to become brown and the trees look as if fire had swept through them. The adult fly pushes the ovipositor under the surface of the leaves, making a shallow oval-shaped pocket in which to place the egg. The tissues of the leaves are so cut that there is no danger of their growing together and pressing the egg, or preventing the escape of the larva.

The larvæ are yellowish white at first, changing to a dirty green as soon as the slime spreads over the bodies. The eggs require two or three weeks to hatch and the larvæ mature about 25 days after hatching. After several molts they cease feeding, drop to the ground and work their way into the soil. After the last molt they do not assume the slimy protection and become yellowish orange in color.

In controlling this pest, hellebore and black leaf 40 have proven the most efficient. Each will do satisfactory work and will not injure the foliage, but the former is much cheaper. Arsenate of lead is cheaper than either but is a slower acting poison and may injure the foliage to some extent on the cherry. Arsenate of zinc is almost certain to burn the foliage. Solutions: Hellebore, one pound to 50 gallons of water; black leaf 40, one part to 100 parts of water.

THE GOOSEBERRY FRUIT FLY.

Premature ripening of currants and gooseberries is oftentimes due to the attack of this insect. The first indication of injury is a small spot on one side of the fruit where growth has apparently ceased. Later the fruit becomes dull, matures early and, upon examination, reveals a dark spot on the interior which proves to be a small footless grub. The fruit drops to the ground, causing a shortage of sometimes three-quarters of the crop.

The adult fly emerges during the early summer and soon after the females commence depositing the eggs. One female may lay as many as 200 eggs during the season, depositing but a single egg in a fruit. The fly lights on the fruit, seeks a desirable place, pierces the fruit with her ovipositor and pushes the egg under the skin. After hatching the grub commences to feed and travel through the fruit, turning finally into the interior and entering a seed. After growing too large for one seed, it binds several together and continues to feed on their contents. Occasionally they leave the fruit before it drops, but more often they remain until afterwards. They enter the soil at about one-half inch in depth where they form cells and transform to pupæ in which stage they pass the winter. Their habits are very similar to those of the apple maggot.

Poultry running between the rows aid in suppressing their work. Late and early cultivation also cause their destruction, while a mulch in the spring prevents the flies from gaining the vines.

A sweetened poison spray—sugar three pounds, arsenate of lead four ounces, water five gallons—seems to attract the fly, but it is often necessary to make a number of applications.

GREEN APPLE APHIS.

A careful examination of the young twigs and water sprouts of apple trees, during the winter months, often show great numbers of tiny, black, oval eggs. Such eggs are found to be those of the green aphis which have been laid there in the fall. Although great quantities of these are often found, it is generally considered that only about one to five per cent. of them are able to withstand climatic conditions in the East and that the rest never hatch.

The history of these insects is interesting. The young which hatch from the eggs in the spring give rise to all succeeding generations and are termed "stem mothers" when fully developed. After hatching, they work upon the newly opened buds and tender leaves. Every stem mother when full grown gives birth to living young without any intercourse with the male. Very few of the second generation have wings. The succeeding broods develop a large percentage of winged females which are larger than the stem mothers and usually lighter green in color. This is the migratory form and furnishes the principal means of distribution of the insect. In the fall the females, instead of producing their own kind, give birth to true sexual form, male and female. These mate, after which the new females lay the eggs on the twigs.

A great deal of work has been given to the best method of controlling this pest, with more or less success. As a general thing, the best spray mixture in use at the present time is black leaf 40, combined with sufficient soap solution to render it properly adhesive. It has been found that the time of day has a great deal to do with the efficiency of the material. Cloudy days, when the humidity is high, and late afternoons, are generally considered the best times for applying the material. This is due, no doubt, to the relatively small amount of evaporation going on at that time, as rapid evaporation has a tendency to reduce the effectiveness of any contact spray.

Tobacco stems, kerosene emulsion, whale oil soap and even ivory soap, have produced good results when properly applied.

THE SHOT HOLE BORER.

Upon examination it is frequently observed that many of our trees have been perforated with very small holes, not more than a twentieth of an inch in diameter. This infestation is more commonly observed on the less vigorous limbs of large trees. However, neglected young trees are often in the same condition. It is an indication of the presence or rather the work of the shot hole borer, a minute beetle about a fifteenth of an inch long. Many of the Gregory orchards this year were infested with this beetle and are in a fair way to be killed unless something is done to prevent further depredations. Each hole represents the exit hole of the beetle and leads to a short channel usually running with the grain of the wood, from each side of which burrows lead off at right angles which gradually enlarge and terminate in a round cell.

The grub of this beetle hatches from an egg which has been deposited in the main burrow and the smaller channel is due to his work. The increase in the size of the branched channel is due to the increase in the size of the grub which has been feeding upon the sap wood. The cell is made by the full, matured grub, in which it transfers to pupa. Eventually the beetle emerges from this pupa and after a short time cuts its way out through the bark. As each of the small channels represents an individual grub, the number of holes is apt to be large.

Trees that are thrifty are less subject to harm from this insect, inasmuch as the freely moving sap tends to flood the burrow, either destroying the borer or driving out the beetle. Infestations may occur in vigorous trees, however, especially in blocks where there is more or less dying wood, because of their tendency to overrun the limits of their original points of attack.

The tendency to leave the brush from pruning operations under the trees, aids them greatly in their propagation; consequently, it should be removed and burned as soon as possible. If an entire tree, whether large or small, should become infested, it should be cut down and burned, as this prevents spreading to other trees. Vigorous trees, as has been said, are not as susceptible, consequently applications of fertilizer and pruning, when properly done, afford a means of protection. Whitewashing the trees also is a preventive measure. All trees should be watched carefully from year to year and, if any evidence of this insect is discovered, care should be taken to see that they are properly looked after.

THE APPLE MAGGOT.

In this insect we have had a serious enemy during the past season. In sections of Cumberland and Androscoggin counties, practically all of the Spies, together with many of the sweet apples, have been a complete failure because of this pest. Other counties have suffered in a smaller way. Where the fallen fruit has been conscientiously picked up for the past few years and where cultivation is being practiced, the damage has been reduced considerably, but even here it is apparent when the orchard is located in the immediate vicinity of one which is being generally neglected. Further investigation of the habits of this pest is needed in order to find some means of control which is more satisfactory.

Best results have been obtained where clean cultivation has been practiced up to the first of July, owing to the early plowing disturbing the pupæ buried in the top soil.

This is especially true where some of the fall fruit (windfalls) has been picked up before it has lain upon the ground for a long time.

NEW FORMULAS.

Woolly Aphis (M. A. Cadoret, France.)

Linseed oil	7 pounds
White lead	1 1-2 pounds
White zinc	1 pound
Turpentine	1 pound

Boil lead, zinc and oil ten minutes, cool, add the turpentine. Paint wounds in spring and fall.

Fruit Flies (Berlesse)

Molasses	20 pounds
Arsenate of potash	4 pounds
Water	20 gallons

Fruit Flies (De Cillis)

Molasses	130 pounds
Honey	62 pounds
Glycerine	4 pounds
Arsenate of soda	4 pounds
Water	20 gallons

SMALL FRUITS.

Weather conditions were as unfavorable to some of the small fruits as they were to the apple. Strawberries in particular suffered from the extreme drouth, with the result that the latter part of the crop was almost a failure. Many of the berries dried on the vines and, in some cases, the vines themselves withered and finally died. The early berries sold at the top price, as usual, and some of the growers in the southern part of the state obtained as high as 20 to 23 cents per quart basket in the Portland market.

The Glen Mary withstood conditions better than most other varieties and demonstrated again its worth as a suitable variety for this state.

Some of the growers have systems of irrigation, mostly of the overhead type, which are not only satisfactory, but are becoming almost necessary in the production of this crop.

Mr. Stantial of Belfast has produced a new variety which he believes will be of great importance. In his experience it is entirely satisfactory, not only as a producer, but as a pollenizer. With the Haverland it is particularly successful in increasing the length of the picking season and in increasing the amount of the crop. Other berries new to the state, but imported from other sections, have found favor and may prove valuable additions to our present varieties when they have received a more extended trial. The new plantings were more or less retarded by the adverse weather, but began to show improvement later on, so that at the end of the growing season they compared favorably with the stand of previous years.

There was very little rust and practically no serious infestations from insects. Most of the growers are spraying thoroughly and giving good culture. It is found that picking the blossom buds the first season aids materially in the development of strong, vigorous vines, owing to the conservation of the growth otherwise put forth to produce pollen.

Raspberries, blackberries, currants and gooseberries were better adapted to withstand the adverse conditions and in general did very well. No new varieties of importance were noted, though the St. Regis and other everbearing sorts were favorably spoken of.

Some of the older beds of raspberries have become infected with crown gall to such an extent that they will have to be removed and new patches planted elsewhere.

The Chautauqua gooseberry brought about two to three cents per quart more than the Downing, its chief drawback being slowness of growth.

The Red Cross and Fay's Prolific currants continue to rule the favorites among the currants, but it would seem that either could be improved upon.

Labor at reasonable rates and in larger amounts is necessary to greater development in the small fruit industry, especially in those districts that are thinly populated.

FOREST INSECTS AND DISEASES.

Spruce Bud Worm.

The increase in numbers of this insect, during the past three years, has given just cause for alarm among the owners of spruce, fir, larch, hemlock and white pine. We are constantly receiving letters from wild land owners and particularly from owners of summer camps who are dependent upon the beauty of their trees for a large part of their summer business, telling us of the enormous damage being done to their trees by this most serious pest. Many of the islands along the coast seem to offer particular inducements to this insect and here we find them especially abundant. Along the highways in every part of the state, evidence of their work is plainly apparent.

During the latter part of this season, parasites in the form of spiders have accomplished a great deal in controlling them and it is to be hoped that in another season we will find they have been more or less exterminated.

The caterpillar begins feeding when the growth starts in the spring and becomes matured about the middle of June. It then transforms into a dark brownish-black chrysalis, emerging about ten days later into a small grayish-brown moth. The flight of these moths continues from the latter part of June up to the latter part of July, during which time they deposit their eggs in small oval patches on the side of the needle. These hatch in about a week and feed on the terminal shoots of the branches for a short time before hibernating as small caterpillars in a shelter near the bud. The larvæ are about four-fifths of an inch long, reddish brown in color, with small, light reddish spots.

In the woodlands we must depend upon parasites for their control, but in groves or where the trees are particularly valuable a better and most efficient method would be to spray with arsenate of lead, two and one-half pounds to 50 gallons of water, as soon as the new growth starts in the spring. Birds and other parasites also control them to a certain extent.

Elm Leaf Beetle.

In addition to the work done in York and Cumberland counties during the past few years, new and relatively large infes-

Crop on Baldwin tree set four years, Auburn.

tations have occurred in Androscoggin, southern Oxford, Sagadahoc, eastern Kennebec and southern Franklin counties. In and about Auburn particularly the damage has been great and some of the elms have been completely defoliated because of them.

The skeletonized brown appearance of the foliage of an infested tree in summer is very striking. The parent beetle is about one-fourth of an inch long and the color varies more or less during the life stages, being greenish yellow at the time of emerging from winter quarters and deepening into a reddish yellow as they grow older. The eggs are deposited in irregular rows of from five to 25 on the under side of the leaves. When hatched the grub is about one-twentieth of an inch long, with a dark yellowish skin, the yellow color becoming more prominent as they molt. The full grown larva is about one-half an inch long. The winter is passed by the beetle in attics, sheds and other sheltered places. With the warm weather in spring, they emerge from their retreats and early in May the beetles fly to the trees and eat irregular holes in the foliage. Egg laying continues for four or five weeks, during which time the beetles consume a large amount of foliage and may deposit as high as 600 eggs. The grubs emerge about the middle of June and feed on the under surfaces of the leaves, which they skeletonize in a short time. The growth is completed in about two to three weeks, after which the grubs descend and seek a place in which to pupate. If the leaves are thoroughly sprayed with an arsenical poison early in the spring, when the beetles begin to feed, many of them will be poisoned and without doubt this is the best method of control. The local spread of the beetles is slow and remedial measures should be practiced as soon as their work is observed. Thus far the parasites have not been very efficient in checking their depredations.

Borers.

Borers of various kinds infesting shade trees have been discovered and sent into the office from time to time, but their work has not been more pronounced than in previous seasons.

Chestnut Bark Disease.

This fall an infection of this disease was discovered in Auburn by the U. S. Department of Agriculture. It is probably the most northern infection and shows the adaptability of this canker to varied climatic conditions. The number of chestnut trees in the state is not large, nor are they developed for economic purposes to any great extent. Nevertheless, those that we have should be preserved and care should be exercised in stamping out this disease before it gains a larger foothold. When the spores of this fungus gain entrance into a wound on any part of the trunk or limbs, they commonly give rise to a spreading canker which soon girdles the tree. In many ways it resembles some forms of apple canker, only it is more destructive. The bark cambium and even the outer layers of sap wood are destroyed. If the trunk is infected the entire tree dies; if the smaller branches, only those portions beyond the point of attack are killed. The canker usually shows in the form of dead, discolored, sunken areas which later become covered with orange or reddish brown spots about the size of a pin head. Under damp conditions spores are freed and may be carried by animals, insects and other agencies to other trees. Small infections may be cut out, care being taken to use sharp tools and to disinfect the wound after the operation. In case of heavy infections, trees should be cut down. About the only remedy that would be efficient would seem to be the breeding of resistant stock.

White Pine Blister Rust.

So far as we have been able to determine, this rust has not gained entrance into the state and it is to be hoped that it will never infect our white pine, as they form a large percentage of our forest wealth. Should anything be discovered we hope the Department will be notified at once.

APPLE PACKING SCHOOLS.

Early in the year, Harry Conant of East Hebron suggested that the Department hold a three days' school at East Hebron Grange Hall to demonstrate packing in boxes and in barrels and to give a series of talks upon matters pertaining to the fruit business. A little later a request came from W. H. Conant in behalf of the growers of Buckfield for such a meeting and still later a request from Mr. Yeaton for one in South Paris.

The first school was held in South Paris, Feb. 11-14; the second was at Buckfield the following week for four days and the last at East Hebron, Feb. 25-27. These schools were a distinct success and the 212 growers who registered for the three meetings expressed themselves as much pleased over the work. The average daily attendance was about 25 and many of the growers were present throughout the meeting.

In detail the work consisted of instruction in grading fruit for box packing, the proper way to nail up a box, the method of placing the papers in the box, adaptability of various packs and their construction, most efficient way to wrap apples and the manner of putting on the cover and storing the box. Demonstrations were given in facing, wrapping, tailing, pressing, heading, and nailing the barrel fruit, showing the proper methods and improper methods of doing each of these operations.

Short talks were given at various times upon different phases of orchard management. All who were present were given the opportunity to practice what had been given them in the way of instruction. Many acquired considerable proficiency in the work. Many ladies as well as men attended the school, especially at Hebron, and, as a general thing, the ladies acquired the knack of packing much more quickly than the men. A few boys were also present and showed that they were greatly interested in the work.

The apparatus and various supplies, including paper, boxes, presses, packing tables, hammers, nails, etc., were furnished by the Department, which also shared in the expense of obtaining the fruit. The hall and the janitor service were furnished by the local men. Mr. Yeaton, Mr. Sweetser and myself undertook the work of instruction.

The great interest in these meetings shows the importance of the work and they will be continued next season as already many applications have been sent in. They afford a special opportunity for discussion along all lines pertaining to fruit growing and fruit marketing, so that it is worth while for those growers who already have a fairly clear conception as to grading and packing.

WESTERN MAINE FRUIT GROWERS' CONFERENCE.

The greatest fruit institute ever attempted in this state was held in Auburn, March 11-12. The meeting opened with a large and enthusiastic gathering of fruit growers and both the enthusiasm and the number of growers increased as the meeting continued. Auburn Hall was used for the institute and its floor capacity was strained to the utmost to accommodate the audience. Around the outside of the hall were booths with nursery stock, spraying machinery, spraying material, machinery for evaporating apples, pruning tools and other orchard apparatus. Among the concerns present were Brackett, Shaw & Lunt of Somersworth, N. H., Frost Insecticide Co. of Arlington, Mass., Haskell Seed & Implement Co. of Auburn, Bowker Insecticide Co. of Boston, Milliken & Philbrook of Portland, Harrison Nursery Co. of Baltimore, Md., Homer Chase Co. of Auburn, and others. Box fruit was supplied by the Oxford Bears Fruit Growers' Association of Hebron and arranged very attractively on the stage in front of the speakers' desk. Barrel fruit was supplied by Fred Ricker of Turner and flowers and ferns by Saunders, the florist of Lewiston. Very appropriate buttons were supplied to those registering for the meeting and commanded universal approval.

THE PROGRAM.

Tuesday, March 11—11 A. M.

Apple Packing Demonstration,
H. P. Sweetser, Asst. State Horticulturist
Inspection of Sprayers and Material
Sprayer Demonstration

1 P. M.

Address, Hon. J. A. Roberts, Commissioner of Agriculture
Spraying,
H. L. Frost, Arlington, Mass., Pres. Massachusetts Fruit Growers' Association.
Extension Work in Oxford County,
G. A. Yeaton, In Charge Demonstration Orchard Farms

Intermission, ten minutes.

Gypsy Moth in Maine, Illustrated Lecture,
Major E. E. Philbrook, Special Field Agent of Moth Work.

General Discussion.

6 P. M.

Supper

Music

Toastmaster, Tascus Atwood. Toasts by Mayor Williams, Governor Haines, Mayor-elect Fowles, Howard Keyser, Harrie Webber.

Wednesday, March 12—9 A. M.

Round Table, Conducted by A. K. Gardner, State Horticulturist

Discussion: Pruning, Planting and Care of Young Trees,
led by Homer N. Chase, Auburn

Marketing,
Edgar W. J. Hearty, Boston, Mass., Pres. Boston Division Nat'l Ass'n of Commission Merchants.

Selecting Apples for Show and Discussion of the Score Cards,
Prof. E. F. Hitchings, University of Maine, Orono

1 P. M.

A Beginner in the Orchard,
Prof. A. N. Leonard, Bates College, Lewiston

Pruning, with Special Reference to Summer Pruning,
F. A. Smith, Ipswich, Mass.

Round Table—continued.

Discussion: Cultivation and Fertilization,
led by Geo. A. Yeaton, Norway, in charge Demonstration Orchard Work, Oxford County.

Discussion: The Package—Facing, Branding and Perfect Pack,
led by Howard L. Keyser, Greene, Pres. State Pomological Society.

Discussion: Co-operation,
led by Wilson H. Conant, Buckfield, Pres. Oxford Bears Fruit Growers' Association

General Question Box.

Conclusions of the Meeting.

Great praise is due Homer Chase for his indefatigable efforts to make the meeting a success. Those present were amply repaid for any sacrifice they had to make in order to be present, in the way of valuable instruction and encouragement in the work. The speakers were first class and presented a great many points that were worthy of deep consideration. The discussions were general, keen, and abounding in vital, practical ideas. One of the best testimonials of the meeting was that it was the concensus of opinion that a similar one should be held next year. The attendance was 362.

NURSERY INSPECTION.

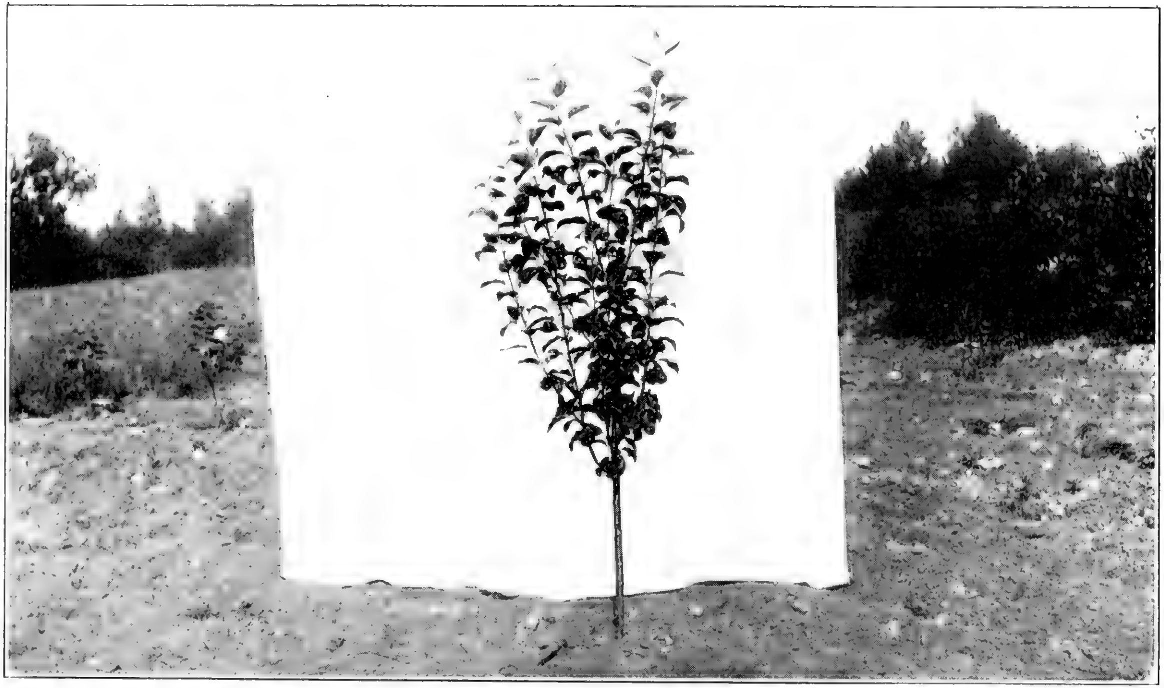
Nurseries, or other places where plants are grown and offered for sale, must be inspected annually. If no dangerous insects or fungous diseases are found, a certificate of inspection is given which allows the owner to ship his plants.

The law relating to this matter is given in Chapter 15, Public Laws of 1907, as amended in 1909, 1911 and 1913.

The same general condition was found this year as in previous seasons. From time to time and in various places, it has been necessary to condemn certain individual specimens and in a few instances the certificate has been withheld, pending careful spraying or removal of infested areas of plants. The rose scale on brambles and woolly aphis on evergreens have been the causes of withholding the certificate. A little San Jose scale has been discovered, but in all cases has been destroyed immediately and careful watch kept on all plants in that vicinity.

As a rule the nurserymen coöperate heartily with the Department and in no instance has the certificate been withheld indefinitely. These men realize the importance of keeping out pests which mean destruction of property and are anxious to apply the proper methods of control.

Below is the list of nurseries that have certificates of inspection from the Bureau of Horticulture:



McIntosh Tree, two years set from whip, Buckfield.

ANDROSCOGGIN COUNTY.

Nurseries.	Address.	Date of inspection.	Acres.	Apple.	Pear, peach.	Cherry, Plum.	Raspberry.	Currant.	Gooseberry.	Blackberry.	Miscellaneous.	Conifer.	Hardwoods.	Ornamental Shrubs.	Total.	Trees condemned.
Chaput, J. P.	Auburn	June 27	2	–	–	–	3,000	–	–	100	50	–	–	–	3,150	–
Dudley, F. H	Auburn	Aug. 6	–	–	–	–	–	–	–	–	–	–	12	–	12	–
Lombard, T. M	Auburn	June 27	¼	–	–	–	500	–	–	–	–	–	–	–	500	–
Merrill, Chas. A	Auburn	June 27	1	–	–	–	2,500	–	–	500	–	–	–	–	3,000	–
Roak, Geo. M. & Co.	Auburn	June 27	¼	–	–	–	–	–	–	–	–	–	–	600	600	–

CUMBERLAND COUNTY.

Nurseries.	Address.	Date of inspection.	Acres.	Apple.	Pear, peach.	Cherry, Plum.	Raspberry.	Currant.	Gooseberry.	Blackberry.	Miscellaneous.	Conifer.	Hardwoods.	Ornamental Shrubs.	Total.	Trees condemned.
Casco Bay Nursery Co.	Yarmouth	June 28	1	–	–	–	–	–	–	–	–	4,000	–	–	4,000	–
Chadbourne, J. A.	Bridgton	June 24	1	–	–	–	1,000	–	–	–	–	–	–	–	1,000	–
Goddard, L. C.	Woodfords	June 26	½	–	–	–	–	25	–	40	–	10	8	500	583	12
Gould, C. E.	Woodfords	June 25	¼	–	–	–	500	–	–	–	–	–	–	–	500	–
Jackson, H. A.	Portland, R.F.D.1	June 25	5	–	–	–	–	–	–	–	–	750,000	200	500	750,700	–
Macomber, E. R.	Woodfords	June 26	½	70	6	20	100	12	–	–	–	5	15	500	728	–
Minot, J. W.	So. Portland	June 25	¼	–	–	–	200	50	–	–	–	–	–	–	250	–
Morse, Fred H	Freeport	May 3	1	–	–	–	2,500	–	–	500	–	–	–	–	3,000	–
Plummer, J. E.	So. Windham	Feb. 1	½	–	–	–	1,000	–	–	–	–	–	–	–	1,000	–
Smith, C. W	Woodfords	June 25	1¼	–	–	–	2,000	–	–	–	–	–	–	–	2,000	500

FRANKLIN COUNTY.

Nurseries.	Address.	Date of inspection.	Acres.	Apple.	Pear, peach.	Cherry, Plum.	Raspberry.	Currant.	Gooseberry.	Blackberry.	Miscellaneous.	Conifer.	Hardwoods.	Ornamental Shrubs.	Total.	Trees condemned.
Chapman, L. R.	New Sharon	Sept. 9	¼	–	–	–	500	–	25	100	–	–	–	–	625	–

HANCOCK COUNTY.

Nurseries.	Address.	Date of inspection.	Acres.	Apple.	Pear, Peach.	Cherry, Plum.	Raspberry.	Currant.	Gooseberry.	Blackberry.	Miscellaneous.	Conifer.	Hardwoods.	Ornamental shrubs.	Total.	Trees condemned.
Ball, H. D. & Son	Hancock	June 30	-	-	-	-	300	110	115	-	-	-	-	-	525	-
Hancock Nursery Co.	Surry	June 30	1	8,000	40	50	100	-	-	-	-	-	-	-	8,190	-
Miller, Wm.	Bar Harbor	May 12	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mt. Desert Nursery Co.	Bar Harbor	July 2	20	1,000	75	50	250	300	50	-	175,000	100,000	100,000	25,000	401,725	-
Mt. Desert Nursery Co.	Northeast Harbor	July 1	2	25	5	25	-	-	-	-	2,000	2,000	1,000	500	5,555	-
Penney, C. A.	Hancock	June 30	1/8	-	-	-	200	-	-	-	-	-	-	-	200	-
Phelps N. H.	Nicolin	June 30	1/4	-	-	-	800	-	-	300	-	-	-	-	1,100	-

KENNEBEC COUNTY.

Nurseries.	Address.	Date of inspection.	Acres.	Apple.	Pear, Peach.	Cherry, Plum.	Raspberry.	Currant.	Gooseberry.	Blackberry.	Miscellaneous.	Conifer.	Hardwoods.	Ornamental shrubs.	Total.	Trees condemned.
Elm Brook Farm Co.	Augusta	June 23	1/2	60	-	80	800	-	-	-	-	-	15	-	955	15
Hussey, J. C.	Oakland	July 11	1	-	-	-	300	-	-	-	-	100	-	3,000	3,400	-
Lapham, E. A.	Pittston	June 23	1/4	-	-	-	500	-	-	-	-	-	-	-	500	-
Mitchell & Co.	Waterville	Aug. 18	-	100,000	-	1,000	-	-	-	-	-	-	3,000	4,000	108,000	-
Perkins, Chas. S.	Vassalboro	Sept. 17	1/8	-	-	-	-	-	-	500	-	-	-	-	500	-
Perley, C. A.	Winthrop	June 27	1/2	7,500	-	-	-	-	-	-	100	-	-	-	7,600	-
Twitchell, Dr. Geo. M.	Monmouth	Sept. 30	-	-	-	-	300	-	-	-	-	-	-	-	300	-

KNOX COUNTY.

Nurseries.	Address.	Date of inspection.	Acres.	Apple.	Pear, Peach.	Cherry, Plum.	Raspberry.	Currant.	Gooseberry.	Blackberry.	Miscellaneous.	Conifer.	Hardwoods.	Ornamental shrubs.	Total.	Trees condemned.
Lufkin, W. C.	Rockland, R.F.D. No. 1	July 14	2	-	-	-	500	100	100	-	-	-	-	-	700	-

OXFORD COUNTY.

Conant, A. A.	Hebron	Aug. 13	1/4	-	-	-	500	-	-	-	-	-	-	-	500	-
Conant, W. H.	Buckfield	Aug. 8	1/2	-	-	-	1,000	-	-	-	-	-	-	-	1,000	-
Maxim, H. F.	Locke's Mills	July 25	12	-	-	-	30,000	-	-	-	-	-	-	-	30,000	-

PENOBSCOT COUNTY.

Bodge, A. R.	Dexter	July 16	1½	-	-	-	-	1,000	250	-	-	-	-	-	1,250	
Eastman, A. A.	Dexter	July 16	2	-	-	-	1,000	2,000	2,000	-	-	-	-	-	5,000	-
Hoyt, Wm.	Dexter	July 16	1/4	-	-	-	-	-	-	-	-	-	-	-	Ginseng	-
McCabe, Robert	Bangor	July 3	1/4	-	20	-	-	-	-	-	-	-	500	200	720	-

YORK COUNTY.

Fernald, Linwood	Eliot	Aug. 26	1½	-	-	-	-	75	-	500	200	-	-	300	1,075	3
Mahoney, G. L.	Saco	June 25	1	-	-	-	-	-	-	-	-	100,000	-	500	100,500	-
Smith, T. W. A.	Biddeford	June 25	1/8	-	-	-	-	-	-	-	-	-	-	300	300	-
Strout's Nursery Co.	Biddeford	June 25	1/4	-	-	-	-	-	-	-	-	-	-	600	600	-

TOBACCO INDUSTRY IN MAINE.

M. B. Smith of Hartford, Conn., conceived the idea that tobacco could be raised on the soils of Maine as well as those of Connecticut if the grower would only adopt the methods that had proven efficient in that state. His first attempt in the summer of 1910 was successful, for during that season he raised on a large farm three miles from Belfast six acres of marketable tobacco. He divided the area into two-acre plots, using Broad Leaf, Havana and Cuba seed, respectively. Two acres of this field he grew in the shade under cloth, which is the method followed by many of the Connecticut growers to get the highest quality of tobacco. The accompanying photograph shows a portion of the field as it was during that first year. Since that time Mr. Smith has not considered it practical to shade the fields and all of the recent crops have been grown in the open.

In 1911, he increased his acreage to ten acres and this year he grew successfully 15 acres, obtaining practically one ton of marketable tobacco per acre, which is considered a good yield. In the previous years he has shipped all of the crop to Connecticut to be cured and sorted, but this year he has his own curing facilities and is manufacturing cigars in his own factory in Belfast. His employes, while not yet experts, are doing satisfactory work and in December he was unable to supply the demand for his product which is on the market as "Pearl Brook Cigars."

The growth of the tobacco plant is not different essentially from that of other common farm crops. The plant is a vigorous grower and responds quickly to proper care. In growing this plant, it is necessary to keep in mind that a definite color is required on the dried leaf and that the ash of the cigar should be white. These qualities insure satisfaction and high prices. Such results are brought about by furnishing the plant an alkaline soil, by heavy applications of lime, by feeding the potash in the form of the carbonate which may be supplied by wood ashes, and last, by giving the plant all the nitrogen it needs so that growth will be rapid. With such a combination, the unfavorable climatic conditions are about all that will make the crop a failure, if ordinary care is exercised.

Tobacco Plants before any leaves are picked.

In selecting a soil for tobacco growing, it is well to choose a rather light soil which is retentive of moisture and well drained. The plant succumbs quickly to wet feet, so that the heavy, poorly drained clay soils are not to be considered. If the roots of the plant are under water for any length of time, during the growing season, the results are disastrous.

The initial preparation of the soil consists in applying lime to the field at the rate of about two tons to the acre and discing it thoroughly in the fall. In the spring the land is plowed and again treated with a light coat of lime, after which it is thoroughly tilled as in the preparation for other crops. Stable manure is used whenever it can be obtained and is supplemented with wood ashes. Two grades of ground bone, cotton seed meal and wood ashes furnish the fertilizer when stable manure cannot be obtained.

The above method is the system practiced by Mr. Smith in first preparing his field and he finds, as they do in other states, that the crop can best be grown on the same field year after year. The quality of the tobacco is materially increased by constant cropping but food and humus must be supplied. This is done by sowing winter rye in the field about the first to the middle of September. This crop is allowed to grow until late spring when it is plowed under, more lime applied and the usual application of fertilizer worked into the ground. In practically every case the fertilizer is applied broadcast instead of in the row or hill, as is customary in many of our other farm crops.

The varieties of seed which are used in this work,—the Havana, Broad Leaf and the Cuban, differ somewhat in size of plant and also in the shape of the leaf, but they each furnish a high grade of tobacco when properly cured.

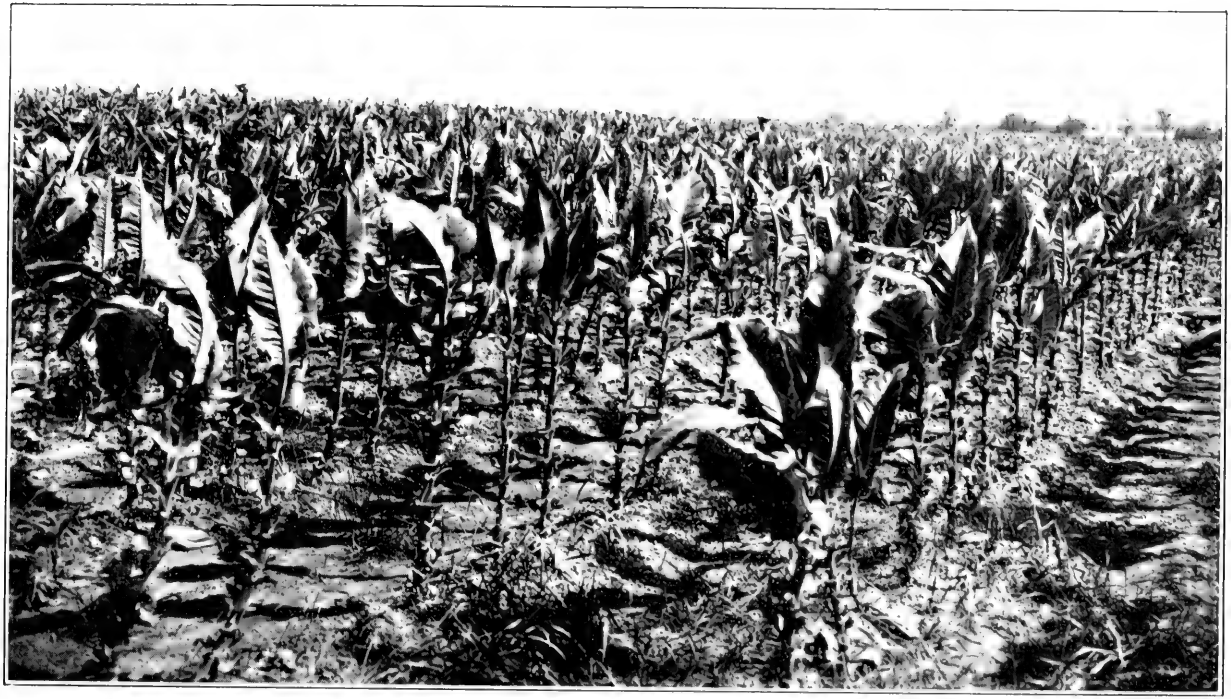
The seed is planted in early spring in common hot beds, covered with sash and furnished under-heat by decaying horse manure. These hot beds are protected in the winter by filling them with horse manure in the late fall. This does not freeze deeply and when thrown out in the spring, the soil itself contains little if any frost. The beds used on the Pearl Brook farm are in sheltered spots and so located as to be handy to the field at planting time.

When all danger of frosts is over in the spring, and this date is considered about the 5th of June as a limit, the plants are removed from the beds and set in the field with the aid of a Bemis transplanter. This machine is handled by three men and two horses. One man drives and the other two feed the plants into the machine. The operation is simple and when handled by experienced men, the machine can transplant as high as two acres of tobacco a day. At each complete movement, the machine makes a hole, empties into it a small quantity of water, drops a plant and rolls the earth firmly in place about the roots. It is sometimes the practice to add a little nitrate of soda to the water in the machine. This encourages the plant to get a quick start and supplies food until the roots reach the fertilizer which has been broadcasted on the field. The plants are set 15 inches apart, considerably closer than when tents are used. The close proximity of the plants to each other in the row helps make shade and holds moisture so that the quality of the tobacco is materially affected for the good.

The best growing season is the same for tobacco as it is for corn and the warm nights are a great help. In a cold season the leaves generally grow rather darker than when rapid growth has been produced. The crop demands high tillage throughout the growing season and ordinary cultivators are used in the control of weeds and maintaining the dust mulch. Hand hoeing is practiced the same as on corn.

The plants when mature often reach the height of seven or eight feet. When the blossoms appear the foreman sends a crew through the field to break them off, as the formation of pollen and seeds is of no value, and the growth is forced into the leaves.

About the middle of August the first picking takes place. This consists of removing the lower four or five leaves which are taken to the drying sheds to commence the process of curing. The usual practice is to make about four pickings at intervals of ten days to two weeks, the last one being made as late as possible before killing frosts. This last picking takes all of the leaves, the main stalk being left on the field. Mr. Smith simply plows this collection of stalks into the soil for another crop, or spreads them on the grass land for top dressing. In Connecticut, these stalks are ground and spread on the



Tobacco Plants, lower leaves removed.

grass land where they are considered a valuable source of plant food. Later on, Mr. Smith expects to adopt similar methods.

The curing of tobacco is the important part of the season's work. It is an easy matter to produce the crop, but the curing of the leaves to make a commercial commodity is an art by itself and in this the ordinary farmer would need advice and perhaps systematic training before he could become successful.

The leaves are gathered in large baskets in the field and transported to the large drying houses. These houses are constructed like large barns with especial attention given to the system of ventilation. A large ventilator runs the entire length of the building at the peak of the roof and about half of the entire sides are so arranged that boards may be tipped at an angle admitting air from all directions. The ventilator on the roof is important as without it moisture is apt to collect on the tobacco in the upper part of the building, causing what is known as pole sweat, which means large loss in the drying.

As the leaves arrive from the field in the baskets, women and girls sew them in series of 36 to 40. The string which they use is a special waxed cord, which they pass through the mid-rib of the leaf close to the base. Ordinary cord will rot and break. Having strung the allotted 40 leaves, they quickly fasten the string to either end of a lath and spread the leaves in such a way that no one touches its neighbor. These women when expert will sometimes string 250 laths in a day.

The laths are then taken by men to the barns and hung on poles so arranged that a lath will just reach from one to the other. The roof of the building is filled first, the men working toward the ground, leaving the space above filled with these great leaves eight or nine inches wide and often more than three feet long. Each leaf hangs free from all others. The barns are filled rapidly, about 20 to 30 making up the crew on the farm when picking begins.

The ideal weather for drying tobacco is alternating wet and dry days, but if wet weather exists for several days charcoal fires are started in all of the buildings to dry out the leaves. If allowed to remain damp, the leaves will become covered with a slime and in a very short time will rot and drop from the strings.

It takes about three weeks of good weather to properly dry tobacco which has been grown under cloth and for that which has been grown in the open the usual time is about five weeks. The leaves are allowed to remain in these drying sheds until the mid-rib of the leaf is thoroughly dry. When this stage is reached, of course the leaves are in such condition that to handle them would mean that many would be ruined through cracking and breaking. For this reason it is necessary to wait for a rainy or foggy day when all of the ventilators are opened wide and the moisture allowed to dampen the tobacco until the leaves are in a pliable condition. Work is pressed rapidly at this time and the tobacco is hurriedly baled in heavy paper wrappers. Each lath of leaves is taken by itself, the leaves pushed together and quickly fastened with the string on which they were sewed. This operation requires practice, as the end of the string is not tied, but so bound among the leaves that it will not loosen in the handling which it undergoes during the curing process. This bundle of leaves called a "hand" is the form in which it is handled throughout the curing process. The bales are pressed only by the weight of the person binding it as he kneels over it to fasten the string.

These bales are hauled to the factory which is situated in the city limits of Belfast and taken directly to the sweat room for final treatment.

This sweat room is a closed room heated by steam pipes which keep the temperature between 85 and 95 degrees F. In this room are several very large trucks which will hold two or three tons of the tobacco. The "hands" are placed carefully in rows across these trucks and shingled over each other in such a way that all but one row of butts of the leaves are covered by the more pliable portion of the leaves. This row of butts coming on the outside of the pile dries out considerably, but when repiled the dry ends are placed in the middle in such a way that they, too, will become properly cured. This pile, as already stated, often contains as high as three tons of the tobacco and in this high temperature and closely covered with heavy blankets the sweating process takes place. A thermometer is placed in the middle of the pile in such a location that it may be drawn out occasionally to determine the temperature of the center of the pile. The sweating is similar to that of a

Drying the leaves of the tobacco plant.

mow of green hay and if allowed to continue for any extended time would result in the natural decomposition of the interior of the mass. When the temperature of the center of the pile reaches 150 degrees F., another truck is rolled alongside and the whole lot is rearranged so that the increase of temperature is stopped to gain gradually in the new position. This sweating process is allowed to continue with frequent re-piling of the crop for about three months. At the end of that time the leaves have a soft, pliable feeling like that of a fine kid leather and in appearance resemble a light brown leather of a thickness less than heavy grade writing paper.

The tobacco may be made into cigars at once, but it is the more common practice to box it up and allow it to remain for about six months or a year, when it may be given its second sweat similar to the first, after which it is considered properly cured.

Before it can be handled by the cigar maker it must be moistened and the liquid used for this purpose is prepared by allowing tobacco stems to soak in water at the temperature of the sweat room. These barrels of stems and water generate considerable ammonia and the liquid itself becomes a dark colored fluid which seems to keep the tobacco in better condition to work than will water alone.

The hands of tobacco are soaked in this liquid and allowed to drain on an especially constructed table which allows the surplus to drain off into a tub. When well drained the hands are unstrung, the tobacco is placed in three grades, and presented to the girls and men who make the cigars. All of the whole leaves are placed by themselves and classed as wrappers. This is the most valued grade and it is the purpose of the grower to get as much of this grade as is possible for here lies the size of his financial return. The second grade is called prime and the poorer one is called stock.

Mr. Smith states that his crop yielded about one ton of commercial product per acre, which he values at $600 per ton. The market price for the different grades is as follows: Wrappers, 50 cents, prime, 14 cents, and stock, 10 cents, per pound. The fact that he is manufacturing the finished product and placing the cigars on the market adds considerable to his total profits.

SPRAYING DEMONSTRATIONS FOR 1913.

Dormant Spraying.

Demonstrations this spring were similar to those of 1912 and have tended to encourage many growers in sections where little or no spraying has been done heretofore. It has been the aim of the Department to carry these demonstrations into sections previously neglected in order that the results may be general rather than local and that the standard of the state may be increased.

We have been fortunate thus far in being invited to orchards where proper methods of pruning and spraying can be fully exemplified and in meeting men who have the necessary energy and enthusiasm, but who lack in knowledge of detail. Such men have carried on and no doubt will continue to carry on the work as it has been explained to them and in a short time will encourage others in their immediate vicinity to do likewise. For the first set of demonstrations, 24 invitations were accepted and meetings were held in 19 of the 24 orchards. Three meetings were prevented by rain, one by small-pox and one by a funeral. Total attendance was 540, making the average attendance 28. The smallest meeting was at Sorrento with 11 present. The largest was at Springfield with 100 present. Three hundred and sixty-three trees were sprayed at a total cost of $14.50 for materials, making the average cost of a tree four cents, not including the labor. The fact that this is larger than last year is due to the increased number of large trees. The greatest number of trees sprayed at one meeting was 40; smallest, 8. In the latter case, no time could be devoted to pruning and the trees while not excessively large, were very thick and contained many dead limbs. In detail, the data of the meetings are:

Six acres of tobacco planted in 1911.

Name.	Address.	Soluble Sulphur.	Trees.	Tone.	Weather.	Pruning.	Attendance.
Dolloff, E. W	Standish	10 lbs.	20	Good	Rain	Old	40
Flint, Walter	West Baldwin	10 lbs.	14	Fair	Fair Windy	Old Young	30
Dyer, Isaac	Gorham	10 lbs.	14	Good	Fair Windy	Old Young	30
Sweetser, F. R	Cumberland Ctr.	3½ gal. L-S.	32	Good	Fair Cloudy	Old	32
Marsh, E. M	Auburn				Rain		
Ricker, Fred	Turner	10 lbs.	18	Good	Fair Windy	Old	31
Curtis, Walter	Litchfield	10 lbs.	18	Good	Fair Windy	Old	31
Cameron, Edith	Union	10 lbs.	18	Fair	Cloudy	Old	20
Harriman, E. F	Liberty				Rain		
Brunberg, Axel	Camden	4 gal. L-S.	17	Fair	Cloudy	Old	16
Robbins, W. K	Hope						
Coombs, C. R	Belfast	10 lbs.	18	Fair	Fair	Old	18
Conant, C. M	Winterport	10 lbs.	25	Good	Cloudy	Old Young	21
Small, Dr. A. M	Freedom	10 lbs.	14	Fair	Fair	Old	63
Patten, R. T	Skowhegan	10 lbs.	14	Fair	Fair	Old	16
Savage, G. W	No. Anson						
Colby, C. B	Norridgewock	10 lbs.	15	Fair	Fair	Old	26
Wing, A. F	Leeds Center	10 lbs.	30	Fair	Fair	Old Young	19
Hill, R. C	Foxcroft	10 lbs.	18	Fair	Fair	Old	19
Smith, Harvey	Plymouth				Rain		
Wilber, L. E	Sorrento	10 lbs.	30	Fair	Fair Windy	Old Young	11
Bickford, F. H	Springfield	10 lbs.	8	Fair	Fair	Old	100
Tilton, Frank S	Charleston	4 gal. L-S	40	Fair	Fair	Young	18

In place of a concentrated solution of lime-sulphur, formerly used, the soluble sulphur, a powdered form of caustic sulphur, was applied. It is much easier to transport, cheaper, and fully as easy to handle. It has given good satisfaction in New York and provided it is as satisfactory in controlling the pests and diseases, is more economical than liquid. It costs $7.50 per 100 lb. barrel and will do the same amount of work as a barrel of liquid which costs from $8 to $9. The Gould Pomona Pump, used the previous season, was again used this year, together with with a new Arlington pump. Both gave very good satisfaction and maintained a pressure from 100 to 150 lbs. with a moderate amount of energy. Cotton hose was also used for the second season and stood up under a pressure of as high as 300 pounds. Nozzles of various types, including some of the aluminum type, were used to demonstrate their good and bad points. We have obtained a large assortment of various sorts and believe that it is of the most fundamental importance that they be given a fair trial, inasmuch as they, more than any other one agency, insure good or poor results on the trees.

On windy days we followed Dr. Whetzel's method of spraying against the wind and are fully in accord with his views upon the matter.

The green aphis were particularly abundant as soon as the leaf buds swelled and proved troublesome throughout the season. The tent caterpillars were out early, many appearing in the last week in April, in sufficient numbers to do a great deal of damage unless cared for. At Sorrento the oyster-shell lice were very abundant and threatened even the large, otherwise vigorous trees. Sulphur and lye had been applied in many places with little effect apparently. Other insects in various forms were prevalent in reduced numbers.

Pruning.

Before the demonstrations in spraying, the time was given over to a demonstration in pruning on trees of all sizes and conditions. Particular attention was given to the thinning out of trees with a heavy crop, so that there was room for more sunshine and better aeration, and at the same time, not enough open space to cause the exposed limbs to suffer from sunscald. This has been a common fault in the "opening up" of old trees and too much stress cannot be placed upon the importance of at least some shade for the limbs.

The desirability of a low, strong frame work was everywhere discussed and whenever possible, exemplified on young trees. The low head is generally discredited because of a lack of understanding as to what constitutes a low head tree. The pruning at the start and the later heading back, and removal of superfluous branches, were thoroughly discussed, to show wherein the general opinion that prevailed was at fault.

The small swivel blade saws were used except in the case of limbs four inches or more in diameter and gave very gratifying results. Their worth cannot be fully appreciated until they have been tried in competition with other saws and the eagerness with which the growers adopted them, once they had seen them work, proved their superiority.

Later Spraying.

In order to show the importance of later applications, second, and in a few cases, third demonstrations were held, as follows:

E. W. Dolloff, Standish, scab and codling moth.

Walter Flint, W. Baldwin, scab and codling moth.

F. R. Sweetser, Cumberland Ctr., scab and codling moth.

Walter Curtis, Litchfield, scab and codling moth.

Axel Brunberg, Camden, scab and codling moth.

Harvey Smith, Plymouth, scab and codling moth.

E. M. Marsh, Auburn, codling moth.

W. K. Robbins, Hope, codling moth.

The attendance at these later meetings was naturally smaller, but many growers found the necessary time to be present. One of the most striking results obtained from the spring spraying was the effectiveness of the dormant spray in the control of the tent caterpillar. In no case did it fail to absolutely control this pest. In this respect it was much better than the arsenate of lead applied at the time the blossom buds were showing pink, for in the latter case a nest was to be found occasionally in the tree. The results obtained from these sprayings have been very satisfactory and the men in whose orchards the demonstrations were carried on are highly enthusiastic over the work.

INSPECTION OF FOREIGN NURSERY STOCK.

Following out the plan adopted last year, this Bureau has coöperated with the Federal Horticultural Board in the control of plant pests and diseases. The inspection of nursery stock from foreign lands is not compulsory, but for the sake of a check on the inspection made in the foreign nurseries and also a check on the permits to import foreign stock, we have considered it a good practice to inspect the plants at the earliest convenience.

While much of this work seems to be of little practical value, one case at least shows the importance of the work. A shipment of French seedlings to Mitchell Nursery Company in Waterville was inspected March 5. On one of these seedlings a winter nest was found. This nest resembled somewhat that of the brown-tail caterpillars, but careful inspection by the Station Entomologist, Miss Edith Patch, showed that it was not a brown-tail nest.

The nest with the little worms still in good condition, after their long trip across the Atlantic, was sent to Washington. Here Dr. Howard, the Chief of the Bureau of Entomology, was unable to name the caterpillars. They were turned over to Dr. Dyer who reared them to the last stage. He was then able to identify them to be Aporia crataegi, a Pierid butterfly, common in Europe. Writing of the Aporia crataegi, Kirby, in his book, "European Butterflies and Moths," states that these moths fly in May and July and he says, "They are common in Europe and Western Asia. The larva is ashy gray, the head black with two reddish-yellow stripes. It lives from autumn to May on various fruit trees and is often very destructive to orchards on the Continent."

This inspection alone may have saved us from a pest nearly, if not quite, as serious as the brown-tail.

Other inspections made during the year are as follows:

Date.	Name.	Location.	No.	Plants.	Country—where grown.
1913					
Apr. 25	George L. Mahoney.....	Saco.........	50	Blue Spruce......	Belgium.
Apr. 25	Porteous, Mitchell & Braun Co............	Portland....	1,000	Roses...........	Holland.
			200	Hydrangea......	Netherlands.
			3,400	Roses...........	
			100	Clematis.........	
			50	Aristolochia......	
			50	Rhododendrons...	
			25	Buxus..........	
Apr. 26	T. Allen & Son.........	Bangor......	214	Roses...........	Germany.
			100	Deciduous shrubs	
			2	Evergreen shrubs	
Apr. 26	Alex. Wallace..........	Portland....	8	Buxus...........	Holland.
			200	Berberis.........	
			50	Ampelopsis......	
			25	Aristolochia......	
Mar. 5	Mitchell & Co..........	Waterville...	40,000	Fruit tree stock..	France.
May 12	Bernard Norris.........	Bar Harbor..	72	Rose plants......	Ireland.
May 29	Mt. Desert Nursery.....	Bar Harbor..	2	Fruit trees.......	England.
			1	Grape vine.......	
			100	Shrubs..........	
May 29	Mrs. Alanson Tucker....	Bar Harbor..	15	Roses...........	Ireland.
May 31	Alexander Wallace......	Portland....	4	Bay trees........	Belgium.
	Adam Sekenger........	Bangor......	220	Shrubs..........	Belgium.
Oct. 14	Alexander Wallace......	Portland....	65	Azaleas..........	Belgium.
			10	Hexe............	
Oct. 20	E. Saunders............	Lewiston....	150	Azaleas..........	Belgium.
			124	Azaleas..........	
Oct. 24	Goddard's Greenhouses..	Portland....	150	Azaleas..........	Belgium.
Oct. 24	Niles Nelson...........	So. Portland.	65	Azaleas..........	Belgium.
			156	Azaleas..........	
Oct. 25	Adam Sekenger........	Bangor......	233	Azaleas..........	Belgium.
Oct. 28	F. G. Danforth.........	Skowhegan..	40	Azaleas..........	Belgium.
Nov. 4	Kennebec Greenhouses..	Bath........	102	Azaleas..........	Belgium.
Nov. 8	L. C. Goddard..........	Portland....	200	Azaleas..........	Belgium.
			125	Azaleas..........	
Dec. 9	....	....	12	Azaleas..........	Holland.
			30	Rhododendrons...	
Dec. 12	E. E. Davis............	Rumford....	36	Azaleas..........	Belgium.
Dec. 24	Thomas Pegler.........	Brunswick...	105	Azaleas..........	Belgium.
Dec. 31	E. Saunders............	Lewiston....	12	Lilacs...........	Holland.
			50	Spirea...........	

APPLE PACKING AND GRADING LAW.

Among the important agricultural laws enacted by the last legislature was the apple packing and grading law. It marks the successful termination of a long continued struggle for an adequate means to prevent misbranding and dishonesty in packing apples. This measure was due mainly to the work of the Pomological Society, particularly its president, H. L. Keyser. His tireless and indefatigable efforts in behalf of this bill stand as an inspiration to the growers of this state. That it will prove a distinct advantage to Maine fruit and Maine growers, there is little doubt, for even with one year's trial a difference can be felt for the better. The work of the fruit inspectors is discussed elsewhere. The law is as follows:

PUBLIC LAWS OF 1913. CHAPTER 156.

An Act to regulate the packing, shipping and sale of apples.

Section 1. The standard barrel for apples shall contain seven thousand cubic inches, provided however that a barrel of the following dimensions when measured without distention of parts: Length of stave, twenty-eight and one-half inches; diameter of head, seventeen and one-eighth inches; distance between heads, twenty-six inches; circumference of bulge not less than sixty-four inches outside measurement, shall be a lawful barrel. The standard bushel box for apples shall contain two thousand three hundred and fifty cubic inches. Provided, however, that a box eighteen inches by eleven and one-half inches by ten and one-half inches, inside measurement, without distention of parts, shall be a lawful bushel box.

Section 2. The standard grades for apples when packed in closed packages shall be as follows:

First. Fancy shall consist of apples of one variety above the average size and color for the variety, and none smaller than two and one-half inches in diameter, sound and free from worm holes, bruises, scab or any other defect that materially injures the appearance or useful quality of the apples, and shall be properly packed in clean, strong packages.

Second. Number one, or class one, shall consist of well matured apples of one variety of normal shape and good color for the variety, not less than two and one-quarter inches in diameter, sound and free from all defects such as worm holes, bruises, scab or any other defect that materially injures the appearance or useful quality of the apple, and shall be properly packed in clean, strong packages.

Third. Number two or class two, shall consist of well matured apples of one variety, not less than two inches in diameter, of medium color for the variety and normal shape. Apples two and one-quarter inches in diameter or less, must be sound. Apples more than two and one-quarter inches in diameter may have one defect such as a worm hole or a bruise if the skin is not broken and shall be properly packed in clean, strong packages.

Fourth. Unclassified. Apples not conforming to the foregoing conditions as to variety, size and other conditions, shall be classed as Unclassified.

Section 3. Every closed package of apples which is packed, sold, distributed, transported, offered or exposed for sale, distribution or transportation in the state by any person shall have affixed in a conspicuous place on the outside thereof a plainly printed statement clearly and truly stating the size of the package in terms of standard bushel box or standard barrel, the name and address of the owner or shipper of the apples at time of packing, the name of the variety, the class or grade of the apples contained therein, and if the apples were grown in Maine that fact shall be plainly designated.

Section 4. It shall be unlawful for any person within this state to pack, sell, distribute, transport, offer or expose for sale, distribution, or transportation, apples which are adulterated or misbranded within the meaning of this act.

Section 5. For the purpose of this act apples packed in a closed package shall be deemed to be adulterated if their measure, quality, grade or purity do not conform in each particular to the claims made upon the affixed guaranty.

Section 6. For the purpose of this act apples packed in a closed package shall be deemed to be misbranded:

First. If the package fail to bear all statements required by section three.

Second. If the package bear any statement, design or device regarding such article or its contents which shall be false or misleading in any particular, or which is falsely branded in any particular.

Section 7. The commissioner of agriculture shall make uniform rules and regulations for carrying out the provisions of this act.

Section 8. The commissioner of agriculture, in person or by deputy, shall have free access, ingress and egress at all reasonable hours to any place or any building wherein apples are packed, stored, transported, sold, offered or exposed for sale, or for transportation. He shall also have power, in person or by deputy, to open any box, barrel or other container, and may, upon tendering the market price, take samples therefrom.

Section 9. When the said commissioner of agriculture becomes cognizant of the violation of any of the provisions of this act he shall cause notice of such fact, together with a copy of the findings, to be given to the person concerned. The person so notified shall be given an opportunity to be heard under such rules and regulations as may be prescribed by said commissioner of agriculture. Notices shall specify the date, hour and place of the hearing, said hearing to be held in the county where said inspection is made.

Section 10. Any person who adulterates or misbrands apples within the meaning of this act, or any person who packs, sells, distributes, transports, offers or exposes for sale, distribution or transportation, apples in violation of any of the provisions of this act, shall be punished by a fine not exceeding one hundred dollars for the first offence, and by a fine not exceeding two hundred dollars for each subsequent offence.

Section 11. No person shall be prosecuted under the provisions of this act when he can establish a guaranty signed by the person from whom he received such articles, to the effect that the same is not adulterated or misbranded, within the meaning of this act, designating it. Said guaranty, to afford protection, shall contain the name and address of the party or parties making the sale of such articles to said dealer, and in such case said party or parties shall be amenable to the prosecutions, fines and other penalties which would attach, in due course, to the dealer under provisions of this act.

Section 12. The word "person" as used in this act shall be construed to import both the plural and the singular, as the case demands, and shall include corporations, companies, societies and associations. When construing and enforcing the provisions of this act, the act, omission, or failure of any officer, agent, or other person acting for or employed by any corporation, company, society, or association, within the scope of his employment or office, shall in every case be also deemed to be the act, omission, or failure of such corporation, company, society, or association as well as that of the person.

Section 13. There shall be appropriated from the state treasury the sum of fifteen hundred dollars for the year nineteen hundred thirteen and the sum of fifteen hundred dollars for the year nineteen hundred fourteen for the purpose of carrying out the provisions of this act. So much of said appropriations shall be paid by the state treasurer to the commissioner of agriculture as may be shown by his bills and vouchers of expenditures in performing the duties required by this act.

Section 14. The commissioner of agriculture shall diligently enforce all of the provisions of this act, and, in this connection, he shall be entitled to have and receive the advice, counsel and assistance of the attorney general and of the attorney for the state in the several counties.

The said commissioner of agriculture in his discretion may recover the penalties for the violation of the provisions of this act in an action on the case in his own name, the venue to be as in other civil actions, and the plaintiff prevailing in any such action shall recover full costs; or he may prosecute violators by complaint or indictment in the name of the state, and such prosecution shall be commenced in the county in which the offense was committed. All fines received under this act by county treasurers shall be paid by them to the state treasurer.

Trial justices and municipal and police courts are hereby invested with original jurisdiction, concurrent with the supreme judicial and superior courts, to hear, determine, enter, and by appropriate process enforce judgment in actions commenced for the recovery of the penalties aforesaid, and to try, and upon conviction, to punish, for offenses against the provisions of this act.

Section 15. All acts or parts of acts inconsistent herewith, are hereby repealed.

Approved April 1, 1913.

NURSERY AGENTS.

Two important measures were passed at the last session of the legislature in regard to nursery stock and nursery agents. The first is an amendment to section 5 of chapter 15 of the Public Laws of 1907. The section as amended reads as follows:

"Sec. 5. Any transportation company that shall bring into this state any nursery stock, such as trees, shrubs, vines, cuttings or buds, or any transportation company, owner or owners of nursery stock or persons selling nursery stock, as thus defined, who shall transport such stock or cause it to be transported within the state the same not having attached to each box or package an unexpired official certificate of inspection or an affidavit of fumigation which shall meet the requirements specified in section two of this act, shall be guilty of a misdemeanor and on conviction thereof be subject to a fine not exceeding one hundred dollars for each offence.

And said transportation companies shall immediately upon receiving consignments notify the commissioner of agriculture of the fact that such consignments are in their possession, or en route to some point within the state, and give the names and addresses of the consignor and consignee, destination of each shipment, the name of the transportation company bringing such stock, and the road or roads over which it is brought; and shall also make such further report relative to such shipments as the commissioner of agriculture may from time to time require. (Samples of notices will be sent on application.)"

Through this amendment it will be possible to accomplish two results: First, a check upon the nurseries sending stock into the state; and second, a check upon the nursery agents who have made the sales. Many notices have already been received from the railroads and with the spring shipments the number will be greatly increased. Heretofore, we have had no means whereby we could ascertain desired information along these lines. The plan has already worked successfully in New York and some of the other eastern states.

After losing a case of the State vs. Staples, an agent selling nursery stock without a license in York County, it was necessary to so construct the law regarding agents that there might be no question as to its validity. Much time was spent in drawing up this law, which is as follows:

Sec. 6 of chapter 15 of the Public Laws of 1907, as amended by chapter 34 of the Public Laws of 1909, chapters 84 and 176 of the Public Laws of 1911, and chapter 120 of the Public Laws of 1913.

"No person, firm or corporation, excepting growers, shall engage in, continue in, or carry on the business of selling or dealing in nursery stock, or solicit purchases of nursery stock within this state, either as owner thereof, or as agent of such owner, without first obtaining a license to carry on and conduct such business in this state. The form of license shall be prescribed by the state horticulturist, and the license shall be issued by him upon proper application therefor, and shall run one year from date of issue. The license fee shall be five dollars ($5.00) per annum for agents, dealers, salesmen or solicitors. The license shall be issued in the name of the dealer, solicitor, salesman or agent, as the case may be, and no license shall be assigned or transferred. Licenses of salesmen, dealers, agents, or solicitors shall show the name and location of nursery and place of business of the nursery men or tree dealers whom they represent or from whom they purchase their stock. Fees obtained from such licenses shall be paid into the state treasury and added to the appropriation of the bureau of horticulture, and shall be used exclusively for the inspection of nursery stock introduced into the state of Maine from outside the state of Maine. Such license may be revoked at any time for failure to comply with aforesaid requirements, or for such other causes as may in the opinion of the commissioner of agriculture be deemed sufficient. Any violation of these requirements shall be punishable by a fine of not less than ten nor more than fifty dollars for each offense.

For the purpose of this act the term nursery stock is hereby applied to all fruit and ornamental trees, shrubs and vines, and includes currant, gooseberry, blackberry and raspberry bushes, also strawberry plants."

No licenses were issued from January 1st up to July 12th, when the new law came into effect. We have every reason to believe that this law will not be contested by the American Association of Nurserymen, in that the features which were undesirable in the old law have been remedied. A license fee still continues, though reduced fifty per cent, in order to cover a part of the expenses entailed in the inspection of incoming stock. It is in no sense a tax. No evidence has been obtained thus far of illegal selling, but it is probable that cases will come up after the spring shipments. The bill had the support of many of the most prominent agents in the state and there is no reason why it should not prove successful.

The following is a list of the agents licensed from July 12, 1913 to December 31, 1913:—

Name.	Address.	License Expires.
Barker, George	Presque Isle	July 12, 1914
Campbell, John C	Steuben	October 27, "
Candage, H. A	Rockland	July 25, "
Cannon, S. T	Augusta	August 11, "
Daggett, Lee	Strong	July 12, "
Davis, Albert C	South Paris	August 22, "
Dudley, Frank H	Auburn	July 22, "
Dyer, Alden	Franklin, R. F. D	August 18, "
Eaton, Samuel H	Oxford	July 12, "
Ellis, Mrs. Nellie	Winslow	August 6, "
Farnham, Mark	Wells	August 14, "
Fleming, Joseph A	Grand Lake Stream	August 1, "
Fox, A. N	South Berwick	September 12, "
Gilman, H. W	South Berwick	July 12, "
Hale, Herbert H	South Bluehill	July 28, "
Hall, F. A	Sebec Village	October 14, "
Huntress, Sarah L	South Berwick	September 5, "
Jellison, Ellis S	Biddeford	September 10, "
Kennedy, Jeremiah H	Phillips	August 29, "
Knight, Edwin W	Lovell	July 29, "
McCabe, Geo. C	Bangor	July 12, "
McCabe, John C	Bangor	August 6, "
McCabe, Robert F	Bangor	July 25, "
Merrill, James	Augusta	July 12, "
Norris, H. L	Winthrop, R. F. D	November 25, "
Norton, A. D	Farmington	September 20, "
Norton, Mrs. A. D	Farmington	July 12, "
Perkins, Fred B	Sherman Mills	July 12, "
Pinkham, Mrs. H. F	Boothbay Harbor	September 6, "
Prescott, Emery	Etna	July 12, "
Roberts, James A	East Waterboro	August 4, "
Savage, J. A	Skowhegan	July 21, "
Savage, J. Frank	Wiscasset, R. F. D. 2	September 5, "
Sawyer, C. L	Westbrook	November 4, "
Schwartz, E. A	West Kennebunk	July 25, "
Simmons, G	North Jay	September 3, "
Smith, Isaac T	Strong	August 18, "
Staples, Nicholas	West Kennebunk	July 18, "
Sterry, Walter	Starks	July 12, "
Tash, Geo. W	New Vineyard	July 12, "
Victory, A. W	Houlton	July 12, "
White, James W	Ludlow	July 12, "
Whitney, Geo. M	Woodfords, R. F. D. 2	July 12, "
Wiggin, Clarence S	Waterford	December 2, "
Williams, Fairfield	Solon, R. F. D	July 31, "
Wood, E. L	Unity	October 20, "

APPLE SHIPMENTS, 1912-13.

After several years' trial to estimate the apple crop through data collected from growers in various sections of the state, we decided that such figures as we were able to get together were of little real value in that they were not an actual index of the amount of fruit produced or shipped. In order to find the exact amount of fruit shipped during the season of 1912-13 cards were sent to the agents at the different railroad stations and to the representatives of the different steamship lines asking that they furnish the Department with the monthly shipments at those points from the first of September, 1912, until the first of August, 1913. Replies were received from most of these agents, and the general offices were kind enough to furnish the total amounts shipped over their lines. The following are the data received from them:

Bangor and Aroostook Railroad	4,160	barrels.
Boston and Maine Railroad	6,425	"
Bridgton and Saco River Railroad	26,614	"
Canadian Pacific Railroad	38	"
Georges Valley Railroad	9,920	"
Grand Trunk Railroad	102,634	"
Maine Central Railroad	436,137	"
Sandy River and Rangeley Lakes R. R.	7,178	"
Eastern Steamship Company	25,141	"
Total shipments	618,247	

Of the local shipments Monmouth heads the list with 24,114 barrels; Auburn was second with 23,868; Buckfield was third with 23,020; West Paris, fourth, with 22,181; Norway, fifth with 21,360, and so on down to the towns where only a single barrel was sent. With these figures we have accurate data as a basis from which we can make fairly close estimates of the following crop. It was generally considered that last year's crop was about 60 per cent of a normal crop, as we term it, so that a normal crop should be in the vicinity of 1,000,000 barrels. The present season's crop was not over one-half of that of last year, but inasmuch as prices are much more favorable a larger per cent of the entire crop produced will in all probability be shipped. It is safe to estimate a shipment of 300,000 barrels for Maine for the season of 1913-14. The early reports from other sections showed that the decrease in production corresponded very closely with our own, especially in the winter varieties. Only two states in New England, namely Rhode Island and Connecticut, showed an increase over last year, and Illinois was the only big fruit producing state which showed any great increase. The Canadian apples, with which we come into closest competition in our foreign shipments, were about the same as last year.

GRADING MACHINE.

With the increased interest over the entire country in fruit sorting machines, it was considered wise, by the Department, to buy a machine and give the fruit growers in the state an opportunity to see for themselves the advantage of such apparatus.

The type of machine decided upon was the Schellenger Fruit Sorter. This machine is being used in the West with especial success and promises to be a valuable asset to the large fruit producer.

The plan which was adopted to get this machine before the largest possible number of growers was to hold public demonstrations with some of the active fruit growers' associations. As the machine itself was very bulky and required some sort of engine power to operate it, it was not practical to hold a long series of demonstrations. Two such meetings were held, one with the Oxford Bears Fruit Growers' Association at the farm of John D. Long, Buckfield, and the other at the farm of Harry Bearce, Hebron, with the coöperation of the newly formed Indian Head Fruit Growers' Association.

These meetings, coming as they did in the height of the picking season, did not have a very large attendance, although about 125 different ones saw the machine work at these two places. It was the purpose to show the machine in actual operation with full crew and this was done in both places in such a way that the apples as they came from the orchard were emptied on to the machine and kept moving until ready for the car. The crews, while never having worked with such a machine before, did good work. With the large handicap of inexperience all those who worked in the packing crews pronounced the machine a practical thing for the men who are handling apples on a large scale.

A final demonstration was held at intervals during the annual meeting of the Pomological Society at Lewiston City Hall. Here hundreds had an opportunity to see the principle of the machine, although it was impossible to show how efficient it was when a crew of men were filling the various stations.

The grader, while not removing wormy or blemished fruit, grades the fruit to size accurately and rapidly. All poor apples are removed at the feeding tray before the fruit enters the machine. The operator at this station needs practice to do the work efficiently, as every motion of hand and eye must be made to count.

The Department was not equipped to store so bulky a machine, so it was sold to the highest bidder. The purchaser was E. E. Page of Corinth, Maine. Mr. Page owns a number of large orchards in Penobscot County and he proposes to use this grader when he packs his fruit next fall.

NEW ENGLAND FRUIT SHOW.

Since the first Fruit Show in Boston in 1909, Maine has taken a less conspicuous part each year. This is particularly true this year because the interstate competition of 100 boxes and 20 barrels has been discontinued. Shipments from Maine, especially those sent by express, have never been in the best of condition upon arrival at the Exhibition Building. It is out of the question to ship a quantity of fruit in barrels to be packed in boxes at the Hall, inasmuch as the time and space are too limited. Consequently Maine growers have been more or less hesitant in sending their fruit to this show to enter into competition with that of the other New England states more favorably located. Much of the Connecticut fruit, as well as that of Massachusetts, Rhode Island and New Hampshire, can be sent to Boston on auto trucks, a great advantage for them. Maine growers also feel that little is to be gained in entering fruit at this show, in that the advertisement that they obtain from it is not sufficient to warrant the extra work entailed in preparing it. To some extent this may be true, but if we are to appropriate money in the interest of this exhibition we should see that a better representation is made in the future than has been the case for the last two years. There is no question but that we can take away a great many more prizes than we have heretofore, if we will but take the time to properly sort and pack the fruit. This is especially true in the case of such varieties as the Spy and Gravenstein, particularly the former, in which class, as a general thing, there is not very much competition. This year the Governor's cup for the State of Maine for the best exhibition of Spy apples was not competed for, and it is very much to the discredit of our growers that this is so. The attendance at the show this year was small and it might be well to transfer the next meeting to some other city where a larger attendance could be had; otherwise new features must be introduced in order to make it more attractive to the people of Boston.

The following is a list of prize winners from Maine:

WILSON H. CONANT.

$25 00	for the best barrel of Northern Spy	Class	C	Sec.	4
5 00	for the best plate of Northern Spy, group 1	Class	D	Sec.	517
4 00	for the best plate of Fall Pippin, group 2	Class	D	Sec.	522
10 00	for the best five varieties from group 1, group 6	Class	D	Sec.	591
10 00	for the third best barrel Baldwins	Class	G	Sec.	1
25 00	for the best barrel Northern Spy	Class	G	Sec.	2
10 00	for the best bushel box Baldwins	Class	G	Sec.	4a
$89 00					

F. E. WHITING.

$3 00	for third best plate of Gravenstein, group 1	Class	D	Sec.	515
2 00	for second best plate of Pound Sweet, group 3	Class	D	Sec.	553
50 00	for the best 5-bushel boxes from Maine	Class	G	Sec.	3
10 00	for the best bushel box of Gravenstein	Class	G	Sec.	4b
$65 00					

H. L. CONANT.

$4 00	for the best plate of Fameuse, group 2	Class	D	Sec.	523
2 00	for the second best plate Tallman Sweet, group 3	Class	D	Sec.	558
25 00	for the best barrel of Baldwins from Maine	Class	G	Sec.	1
$31 00					

CLEMENT AND TAYLOR.

$15 00	for second best barrel of Roxbury Russets	Class	C	Sec.	6
1 00	for fifth best plate of Roxbury Russets, group 1	Class	D	Sec.	519
4 00	for the best plate of Yellow Bellflower, group 2	Class	D	Sec.	534
3 00	for the best plate of Opalescent, group 3	Class	D	Sec.	550
$23 00					

W. G. CONANT.

$2 00	for third best plate of Wagener, group 2	Class D	Sec. 536
2 00	for second best plate of Bailey Sweet, group 3	Class D	Sec. 537
1 00	for third best plate of Blue Pearmain, group 3	Class D	Sec. 539
2 00	for second best plate of Rolfe, group 3	Class D	Sec. 554
1 00	for second best plate of Pewaukee, group 4	Class D	Sec. 576
6 00	for second best box of McIntosh Red	Class G	Sec. 4c
6 00	for second best box of R. I. Greening	Class G	Sec. 4e
$20 00			

H. G. BOWMAN.

$15 00	for the second best barrel Baldwins	Class G	Sec. 1

ESTES NICHOLS.

$15 00	for third most attractive retail package	Class F	Sec. 1

E. E. CONANT.

$2 00	for the best plate of Black Oxfords, group 4	Class D	Sec. 565
10 00	for the best bushel box McIntosh Red	Class G	Sec. 4c
$12 00			

CHASE FARM.

$1 00	for fifth best plate R. I. Greenings, group 1	Class D	Sec. 518
10 00	for the best bushel box R. I. Greenings	Class G	Sec. 4e
$11 00			

HARRY W. LITTLEFIELD.

$2 00	for the second best plate Shiawassee, group 3	Class D	Sec. 555
2 00	for the best plate of Alexanders, group 4	Class D	Sec. 561
2 00	for the best plate of Wolf River, group 4	Class D	Sec. 585
$6 00			

LYMAN K. LEE.

$2 00	for second best plate Blue Pearmain, group 3	Class D	Sec. 539
2 00	for second best plate of Mildings, group 3	Class D	Sec. 547
$4 00			

FRANKLIN PIERCE.

$3 00	for the best plate of Mildings, group 3	Class D	Sec. 547

C. W. CUMMINGS.

$2 00	for third best plate of Yellow Bellflower, group 2	Class D	Sec. 534

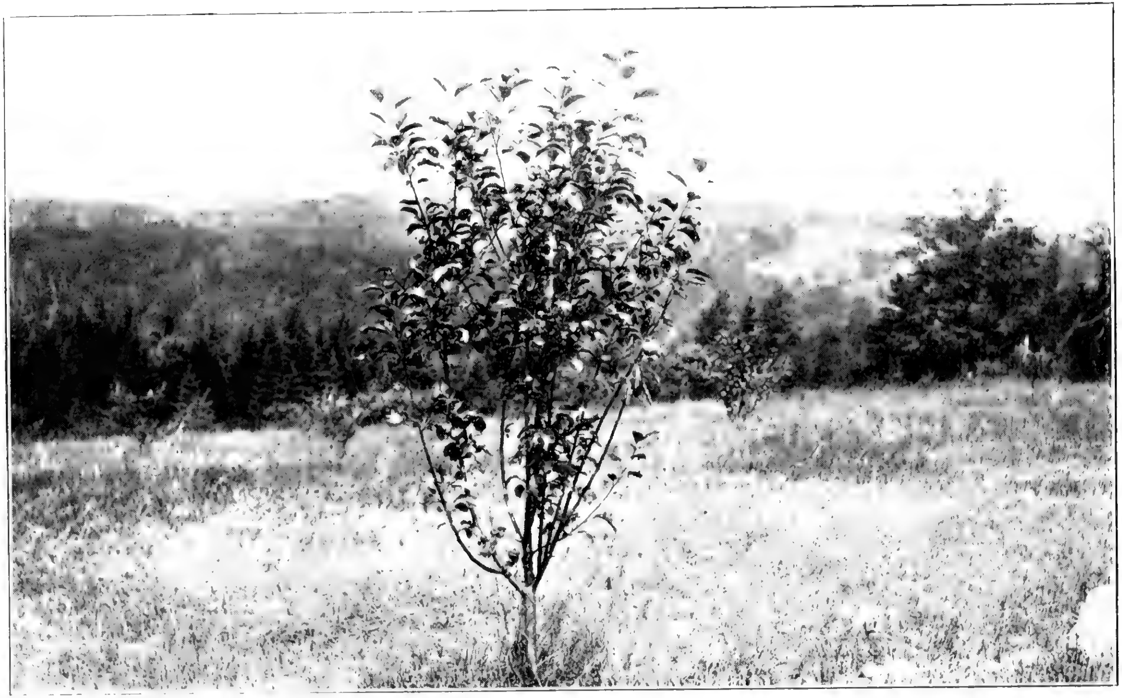
OXFORD BEARS FRUIT GROWERS' ASSOCIATION.

$35 00	for the best plate exhibit by any Grange or Association in New England, group 5	Class D	Sec. 588
$331 00	Total prizes won by Maine exhibitors.		

GREGORY ORCHARDS.

This year we attempted to visit all of the Gregory orchards but were unable to do so because of the short season available for this work. A score card was made out, allowing points for pruning, spraying, size of trees, general appearance, etc., and each orchard visited was scored according to this card. A larger part of these orchards scored over 800 points on the basis of 1,000, and those that did not are practically eliminated from the contest, in that they could not in a single season gain sufficiently to overcome the lead of the others. This may be of some importance to the judges if they wish to take our figures, and will save time and money in visiting these orchards. The highest scoring orchards were in the vicinity of 960 points, usually Stark or McIntosh, and well scattered throughout the belt of the contest. The orchards are to be scored in the summer of 1914 and the prizes awarded in the fall. The second contest will begin in the spring of 1915 and it is of the greatest importance to those who are planning to enter that they have their land in proper condition. Cropping in 1914 will undoubtedly help in the early growth of the young trees. Orders to the nurserymen should be forwarded in season to secure good stock and it might be well to state that the trees are to go into competition and that it will be good business for the nurseryman who furnishes the winners.

The competition between the first thirty orchards of the present contest promises to be very keen and there will probably be more or less disappointment when the prizes are awarded. It is hoped, however, that such contestants will show the right spirit and not criticise the work of the judges too harshly, but will enter the next contest with greater enthusiasm and a resolve to do better work. Those whose orchards have been more or less unsuccessful should not be discouraged for in most cases their troubles were such as could be remedied by a more thorough understanding of orchard culture. From the hundred reports received some tabulations have been made showing the methods employed and the costs of operation. These are given in detail as follows:



Bearing Spy Tree, W. Minot, two years set.

STATISTICS.

Variety, as per Report of 1911.

Stark	51
McIntosh	46
Baldwin	27
Wolf River	18
Wealthy	16
Spy	16
Tallman Sweet	12
King	10
Gano	10
Gravenstein	7
Delicious	6
Scattering	

Pruning 100 Orchards to Date.

Some pruning done	76
No pruning done	24

Spraying.

No. of Applications.	1.	2.	3.	4.
Lime-sulphur	14	19	1	
Arsenate of lead	26	6	1	
Pyrox	6	3		
Tobacco	3	2		
Soap	4	1		
Kerosene	4			
Nicotine	3			
Soluble sulphur	2			
Bordo lead	1			
Bordeaux mixture	4			

Fertilizer.

Commercial	38
Manure	26
Both	13
Not any	23

Cultivation.

Truck crop	43
Hay	14
Dug around	13
Mulch	10
Grain	8
Clean cultivation	6
Cover crop	2
Poultry	1
No method reported	3

Trees Reset.

Unknown	124
Winter-killed	35
Mice	30
Snow	8
Borers	8
Neglect	5
Hail	3
Mechanical	1
Wind	1
Drouth	1

Insect Pests.

Brown-tail moth	59
Green aphis	27
Borers	9
Orchard tent caterpillar	8
Woolly aphis	4
Gypsy moth	2
Oyster-shell bark louse	2
Red-humped caterpillar	1
Bud moth	1
Leaf roller	1

Mice Protection.

Tarred paper	23
Wire	26
Tramped snow	3
Paper	3
Banked dirt	2
Paint	1
Veneer	1
Laths	1
Not any	40

Borer Protection.

Cutting out	22
Wire	8
Tarred paper	3
Soap	1
Paper	1
Paint	1
Tobacco dust	1

Amount of Fruit.

One apple	2
Two apples	2
Three apples	2
Four apples	2
Five apples	1
One peck	2
Half bushel	1
Bushel	1
Six quarts of cherries	1

COSTS PER ACRE.

Pruning.

Highest	$10 00
Lowest	25
Average	1 08
Popular—19 growers	50

Spraying.

Highest	$10 00
Lowest	30
Average	2 06
Popular—12 growers	1 00

Fertilizer.

Highest	$10 00
Lowest	53
Average	3 26
Popular—7 growers	2 00

Cultivation.

Highest	$15 00
Lowest	40
Average	3 60
Popular—9 growers	2 00

Mulch.

Highest	$25 00
Lowest	50
Average	6 09
Popular—2 growers	4 00

Grafting.

Highest	$ 60
Lowest	25
Average	41

Insect Protection—Other Costs.

Highest	$4 70
Lowest	15
Average	1 36
Popular—8 growers	1 00

ACKNOWLEDGMENTS.

I wish at this time, Mr. Commissioner, to express my deep appreciation of your assistance and consideration at all times during the year. The different members of the Experiment Station, College of Agriculture and Department of Agriculture have at all times rendered hearty coöperation.

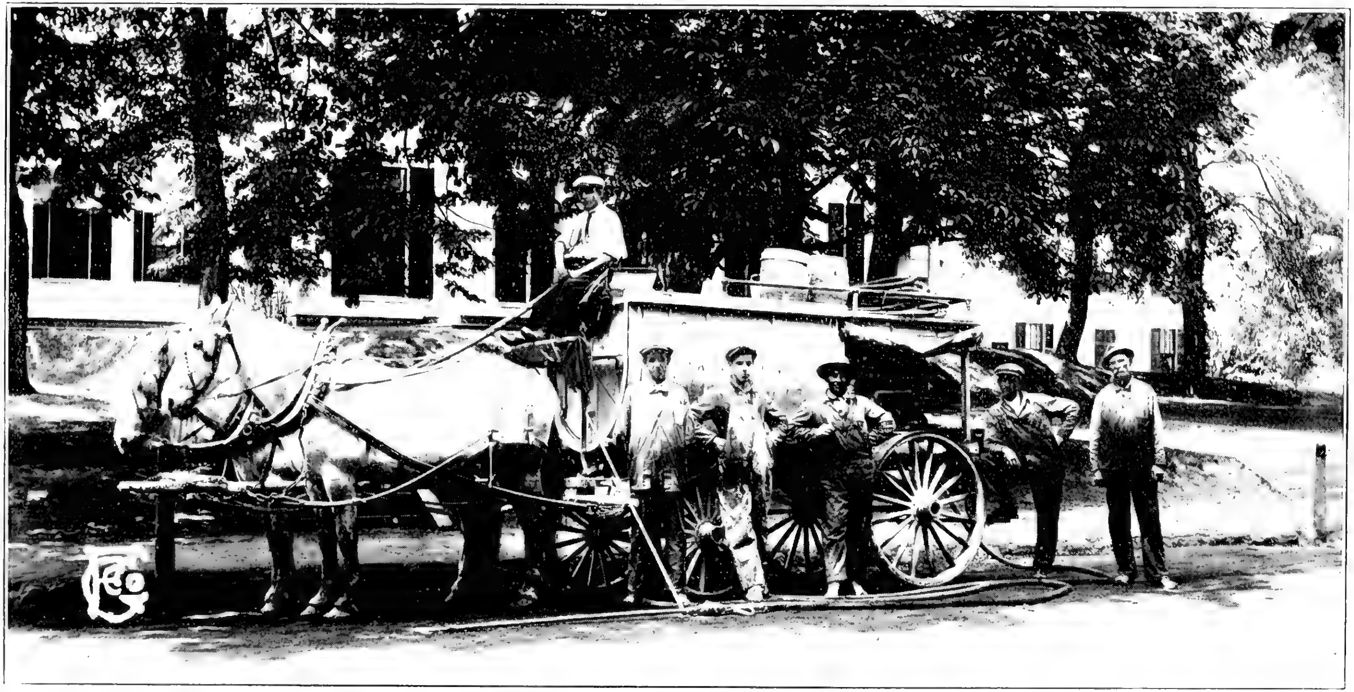
Mr. Sweetser, who has shared the work equally, has ever proven his ability by his earnest and zealous attention to the best interests of the Bureau and growers.

Respectfully submitted,

A. K. GARDNER,

Horticulturist.

Bureau of Horticulture.



A "Solid Stream" Sprayer equipped for work.

REPORT OF THE SPECIAL FIELD AGENT IN CHARGE OF GYPSY MOTH WORK, 1913.

To the Hon. John A. Roberts, Commissioner of Agriculture:

I herewith submit my annual report as field agent in charge of gypsy moth work for the year 1913.

The most discouraging feature of the gypsy moth situation is the increase of infested territory. At the close of the year 1912 the field agent reported 85 towns infested. At the present time the known area comprises 171 towns located in 13 different counties, and as yet the actual limits of the district infested with the gypsy moth are not known, and they will not be determined until such time as a more thorough examination of the outlying towns is made by the trained scouts of the United States Government.

This condition is due to the fact that the appropriations have not been large enough to properly carry on the work and I would advise the changing of the present policy to one of education of the people of the state to handle their own infestations and to the development of parasites for both the gypsy and brown-tail moths.

In order to carry out the present methods of suppression of the moth a very large sum of money would be necessary; so large, in fact, that it would be excessive for the state to raise such for this work. From my experience in this work I believe that we would get better results by educating the property owner to care for his trees and in the development of parasites. Massachusetts has expended 10,000,000 dollars in the moth work. This is a large sum of money. Massachusetts is a rich state and is able to expend such a sum of money for such a purpose, but for Maine, the prospect would be ruinous. Hope must be placed in the development of parasitic enemies, education of the people as to the proper methods in handling the insect, and the purchase of high power spraying machines by the different towns. This is by far the cheaper method of handling the work by the towns, both for the gypsy and brown-tail moths. With a high power spraying machine in each town the work can be done much more satisfactorily than by any other methods. These same high power machines which usually have a tank capacity of 400 gallons and a sufficient power to maintain a pressure of 300 pounds at the end of a 1,500 foot length of 1 inch hose, can be used to great advantage by the towns for fires, both in the woodlands and in the residential sections. They can be adjusted to spray directly from the brook, pond or tank, so that they are adaptable for service when other equipment would be useless.

In the orchard the gypsy moth is readily controlled by painting the egg masses with creosote in winter and by spraying the trees with arsenate of lead, 5 pounds to 50 gallons of water, in the early spring when the eggs are hatching. Where this is done very little trouble results from the caterpillars.

THE WORK OF THE YEAR.

Owing to the lateness of the appropriation, which caused delay in starting the work in the field, it was impossible to cover more than a small portion of the infested region, but an attempt was made to destroy as many egg clusters as possible in the towns of Kittery, York, Eliot, South Berwick, Wells and Kennebunk before the caterpillars began to crawl. Crews were started in these towns on the first of April and the scouting continued until the eggs hatched. It did not seem wise to expend too much of our appropriation in scouting new territory while in the towns mentioned above there was an opportunity to destroy egg clusters by the hundreds of thousands, and thus relieve the people of such towns from caterpillar annoyance and great damage to woodlands and orchards as well as to lessen the liability of spread to the other towns to the eastward.

As soon as the eggs hatched and the caterpillars began to crawl spraying was begun and continued until the latter part of July with excellent results. In the spraying operations we used eight and one-half tons of arsenate of lead and millions of caterpillars were destroyed. As soon as the brown-tail had pupated I began putting on burlaps. These burlaps were very carefully attended by the men during the caterpillar season. 102,000 trees were burlapped and 978,000 caterpillars were taken from under the burlap bands and destroyed. Many caterpillars were destroyed by the burning of stone walls and rock piles. Forest fires in the towns of York, Kittery, Eliot and Wells have destroyed many thousand caterpillars.

Owing to lack of funds the work stopped on August 25, and the men were given a vacation until October 15, when the scouting work was again taken up and continued and is now being carried on. During the scouting operations 903,173 egg clusters were found and destroyed in the towns of Kittery, York, Eliot, South Berwick, Wells, Kennebunk, Sanford, Portland, South Portland, Westbrook, Brunswick and Oxford. In this work 400 gallons of creosote were used in painting the egg clusters.

The state has added to its field equipment this year a high power spraying machine. With this machine results have been very gratifying in the towns of Kittery, Eliot and South Berwick, where it was used during the year. At the present time, York, Wells, Kennebunk and Saco have power spraying machines which take care of the post road from Kittery to Scarboro by spraying, and never in the history of the work against the gypsy and brown-tail moth have the trees along the highway or post road been in such good condition as at the present time. Sanford, Yarmouth and Auburn also have power machines which are being used to good advantage and without any doubt a great many more towns will purchase machines this coming year.

The following list shows the towns now infested with the gypsy moth: Total, 171 towns.

Androscoggin County.

Auburn	Lewiston	Minot
Durham	Lisbon	Poland
East Livermore	Livermore	Webster
Greene		

Cumberland County.

Baldwin	Gray	Raymond
Bridgton	Harpswell	Scarboro
Brunswick	Harrison	South Portland
Cape Elizabeth	Naples	Standish
Casco	New Gloucester	Westbrook
Cumberland	North Yarmouth	Windham
Falmouth	Otisfield	Yarmouth
Freeport	Portland	Sebago
Gorham	Pownal	

Franklin County.

Chesterville	Jay	New Vineyard
Farmington	New Sharon	Wilton

Hancock County.

Brooksville	Ellsworth	Southwest Harbor
Bucksport	Orland	Tremont
Castine	Mt. Desert	

Kennebec County.

Belgrade	Hallowell	Rome
Benton	Manchester	Sidney
China	Mt. Vernon	Waterville
Clinton	Oakland	Wayne
Fayette	Pittston	Winslow
Gardiner	Readfield	Vienna

Knox County.

Camden	South Thomaston	Vinalhaven
Rockland	Thomaston	Warren
Rockport	Union	

Lincoln County.

Alna	Edgecomb	Westport
Damariscotta	Newcastle	Whitefield
Dresden	Nobleboro	Wiscasset

Spraying by the "Solid Stream" method.

Oxford County.

Albany
Bethel
Buckfield
Canton
Denmark
Dixfield
Fryeburg
Greenwood
Hanover
Hartford
Hebron
Hiram
Lovell
Norway
Oxford
Paris
Peru
Porter
Rumford
Sweden
Stoneham
Sumner
Waterford
Woodstock

Penobscot County.

Bangor
Brewer
Hampden
Levant
Milford
Newburg
Orono
Plymouth

Sagadahoc County.

Arrowsic
Bath
Bowdoin
Bowdoinham
Georgetown
Perkins
Phippsburg
Richmond
Topsham
West Bath
Woolwich

Somerset County.

Cornville
Detroit
Fairfield
Mercer
Norridgewock
Palmyra
Pittsfield
Skowhegan
Smithfield
Starks

Waldo County.

Brooks
Burnham
Jackson
Northport
Thorndike
Waldo

York County.

Acton
Alfred
Berwick
Biddeford
Buxton
Kennebunk
Kennebunkport
Kittery
Lebanon
Limerick
Old Orchard
Parsonsfield
Saco
Sanford
Shapleigh

York County—Concluded.

Cornish	Limington	South Berwick
Dayton	Lyman	Waterboro
Eliot	Newfield	Wells
Hollis	North Berwick	York

The increased number of towns from that of 1912 does not mean that the infestations have increased, but indicates that at the finish of the year 1912 the Government scouts had not reached the limit of the infested area. This branch of our work is conducted by the United States Government and consists of scouting the new towns along the border of infested territory. This work is not done by the Government with any effort of preventing the spread of the moth to new territory, but rather to establish a quarantine line in accordance with the United States regulations relative to the shipment of forest products from sections infested with the gypsy moth. At the present time it is doubtful if the limit has been reached and I look for a large number of towns to be added to the infested list in the next year.

CORRESPONDENCE.

In addition to the field work, a great deal of correspondence has been carried on by the field agent. During the year 1,400 letters have been received and answered, all of which related to the proper methods of handling the gypsy moth, many of them reporting new infestations. In such cases an inspector has been sent to the person making such report with the purpose of educating the persons in the proper methods of taking care of the pest. By this method we have enlisted the support and help of a great many people and I believe that this service is the best that can be rendered to our citizens, as it helps them to take care of their orchards and shade trees in the best manner possible.

BULLETIN AND COLORED POST CARDS.

There seemed to be a desire on the part of many of our citizens to know more in detail of the life history of the gypsy and brown-tail moths as well as the parasite work which has been carried on in the state during the year 1913, and it was to give this information that the special field agent, with the help of the chief inspector who was in charge of the parasite work, published the bulletin in December. 8,500 copies were sent out to different parts of the state and were well received. It can be had by any one interested by applying to the Commissioner of Agriculture.

During the past year the special field agent had printed (with permission of Massachusetts State Forester) 8,000 colored post cards, illustrating in natural colors and size the various transformations in the life history of the gypsy moth, the brown-tail moth and the Calosoma sycophanta beetle. These illustrated cards have served to clearly set forth the characteristics of each moth. Besides giving their natural size and color, the cards contained a brief description of each insect.

In the case of the Calosoma beetle the object of printing the card was to familiarize every one with the insect, so as to give it protection. It is an insect imported for the purpose of assisting in the destruction of the gypsy and brown-tail moths. These three cards have been greatly sought after by our citizens, and served nicely for educational purposes. They can be had in limited numbers by applying to Special Field Agent, 736 Congress St., Portland, Maine.

LECTURES.

During the year thirty-five lectures have been given before different societies, such as granges, schools and churches, as well as farmers' institutes. All of these were illustrated with lantern slides showing the life history of both gypsy and brown-tail moth, as well as the methods used in the field for the extermination of same.

FINANCIAL STATEMENT.

Appropriation, 1913	$30,000 00

EXPENDITURES.

Wages of field force	$23,398 53
Wages of laboratory force	1,029 76
Travel expenses, field agent and 3 inspectors	1,329 23

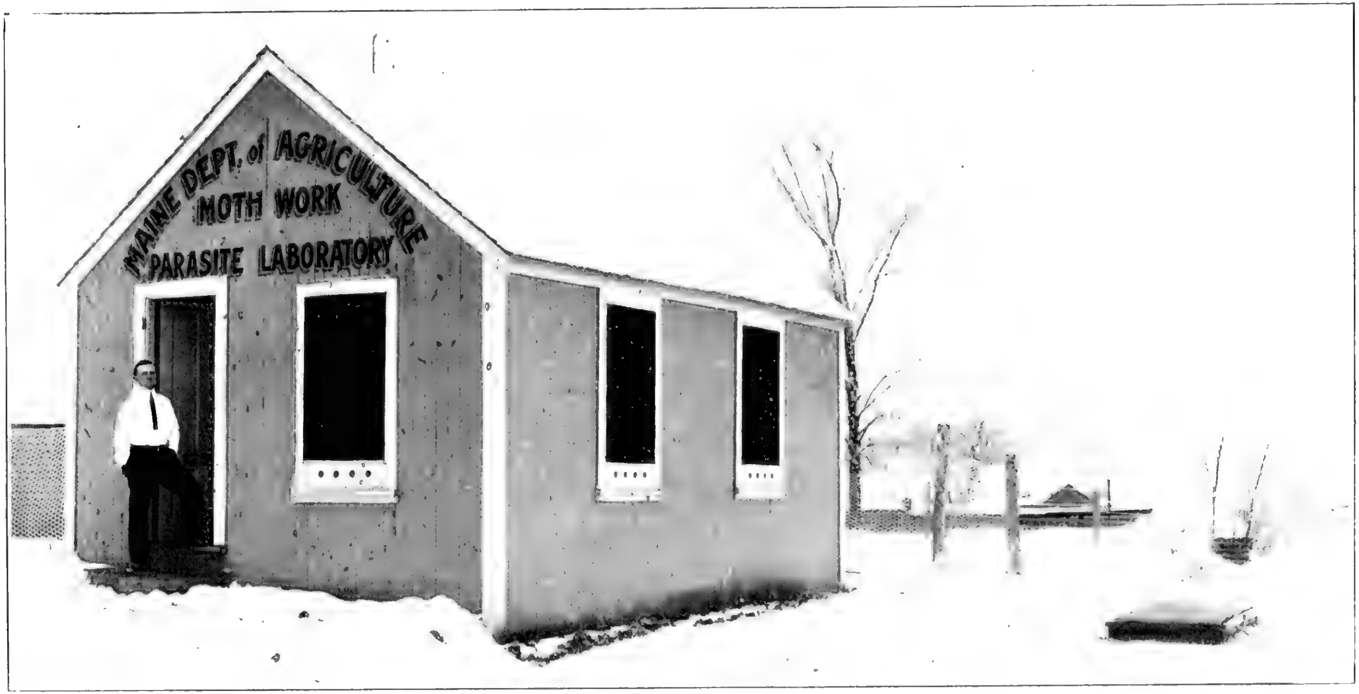
Supplies for field work	3,515 70
Supplies for laboratory, including building	550 00
Printing and binding	55 37
Insurance, laboratory building and supplies	29 25
Total expenditures	$29,907 84
Balance unexpended	92 16

INTRODUCTION OF PARASITES.

In Massachusetts the results with different parasites were so encouraging that after eight years of field work it was deemed most practical to attempt colonization of parasites to complement the field work in Maine, and last March a laboratory for breeding parasites and for making observations on their work was established in Portland at 1,258 Forest avenue. A building 12x18 was built that accommodates the use of fifty trays 4 feet long, 2 1-2 feet wide and 5 inches deep. Space is also afforded in the building for microscopic dissection and for keeping accurate notes on development and dispersion of the insects worked with. In the work at the laboratory the predaceous and parasitic enemies of the gypsy and brown-tail moths, used to breed, and liberate in this state, have been selected with great care as to their economic importance.

The undertaking was begun only after a careful study of the relative value of the different parasites dealt with at the United States laboratory and relying on the advice of Prof. A. F. Burgess in charge of the government laboratory at Melrose, Mass., and of the experts connected with same. The work of breeding and liberating thus far has been with the Apanteles lacteicolor and Meteorus versicolor as enemies of the brown-tail moth, Compsilura concinnata, parasitic on both the gypsy and brown-tail moth and the Calosoma sycophanta beetle, also predatory to both insects.

Without taking up the life history of any of the parasites it might be interesting to learn of the methods used in handling the Apanteles. In European countries where this insect is well established it is possible to collect the cocoons in large quantities from the field and transport them to other localities. But at the Maine laboratory the following method of development was adopted.



Parasite Laboratory at 1258 Forest Ave., Portland, Me., cross showing hibernating cage for Calosoma beetle larvae.

Brown-tail webs, collected in localities known to be infested with Apanteles and Meteorus were brought to the Maine laboratory and placed in feeding trays. These trays are made of a light wooden frame with cotton cloth bottom, the top open except for narrow strip covered with tanglefoot. As the caterpillars emerged from the webs they were held in confinement by the tanglefoot and fed at once on fresh cherry leaves, or other suitable food plant. This feeding was continued at intervals of two or three hours for ten days when a section of coarse mosquito netting cut to fit the inside dimensions of the tray was spread over the refuse feed and larvae, and more feed placed in the trays, thus drawing the maggot bearing larvæ away from the refuse feed. After another six days this operation was repeated, with similar effect. When the maggots began to emerge and spin cocoons, the sections of the web bearing the refuse feed and moulting nets were transfered to the picking cage, leaving the more active caterpillars in the feeding trays.

The work of picking the cocoons from the refuse was very disagreeable and attended by great personal discomfort. The dried and partly eaten leaves, the moulting webs and all material necessary to be handled are covered with the poison spines from the brown-tail hairs. To inhale this poison or acquire in the eyes is very dangerous.

This disagreeable feature was obviated to some extent by the use of a picking cage. This resembles an ordinary show case with top and sides of glass and at the back, holes cut, and armulets made of canvass inserted to protect the operator during the process of picking. Even by this protection and by wearing rubber gloves great discomfort was experienced during this operation. As soon as a sufficient number of cocoons were obtained they were carried into the field for colonization as quickly as possible before the adult flies had time to emerge; suitable localities having been selected by careful inspection earlier in the season. In the field the cocoons were placed in a waterproof box, this box being slightly perforated on the side, nailed to a tree, both tree and box smeared with tree tanglefoot to prevent destruction of the cocoons by ants, and here left to emerge. In this manner colonies were liberated in North Yarmouth, New Gloucester, Buxton, Gorham, Old Town, Pittsfield, Dexter, Winterport, Readfield, Portland, Gardiner, Lisbon, Newcastle and Wiscasset, and about 15,000 cocoons distributed.

A sufficient number of Meteorus versicolor were also obtained to establish two colonies of this parasite which is handled in a very similar manner to the Apanteles already described. As soon as the work on the Apanteles and Meteorus was completed, work with the Compsilura and Calosoma was taken up and continued until plantings of each had been made. The Compsilura concinnata should prove of great economic value, as it will attack both the gypsy and brown-tail moth with avidity and at least sixteen of our native insects are known to serve as its hosts. The cabbage butterfly and the tussock moth are readily attacked and great good may be expected to this vicinity where the tussock moth to Portland and the cabbage butterfly to Cape Elizabeth have at times been considered as serious pests. Colonies of this parasite have been liberated in the towns of Yarmouth, Gardiner, Georgetown, Waldoboro, Oxford, Baldwin and Portland. Two colonies of the Calosoma beetle were established, one in Portland and one in the badly infested woodlands of York. We collected several hundred of the larvæ of these beetles and confined them in hibernating ground cages at the laboratory, where they will be available for colonization in the spring of 1914.

The following table shows kind and location of parasite colonies in the state:

Town.	Colony liberated.
Baldwin	Compsilura concinnata
Buxton	Apanteles lacteicolor
Dexter	Apanteles lacteicolor
Gardiner	Apanteles lacteicolor
	Compsilura concinnata
Georgetown	Compsilura concinnata
Gorham	Apanteles lacteicolor
Lisbon	Apanteles lacteicolor
Newcastle	Apanteles lacteicolor
	Meteorus versicolor
North Yarmouth	Apanteles lacteicolor

Old Town	Apanteles lacteicolor
Oxford	Compsilura concinnata
Pittsfield	Apanteles lacteicolor
Portland	Calosoma sycophanta
	Apanteles lacteicolor
	Compsilura concinnata
Readfield	Apanteles lacteicolor
Waldoboro	Compsilura concinnata
Winterport	Apanteles lacteicolor
Wiscasset	Apanteles lacteicolor
	Compsilura concinnata
Yarmouth	Compsilura concinnata
York	Calosoma sycophanta

GENERAL.

No one need fear retarding or interfering with these parasites by general extermination of their hosts in orchards, as the sites selected for colonization of these parasites have been selected in localities where the moth colonies will afford abundant food for their support until they become strong and well established.

It is the purpose of the Department to give all information possible to interested people and the hope is that every one interested in the extermination of these moth pests will acquaint themselves with the nature of the parasites, that none may be destroyed through ignorance of the habits of these beneficial insects.

From the information obtained as to dispersion the results of the season's work have been most encouraging and it will be the policy to breed and distribute parasites more extensively the coming season.

The work of the year has proved that the building occupied and used at the present time is not large enough to accommodate the work contemplated for next season. A larger building will be erected with a capacity of one hundred trays, better ventilation and more light, and it is hoped with this new equipment to increase the number of parasite colonies so that all of the infested territory will be given protection which ought to assist the field work very greatly.

ACKNOWLEDGMENTS.

I am pleased at this time to acknowledge the help and advice received from others interested in the work; the advice relative to parasite work received from the government agent A. F. Burgess, which has been freely sought and as freely given. To the inspectors, foremen and members of the force I am glad to acknowledge my obligations for their loyalty to the department, and their efficiency, to which in no small measure is due whatever success may be obtained in the work. And to you, Sir, allow me to express at this time my sincere thanks for your kind coöperation in all matters pertaining to the work.

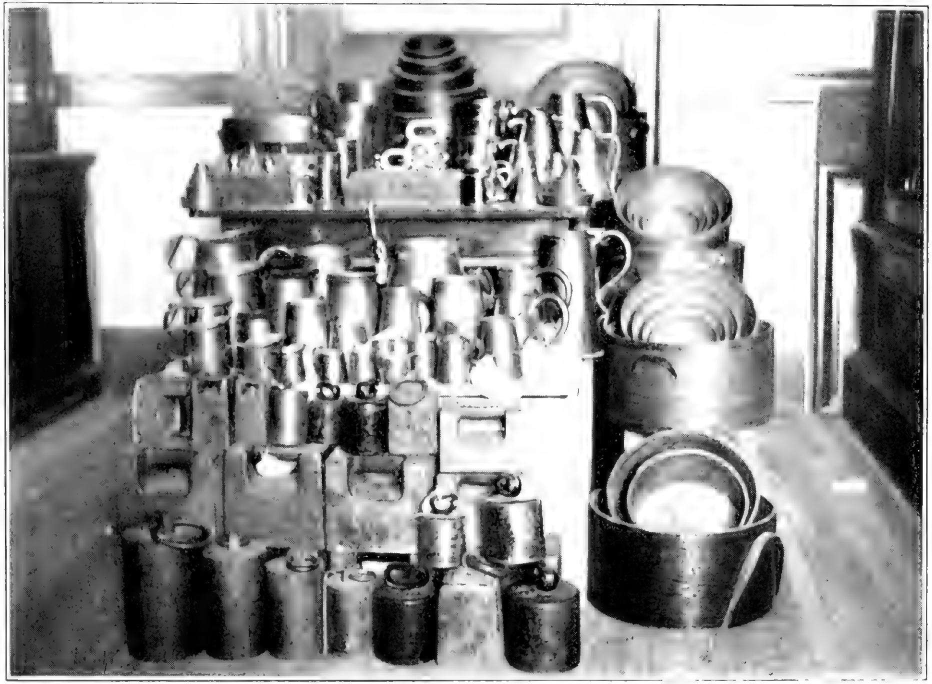
CONCLUSION.

Again I would emphasize the fact that unless larger appropriations are to be made by our legislature we must change our methods of work. I believe that we would get better results by a campaign of education and the development of parasitic enemies than by the present methods. The individual can be taught to take care of the orchards and shade trees by spraying and painting the egg clusters of the gypsy moth, and we are in hopes that the parasite will take care of the woodland.

We are at work in connection with the U. S. Government thinning a woodlot belonging to Mr. Weymouth in North Berwick. This is experimental work to determine what damage the gypsy moth will do in woodlands where the hard wood growth has been cut out leaving only the evergreens. This work is now going on and will not be finished until sometime in March. In foreign countries this method is used with success in combating the gypsy moth.

EDWARD E. PHILBROOK,

Special Field Agent.



First lot of weights and measures sent to the State Sealer under the law passed in 1911 making the Commissioner of Agriculture State Sealer.

REPORT OF DEPUTY STATE SEALER OF WEIGHTS AND MEASURES.

To the Hon. J. A. Roberts, Commissioner of Agriculture:

I respectfully present my first annual report as Deputy State Sealer of Weights and Measures of the work done by this Department.

Up to 1911, the State Treasurer was the State Sealer. The law at that time was changed making the Commissioner of Agriculture the State Sealer and a set of standards was purchased. As no provision for money was made to enforce the weights and measures law, very little was done in the matter until the year 1913, when the law was changed, allowing two or more cities or towns to combine to purchase a sealer's outfit and an appropriation of $2,500 a year was made by the state for the years 1913 and 1914.

When we started on this work, March 1, 1913, there were not a dozen cities or towns in the state equipped so a sealer could properly perform his duties. At the present time, we have some four hundred cities, towns and plantations—out of five hundred and twenty—that have the proper equipment to carry on this work.

The greatest difficulty we have to meet is the changing of sealers every year, which, I think, is all wrong. After a sealer has had one year's experience, he is better qualified to perform his duties and every succeeding year makes him more capable. Therefore, I think it would be better if all the sealers in the state were put under civil service and held office during their efficiency.

I would also recommend a law governing the weight of bread. A loaf of bread for sale should weigh two pounds. One-half loaf should weigh one pound.

As the work of the office has kept me confined here at Augusta most of the time, I have not been able to visit as many local sealers as I wished. I have visited some twenty-five different cities and towns and found the local sealers taking hold of their work in very good shape.

The law requires the local sealers to make a report to the State Sealer, on or before the first day of November of each year, giving a detailed account of their work for the year. As it was so late in the year before a large number of the cities and towns received their outfits, we have not had as many reports as we shall expect the coming year. The law in regard to sealers making a report is compulsory and we hope next year that we shall be able to make a much better report. Following is a summary of the work done by the local sealers from ninety-three cities and towns.

REPORT FROM NINETY-THREE TOWNS AND CITIES.

Name of Town.	Number Tested.							Number Condemned.								Weights adjusted.	Scales repaired.	Milk cans tested.	Oil cans tested.
	Scales.	Weights.	Dry measures.	Liquid measures.	Yard sticks.	Oil pumps.	Milk jars.	Scales.	Weights.	Dry measures.	Liquid measures.	Yard sticks.	Oil pumps.	Milk jars.	Milk cans.				
Abbot	9	28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acton	4	9	-	-	-	-	500	-	-	-	-	-	-	-	-	-	-	-	-
Alfred	31	65	7	6	1	4	-	4	-	-	-	-	-	-	-	-	-	-	-
Anson	33	30	-	11	-	1	899	1	4	-	1	-	-	55	-	-	-	-	-
Ashland	46	100	4	22	12	17	-	2	2	-	1	-	1	-	-	-	-	-	-
Auburn	351	772	28	27	-	17	5,166	3	4	5	-	-	-	90	-	87	-	-	-
Augusta	240	451	64	14	-	28	10,065	23	-	14	2	-	-	130	-	20	-	-	-
Bangor	501	1,064	136	190	75	7	12	2	4	1	1	6	-	-	-	-	5	-	-
Baring	5	-	1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biddeford	220	174	217	247	55	7	600	5	-	4	-	-	-	-	-	-	-	-	-
Bath	47	104	15	40	12	-	-	13	8	-	2	-	-	-	-	-	-	-	-
Bridgton	54	140	-	16	-	-	100	2	6	-	2	-	-	-	-	-	-	-	-
Brooks	28	124	-	21	8	9	-	2	-	-	9	-	-	-	-	-	-	-	-
Brownfield	50	118	16	37	6	14	118	12	-	-	3	1	-	-	-	-	-	-	-
Brunswick and Topsham	87	60	32	30	60	2	-	1	-	-	-	1	-	-	-	-	-	-	-
Calais	112	-	10	25	37	4	229	9	-	-	-	-	-	-	-	-	-	-	-
Cape Elizabeth	16	5	-	17	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Caribou	121	247	1	49	6	31	-	13	-	-	-	-	2	-	-	-	-	-	-
Columbia Falls, Columbia and Addison	84	203	78	111	24	24	-	9	-	1	2	-	-	-	-	-	-	-	-
Cooper	2	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cornish	30	52	42	16	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Denmark	25	35	2	14	4	4	-	9	-	-	2	1	-	-	-	-	-	-	-
Eastbrook	4	1	-	1	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-
East Livermore	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eastport	147	291	103	304	3	29	52	7	-	9	34	-	-	-	-	-	-	-	-
Ellsworth	130	292	73	146	41	25	153	17	19	11	13	6	5	16	-	-	-	-	-
Fryeburg	79	161	33	48	18	7	96	11	-	2	5	2	-	4	-	-	-	-	-
Gilead	9	5	-	4	1	-	2	1	-	-	1	-	-	-	-	2	-	-	-

Glenburn	5	11	-	7	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Gray	43	95	24	61	10	13	53	-	-	3	6	1	5	1	-	-	-	-	-
Greene	13	28	-	7	2	1	-	-	-	-	1	-	-	-	-	-	-	-	-
Greenville	39	91	16	29	16	15	-	4	-	2	2	-	1	-	-	-	-	-	-
Guilford	41	90	-	11	12	2	-	2	-	-	-	-	-	-	-	-	-	-	-
Hallowell	53	118	19	35	5	14	3,000	1	-	-	18	-	1	69	-	-	-	-	-
Harrington	22	61	32	40	6	6	-	2	-	-	-	-	1	-	-	-	-	-	-
Hermon	17	53	8	14	4	7	-	2	2	2	1	1	-	-	-	-	-	-	-
Hiram	37	12	14	-	5	-	-	2	-	-	-	-	-	-	-	-	-	-	-
Hudson	7	13	-	6	1	1	-	1	-	-	-	-	-	-	-	-	-	-	-
Industry	12	20	-	6	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Kenduskeag	24	80	-	25	4	7	-	1	-	-	-	-	-	-	-	-	-	-	-
Leeds	30	83	10	21	9	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Lewiston	467	76	20	-	18	-	464	22	4	-	-	1	-	11	-	-	-	-	-
Levant	7	30	-	10	3	4	-	-	-	-	-	-	-	-	-	-	-	-	-
Lincoln	50	-	24	18	10	18	20	-	-	6	-	-	-	-	-	-	-	-	-
Livermore	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lovell	37	67	7	41	1	6	-	4	-	-	5	1	-	-	-	-	-	-	-
Madison	63	40	-	37	22	11	984	1	3	-	4	-	-	54	-	-	-	-	-
Mars Hill and Blaine	43	-	11	25	13	12	144	-	-	-	-	-	-	-	-	-	-	-	-
Masardis	16	34	1	12	5	3	-	-	3	-	-	-	-	-	-	-	-	-	-
Monmouth	42	98	7	37	5	1	-	2	1	1	1	-	-	-	-	-	-	-	-
Monson	36	51	8	14	7	11	-	1	-	-	-	-	-	-	-	-	-	-	-
New Gloucester	34	91	15	75	7	10	32	5	17	4	20	-	6	-	-	-	-	-	-
New Sweden	39	-	-	31	6	3	-	1	-	-	2	2	-	-	-	-	-	-	-
North Berwick	36	-	-	14	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Norway	3	-	-	-	-	-	555	-	-	-	-	-	-	-	-	-	-	-	-
Oakland	15	4	6	4	1	-	700	-	-	-	-	-	-	7	-	-	-	-	-
Orland	18	-	2	27	6	2	-	-	-	-	7	-	-	-	-	-	-	-	-
Otisfield	18	20	-	13	4	6	-	4	-	-	-	-	1	-	-	-	-	-	-
Portage Lake	15	19	3	9	2	6	-	-	-	-	-	-	-	-	-	-	-	-	-
Portland	1,365	1,920	36	32	12	4	46,734	123	-	-	-	-	-	292	17	-	-	1,567	132
Presque Isle	33	61	2	9	-	5	809	1	4	-	4	-	-	64	-	-	-	-	-
Rangeley	67	1	13	57	22	5	5	5	-	-	-	1	-	-	-	-	-	-	-
Raymond	24	52	5	24	5	6	-	3	2	2	5	-	2	-	-	-	-	-	-
Rockland	471	1,178	222	429	70	34	-	48	15	17	60	-	5	-	-	-	-	715	-
Saco	80	137	51	36	5	5	-	-	-	-	-	-	-	-	-	-	-	-	-
Sangerville	9	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sanford	142	426	103	79	9	51	3,821	17	-	9	11	-	1	-	-	-	-	-	-
Scarboro	32	40	-	20	3	-	1,162	1	-	-	-	-	-	5	-	3	-	-	-
Shapleigh	27	71	15	14	1	10	-	5	-	-	-	-	-	-	-	-	-	-	-
Shirley	14	32	-	7	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South Portland	121	712	216	196	-	41	3,024	-	-	-	-	-	-	-	-	-	-	-	-
Standish and Sebago	60	208	43	53	19	10	-	2	-	2	1	-	-	-	-	-	-	-	-
Starks	12	8	-	6	3	-	74	-	-	-	1	-	-	1	-	-	-	-	-

REPORT FROM NINETY-THREE TOWNS AND CITIES.

Name of Town.	Number Tested.							Number Condemned.								Weights adjusted.	Scales repaired.	Milk cans tested.	Oil cans tested.
	Scales.	Weights.	Dry measures.	Liquid measures.	Yard sticks.	Oil pumps.	Milk jars.	Scales.	Weights.	Dry measures.	Liquid measures.	Yard sticks.	Oil pumps.	Milk jars.	Milk cans.				
Stockholm	23	-	2	23	6	2	-	3	-	-	5	3	-	-	-	-	-	-	-
Stoneham	6	12	6	3	1	1	-	-	-	-	-	-	1	-	-	-	-	-	-
Stow	9	2	1	5	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-
Strong	16	38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Surry	15	35	9	12	3	6	-	1	1	-	2	-	-	-	-	-	-	-	-
Trenton	4	14	5	4	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Westbrook	111	232	24	26	9	14	312	4	16	-	-	-	-	4	-	-	-	25	-
Westfield	6	-	-	6	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Willimantic	7	21	1	2	2	1	-	1	-	-	-	-	-	-	-	-	-	-	-
Wilton	66	122	14	62	9	15	-	11	-	4	18	1	-	-	-	-	-	-	-
Winn	16	50	5	9	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Winslow for the Hollingsworth & Whitney Co.	49	198	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Winslow	41	77	24	31	-	4	-	4	-	1	2	-	-	-	-	-	-	-	-
Winterport and Monroe	54	106	10	22	11	7	-	1	2	1	-	-	1	-	-	-	-	-	-
Woodland	12	-	2	9	4	4	-	2	-	-	-	-	-	-	-	-	-	-	-
Totals	6,659	11,588	1,898	3,207	769	622	79,885	437	118	101	255	28	33	803	17	112	5	2307	132

In conclusion I wish to thank you for the hearty coöperation in all matters pertaining to my office.

Very respectfully yours,

LEVI S. PENNELL,

Deputy State Sealer.

REPORT OF BUREAU OF MARKETING AND SUPPLIES.

To Hon. John A. Roberts, Commissioner:

I have the honor to transmit herewith a report of the Bureau of Marketing and Supplies relative to the special work of this department in bringing about a state wide organization of those engaged in agricultural work, thereby perfecting a system of marketing and buying supplies that would bring the markets and base of supply nearer the consumer and producer.

The men selected to carry on the educational work and lay the foundation upon which to build the system realized the magnitude of the work before them, therefore great care was taken to start at the base of the trouble so as not to make a backward step necessary.

As the special work in which the Department is now engaged is a departure from the usual methods of agricultural departments, a statement as to the conditions that influenced the Department to undertake to solve the problems of marketing and buying supplies will not be out of place. In the more early years the farmer was engaged in a system of general farming, raising about everything he required to maintain life and clothe himself and family. Later he became commercially engaged, and then it became necessary to raise the crops that had the most commercial value. These crops he had to market and the only method presented was to sell them to a local buyer or consign them to commission men. Both of these methods were unsatisfactory. The farmer was entirely at the mercy of the men engaged in the commission business, for he had no way to determine just what returns should be made. In the case of the local buyer, to some extent the same conditions obtained. The farmer had no medium through which he could be informed as to market conditions and therefore was obliged to accept the price offered. In the buying of supplies, practically the same conditions prevailed. Between the farmer's base of supply and himself there was an army of agents and sub-agents to support, each adding to the cost of the goods he wished to purchase.

There was great unrest, not only in Maine but throughout the whole country, and the farmers of Maine were waiting patiently for something to turn up whereby better conditions could be brought about. To meet the demand of the farmers the Agricultural Department started the educational work through the medium of Farmers' Institute meetings in December, 1911. From this date to June, 1912, local organizations were incorporated, as follows:

LIST OF EXCHANGES AND SECRETARIES.

Maine Central Potato Exchange of Brunswick
W. S. Rogers, Cathance, Me.

Central Maine Farmers Exchange, Waterville
J. O. Peck, Winslow, Me.

Maine Central Potato Exchange, Dexter
F. L. Hutchinson, Sangerville, Me.

Aroostook Farmers Exchange, Fort Fairfield
Stephen Ames, Ft. Fairfield, Me.

Maine Central Farmers Exchange, Farmington
J. H. Merrill, Farmington Falls, Me.

Cumberland and Oxford Farmers Exchange, Bridgton
A. J. Chadwick, Bridgton, Me.

Aroostook Potato Growers Association, Presque Isle
J. Frank Guiou, Presque Isle, Me.

New Sweden Grange Produce Company, New Sweden
August Peterson, Pres., New Sweden, Me.

Androscoggin Grange Coöperative Association, Auburn
V. W. Canham, Lisbon, Me.

Central Maine Coöperative Association, Dover
B. L. Batchelor, Dover, Me.

The four last named organizations were organized in 1911, before the Agricultural Department started the state wide movement. On June 28, 1912, a state wide meeting was held at Bangor, composed of representatives from the local organizations, resulting in the incorporation of the Farmers Union of Maine as a state central body.

OFFICERS.

President, E. S. Crosby, Bath, Maine
Vice Pres., B. L. Batchelor, Dover, Me.
Treasurer, W. S. Rogers, Cathance, Me.
Clerk, W. C. Stetson, Waterville, Me.
Gen. Mngr., C. E. Embree, Bangor, Me.

GENERAL DIRECTORS.

C. R. Martin, August Peterson, M. S. Lyons.

DIRECTORS AT LARGE.

J. P. Buckley, Stroudwater, Me.
C. E. Embree, Bangor, Maine.

The Farmers Union of Maine is controlled by one representative from each of the local exchanges and therefore is thoroughly representative in its government. The relation of this central body to the locals is in the nature of a guiding and directing influence rather than a controlling factor.

The work of organizing was continued by the department up to September 1, 1912, at which time, because of lack of available funds, the Farmers Union of Maine was placed in charge of the movement, but was unable to continue the educational work for the same reason. It was then decided to start shipping operations. Headquarters were opened at Bangor and agents appointed in the marketing centers, and the local exchanges were notified that the Farmers Union would find a market for their potatoes and other products. The management fully realized the unpreparedness of the locals to ship as an organization, for the reason that they were lacking in managers and had no houses through which to load their stock. However, there was no other way out of the dilemma except to demonstrate that the organization could successfully market the product.

From October 1st to April 1st, two hundred and fifty cars of potatoes, three cars of apples and two cars of hay were successfully marketed with the exception of about eight cars. Four of these cars were frosted on account of the inadequacy of the heaters furnished by the railroads. A loss was brought about on the other four cars because of bad loading. Seventy-five per cent of the cars shipped were loaded by individual stockholders without supervision. These loaders were men without previous experience, either in loading or shipping, therefore they are to be congratulated that only four cars were rejected because of bad loading.

All products were sold at a price before the car left the loading station. These cars were shipped as directed by the manager of the Farmers Union of Maine, direct to the dealer in the city, with draft attached. The draft was paid to the bank through which it was drawn and the proceeds returned direct to the loader. At the end of the month the loader or the exchange paid the Farmers Union of Maine one and one-half cents per bushel, for each bushel sold. One cent of this was used to pay the agent in the city and the remainder was transferred to the treasurer of the Farmers Union of Maine. This method met with the hearty approval of the stockholders, for every dollar the product was sold for went through the hands of the owners of the stock and then they paid for the services rendered. This was a great improvement over the methods of the past, and one that will be greatly appreciated as the plan becomes perfected.

For years the farmer has furnished the capital with which the commission man conducted his business and was obliged to accept the returns made, without knowing whether or not he was receiving his portion of the profits.

Early in the season of 1913-1914 it was decided not to ship the product through the Farmers Union of Maine, but instead appoint agents in the marketing centers and have each local organization sell its product direct through these agents. This places more responsibility upon the locals and will more quickly bring them in line along better business methods. Many of these exchanges have met with excellent success, while the successes of others are indifferent.

The North Penobscot Produce Exchange of Springfield erected two potato houses; one at Kingman and one at Wytopitlock. Up to December 1, 1913, the manager of the Kingman house had shipped 60 cars, showing a profit to the organization after paying all bills of $400.00. The New Sweden Grange Produce Company of New Sweden have also built two potato houses; the Easton Farmers Union, Easton, purchased a house at the Station; the Brooks Farmers Union are engaged in building a potato house; the Cumberland and Oxford Produce Exchange of Bridgton have just completed a house on the line of the railroad and are installing a complete grinding outfit; the Clinton Farmers Union have purchased a building for grinding and carrying on a general supply business. From a profit sharing basis, the Central Maine Coöperative Association of Dover have undoubtedly met with the greatest success. This organization was incorporated in 1911.

During the year 1912 the Central Maine Produce Exchange at Pittsfield, and the Eastern Maine Co-operative Association at Calais, were organized.

From September 1, 1912, to April 1, 1913, the organization of new exchanges was interrupted by the lack of funds. On April 1st, however, owing to an appropriation by the legislature, the work was resumed and up to December 1, 1913, additional exchanges or Unions were incorporated, as follows:

Ashland Maine Farmers Union
L. E. Young, Sec., Ashland, Me.

Easton Farmers Union
Dura Stanchfield, Sec., Easton, Me.

Farmers Union of Stockholm
J. E. Berquist, Sec., Stockholm, Me.

Bucksport Farmers Union
R. S. Genn, Sec., Bucksport, Me.

Clinton Farmers Union
L. A. Burns, Sec., Clinton, Me.

Windsor Farmers Union
F. D. Erskine, Pres., Windsorville, Me.

No. Knox Potato & Apple Growers Exchange
H. L. Grinnell, Sec., Union, Me.

Hampden Produce Exchange
C. E. Carter, Sec., Bangor, Me.

Lincoln Farmers Union
Ard Edwards, Sec., Lincoln, Me.

Orrington Farmers Exchange
Raymond L. Perkins, Sec., So. Brewer, Me.

North Penobscot Produce Exchange
P. E. Averill, Sec., Prentiss, Me.

Somerset County Farmers Union
H. F. Goodwin, Sec., St. Albans, Me.

Waldo County Farmers Union
W. L. Grey, Troy, Me.

Eastern Maine Produce Exchange
Lewis Huff, Sec., Danforth, Me.

Harmony Farmers Union
W. G. Bailey, Sec., Harmony, Me.

Belgrade Farmers Union
John W. Penney, Sec., Belgrade, Me.

Franklin County Farmers Union
Albert Pratt, Pres., Wilton, Me.

Fryeburg Farmers Union
A. O. Pike, Pres. Fryeburg, Me.

Kennebec Valley Farmers Exchange
A. H. McKenney, Sec., Madison, Me.

Farmers Union Grain and Supply Company, Waterville
E. E. Austin, Manager, Waterville, Me.

Brooks Farmers Union
Robert M. Stiles, Sec., Brooks, Me.

Kenduskeag Valley Farmers Union
E. C. Fogg, Sec., Bangor, R. F. D.

Morning Light Grange
Frank P. Clement, Sec., Monroe, Me.

THE BUYING OF SUPPLIES.

Early in the work of organization there was a demand for supplies, such as flour, grain, feed, poisons and other articles, and during the winter of 1912 an occasional car of grain was bought and distributed at a substantial saving over the regular retail price charged by the dealers. As the number of exchanges increased and the demand for supplies became greater it was determined to in some way locate a central supply house through which the local exchanges could purchase their supplies. It was also decided that there must be from $20,000.00 to $50,000.00 capital. All of the exchanges were of recent organization and were raising or trying to raise sufficient funds with which to properly conduct their business locally. A number of them were busy raising capital with which to build potato houses. Therefore it was useless to undertake to raise money to engage in the wholesale grain business.

Waterville appeared to be the most central point and the mills of the firm of Austin & Haines the most desirable. Austin & Haines finally agreed to reorganize under the name of the Farmers Union Grain and Supply Company and increase the capital stock from $10,000.00 to $20,000.00, the total capitalization to be paid in by Austin & Haines. A side contract was then made with the said Austin & Haines whereby they are to sell to the Farmers Union, or its constituent members, as they may desire, said stock of said grain company so held by them, at par, until the amount of stock so sold by both of them shall equal 49 per cent of the total amount of the stock of said Farmers Union Grain and Supply Company issued and outstanding. Then they agreed to turn over the whole remaining 51 per cent in a block, to said Union or any of its constituent members at par as aforesaid, if said members or the Union so desire to purchase. The said Austin & Haines further agree to sell to the new corporation its real estate in Waterville for thirteen thousand eight hundred dollars ($13,-800.00.)

This property consists of two large buildings fully equipped for doing a grain business and quite a large tract of land, on which it is proposed to build a storage house for potatoes and other products, and also open a coal and wood yard. Since the reorganization, business has increased rapidly and it is estimated that the first year will show a gross business of more than $100,000.00.

FERTILIZER.

One of the most important articles purchased by the farmer is commercial fertilizer. It is estimated that the total tonnage of the state amounts to 130,000 tons and this undoubtedly is a conservative estimate. Estimating the value at $36.00 per ton the farmers of Maine pay out annually $4,680,000.00. This is about one-third of the value of the potato crop annually marketed.

While the Maine farmer exercises great care in preparing the seed bed and carrying on other farm operations, he purchases his fertilizer as a rule without any knowledge of its actual growing qualities and gambles as to results. The Department believed that all farm operations should be conducted with as much certainty as the nature of the business would permit and in the case of fertilizer, if the farmer could not make sure of the quality of the goods he purchased, then he should buy the various ingredients and practice home mixing. However, if the farmer is a member of an association he can be reasonably sure that his fertilizer is made of ingredients available as a plant food and that no so-called filler enters into its make-up. During the last five years the farmer has been paying too much money for his fertilizer and the Board of Directors of the Farmers Union of Maine decided to enter the business of supplying the Union members with this important article. The manager was instructed to contract for 2,000 tons. Proposals for bids were sent out to all reliable companies operating in Maine, but we were unable to get prices from any one of them and in fact two of the companies refused to sell to any farmers' organization. This enabled the manager to contract with the I. P. Thomas & Son Company whose office is located at 1000 Drexel Building, Philadelphia, Pa., and whose manufacturing plant is located at Mantou Point, N. J. The goods of this company had been thoroughly tested by the manager when connected with the Long Island Potato Exchange of Riverhead, N. Y., and in every case proved highly satisfactory. A contract was made for the following grades: 4-8-7, 4-8-10, 4-6-10, 5-8-7. The price paid, delivered at any point in Maine, was as follows:

4-8-7	$29 00
4-6-10	30 50
4-8-10	31 00
5-8-7	32 00

By vote of the Board it was decided to retain a profit of $2.00 per ton, $1.00 of which was to go to the Farmers Union of Maine and $1.00 to the local exchanges, it being understood that if this money was not required to meet expenses it should be divided among the various organizations. This increased the price to the stockholders, making the cost as follows:

4-8-7	$31 00
4-6-10	32 50
4-8-10	33 00
5-8-7	34 00

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The most of the exchanges, however, did not retain the profit of $1.00 and the stockholders secured their goods at only $1.00 advance over cost. The Aroostook County Potato Association of Presque Isle was the first to enter the business of furnishing fertilizer and the prices secured by this association enabled them to make a cut of $2.00 per ton under the cash price charged by the regular companies. This cut was met by all the manufacturers doing business in the county, resulting in a saving of $120,000.00 to the farmers of Aroostook. This was during the season of 1912. In 1913 the Farmers Union of Maine was operating in almost every producing center in the state and this caused the companies to cut prices covering the whole state and, as it is estimated that 130,000 tons are used in the state, this saved the farmers $260,000.00.

While the operations of the farmers' organizations have very materially reduced the price of fertilizer, owing to the small contract made the lowest price has not yet been secured, but in time the saving along the lines of fertilizer will many times pay all the expense of organizing. While the exact figures are not available at this time it is estimated that out of the 130,000 tons of fertilizer consumed in the state, at least 100,000 tons have been and are being bought on what is termed December payment. The farmers who buy in this way have been paying an enormous interest for the use of the money. For example, the price of a 4-6-10 on December payment has in the past five years been $38.50. Any time during the five years had the farmers been organized this grade of fertilizer could have been purchased for $32.50, leaving a profit of $2.00 to go into the funds of the association. The difference between $32.50 and $38.50 is $6.00. This is $6.00 for the use of $32.50 for six months. For one year the cost would be $12.00 and, as $32.50 is about one-third of $100.00, the rate of interest is 36 per cent. With this evidence before them it would appear that the farmers would purchase all their supplies through their association. This, however, was not the case, for the farmers had not the available cash and their associations did not have sufficient capital to furnish the goods on time. Figuring from a basis of 130,000 tons at $6.00 per ton over the cash price charged by the farmers' organizations, then the farmers paid out in interest money the grand total of $780,000.00. This money practically all went out of the state where it is much needed, as the banks have not sufficient money to finance the farm. It has been said that the banks were loth to furnish the farmer with funds, but the experience of the department is that the banks will loan the farmer under proper conditions. However, it must be plain to all that our credit system is extremely bad for the prosperity of the farm and it would appear that our legislators, both state and national, are far behind other countries in establishing rural banks through which the farmer can secure sufficient capital to properly finance his farm operations. The Bureau of Marketing and Supplies would strongly recommend that if Congress does not establish a rural banking system our state legislature act at its next session.

The department's plan of organizing extends far beyond our state line. First, the foundation is laid at the farm. The farmer is in control at the loading station, he controls the state central body, and when the other states have established state central bodies and made their organization state-wide, the farmer will be in control of the organization work in every marketing center in the country.

Our state covers a large territory, and I find it difficult to respond to all the calls for my services and take care of the office work. We now have thirty-three local exchanges, a state central body and a state supply house through which the local exchanges purchase their supplies. A number of these are prospering, while some of them are not active and these need considerable attention. It would be good judgment to stop organizing new exchanges for a time, but as the department is for all farming Maine, it would not appear to be good judgment to refuse to organize in sections where we are requested so to do. Every local exchange organized since April 1, 1913, has been organized by request. The Bureau of Marketing and Supplies is not endeavoring to extend the territory already occupied, but rather seeking to enlarge and put into active operation every exchange now in the field. The bureau has appointed selling agents in Boston, Worcester and New York, secured credit for the farmers through the banks, contracted for the farmers' supply of fertilizer, poisons and small seeds, established a central supply house, assisted in bringing about the building of potato houses and grist mills, educated along the line of stock true to name, better grading and sorting and an honest pack in all cases. It would be guess work to estimate how many thousands of dollars have been lost by the farmers of Maine on account of poor grading and sorting. This method, however, has reduced the price of all Maine stock from five to ten cents per bushel and if the bureau can bring about the grading of the potato and apple up to the standard recognized by the buyer it will add greatly to the wealth of the state of Maine.

There is no occupation so difficult as the organizing of any line of trade and while it does not call for a man of unusual ability it does call for a man of peculiar make-up. One of the most unfortunate conditions to overcome is the fact that the farmer and the townsman have both come to the conclusion that the farmer cannot be organized. We meet and discuss farmers' associations for the marketing of the product of the farm. We would not think of discussing the Standard Oil Company, the Great Northern Lumber Company, the United Steel Co., or any other of our large combinations as to their ability to market their product. These conditions the Bureau of Marketing and Supplies hopes to overcome, by submitting positive proof that farmers' associations can successfully market the product of the farm.

First, we have the remarkable record of the Eastern Shore of Virginia Produce Exchange, Inc.

SUPPLEMENTARY DETAILS OF 1913 BUSINESS. SUBMITTED BY SECRETARY AND TREASURER.

Gross sales of produce f. o. b.	$4,249,514 39
Gross sales of produce consigned	394,288 44
	$4,643,802 83

Seed potatoes purchased for members	$ 60,837 66
Printed covers	67,768 76
Berry crates	11,501 73
	$140,108 15

TOTAL PURCHASE FOR MEMBERS.

Gross sales for year 1913	$4,783,910 98
Gross sales for year 1912	3,684,740 99
	$1,099,169 99

PACKAGES OF PRODUCE HANDLED.

Barrels, Irish potatoes	1,668,984
Barrels, sweet potatoes	961,463
Berries, cabbage and onions	184,639
Miscellaneous	9,553
Total	2,824,639

Number packages shipped in 1913	2,824,639
Number packages shipped in 1912	1,848,115
Increase of packages for 1913	976,524
Total number of packages sold for members	259,153

CALIFORNIA FRUIT GROWERS' EXCHANGE.

Report of Dr. G. Harold Powell, Manager.

In 1905 this exchange marketed only 47% of the total crop of the citrus fruit while in 1913 they marketed 61% of the total crop. In 1912 the total crop was estimated at 34,000 carloads or 13,250,000 boxes. In 1913 the heavy November winds destroyed 10% of the crop and the unprecedented freeze of January still further reduced it so that only 12,445 carloads were sent to the market. However, by the excellent management of the exchange much fruit was saved that under the old conditions would have been lost. The total gross sales of the organization in 1913 amounted to $13,500,000.00 and this business was carried on at an expense of less than 2% in comparison with 20% before the exchange was started.

THE SOUTH JERSEY FARMERS' EXCHANGE.

The South Jersey Farmers' Exchange was organized in April, 1909, and the business transacted by this organization since that date is as follows:

1909	$363,249 49
1910	445,092 86
1911	877,883 75
1912	734,746 00
1913	703,220 30
Total	$3,124,192 40

LONG ISLAND POTATO EXCHANGE, RIVERHEAD, N. Y.

The Long Island Potato Exchange was organized in 1808. The gross business of this organization per year was not available at this writing; however, the business for the year ending June, 1913, amounted to a total of $268,903.60. The most important articles are as follows:

Potatoes	$128,662 56
Fertilizer	42,727 63
Feed	55,025 14
Seed potatoes	16,169 83
Flour	4,217 73

The price received by the farmers of this association averaged about 75 cents per barrel more than the farmers of Maine received. This was brought about by a system of better sorting and grading than we practice in Maine.

Every one has a more or less vague idea of the meaning of coöperation, but here we have shown the results of actual test in everyday business affairs.

Men in all the walks of life are now very much concerned over what is termed the "Rural Problem." From a social and economic standpoint this is perhaps the most vital question of the hour, one worthy of very careful study, but after all possible has been assimilated from the opinions and theories of others its final solution will be made by the man upon the farm. The popular cry "Back to the Farm" will prove a passing hobby unless it can be demonstrated that farming is not only a profitable occupation, but that the farmer can be surrounded by the comforts and conveniences of modern life.

The farmer may study scientific methods of farming with pleasure and profit and learn to get from the soil the last pound it is capable of producing, but the vital question of marketing must be solved, if solved at all, by the coöperation of individuals.

Respectfully submitted,

C. E. EMBREE.

INSTITUTE PAPERS.

WINTER EGG PRODUCTION.

By GEORGE L. GILLINGHAM, Moorestown, N. J.

To secure eggs in winter in paying quantities we must depend upon pullets. Old fowl, over one year old, cannot be depended on, as there is no certain date when they will go into the molt or definite length of time when they will be molting; and as a hen will not produce eggs and grow a new coat of feathers at the same time, she will lay but few eggs during the cold winter months. But the pullets should be hatched from adult hens—hens that are strong and healthy and mated with a strong, vigorous cock bird or early hatched cockerel.

The pullets should be hatched in early spring, but not too early, as if hatched before March 1 they will go into the molt before winter and you will not have anything better than an old hen. From the middle of March to the middle of April is the proper hatching season. With all of our domestic animals, well born means half raised, hence the importance of having these pullets well hatched from strong, vigorous parents, as one will have to keep enough yearling hens from which to get the eggs for hatching.

In this business there are four important essentials: First, the man; second, the breed; third, the feed, and fourth, the care. The two latter are so closely connected that they may be treated under one head. The man, which also means woman, as she it is who often takes care of the poultry on the farm, must first have knowledge and, lastly but most important, a love for the occupation, for unless one has this he will not succeed, as he will neglect the little things that go to make a success as a whole. It is the little things in our work that tell in the long run.

After the chicks are hatched they should not be fed for at least 24 hours and preferably 36, or even 48 hours. I would much rather they would go 48 than to feed them before 24, as in the last process of hatching the yolk of the egg is absorbed by the chick's body and constitutes the contents of the intestines which nature intends to support the chick for the first 24 hours. To start the digestive tract at work before this, has a tendency to upset the entire system and cause diarrhœa and many other ailments which, in many cases, cause the death of the chick. The first feed should be light grit to start the gizzard at work, or, in other words, furnish the chick with its teeth, as the gizzard is where the chick's teeth really are. The best feed I have found for this purpose is the shells from which the chicks were hatched. Place these in the stove oven and heat them to a light brown; crumble fine and place them on a board before the chicks for a few hours and let them play and work among them and they will pick up quite a few of them. They are then ready for their first feed which should be dry oatmeal, bread crumbs, or any easily digested light food for the first day or two, with water or milk before them. After two or three days they may be fed on the commercial chick foods that are sold ready mixed by most of the poultry feed dealers.

I have always found that these pullets should be grown and their bodies developed and the ovaries developed, on the same kind of feed we use to make the egg after the hen is grown; hence, after the chicks leave the baby stage, feed the dry egg mash and the scratch foods, made up of as many different grains as possible. The best dry mash I have ever found for egg production, as well as for growing the pullets to maturity, is composed of 200 pounds of wheat bran, 200 pounds of wheat middlings, 200 pounds of ground oats, 100 pounds of corn meal, 100 pounds of linseed meal, 100 pounds of alfalfa meal, 100 pounds of beef scraps and 40 pounds of charcoal. Keep this before the growing chicks dry and allow them all the exercise they will take; if on a farm, unlimited range. If confined to yards, make them scratch the grain out of deep litter, which should be also fed sparingly, morning and evening, in addition to the dry mash constantly before them in hoppers or troughs, so constructed as to prevent waste.

With this care and feed they should grow very rapidly; and as they develop and show maturity, with red combs and gills, they should be removed from the cockerels and placed in their winter houses before they begin laying, for if they begin laying previous to this, the moving or housing will check egg production, as it is the happy, contented hen as well as the busy hen that produces the eggs, and anything that interferes with this contentment will stop the production of eggs. Hence the importance of having them accustomed to their new quarters and begin laying before cold weather sets in and then they will seldom stop if they have comfortable, dry quarters and proper care.

The style of the house is not so important as it is that it should be dry and comfortable, but not too warm. The house should face the south or southeast, with the back to the cold winds, and be perfectly tight. Avoid too much glass, as, being a good conductor of heat, it will make the house too warm in the middle of the day and conduct all the heat out in the night and make it too cold. The floors should be made of matched boards through which no draft can come from below, or preferably a floor of cement; these should be covered with dry leaves, straw, or light litter of some kind to the depth of five or six inches, and in this all the grain feed should be thrown, causing them to scratch for it, thus keeping them busy. Allow five or six square feet of floor space to each hen in the house; feed one pint of scratch feed per 12 hens in the morning and one quart to 12 hens in the afternoon, about an hour before sunset, keeping the above dry mash in the hoppers at all times and a liberal supply of clean water always before them, as an egg is composed of 75 per cent. water. In addition to the above-mentioned feed they should be furnished with green or succulent feed, such as cabbage, turnips, mangels, sugar beets, etc., as this will have a two-fold benefit. First, it will help the other food to digest more readily, so that more benefit will be derived from it; and second, the succulence will help to furnish them more moisture in addition to the water that enters so largely into the composition of the egg.

In the absence of the succulent feeds mentioned, no better substitute can be found than sprouted oats. This can be supplied in winter by soaking the oats in warm water 24 hours, then spreading in boxes or trays two inches deep and sprinkling each morning with warm water, keeping in a warm room or cellar. When two or three inches high they will be ready to feed, at the rate of about one square inch per hen, per day, and will be greatly relished by them. Grit in some form should always be before them.

By thus growing your pullets and carefully housing and caring for them and cultivating a love of the occupation, there is no reason why one should not receive as paying a crop of eggs in the winter months as any month of the year.

THE BETTER COW.

By W. F. McSparran, Furniss, Pa.

Dairying has become such an important branch of American farming, especially in the eastern states, that dairymen at large should fully realize its importance both as a trade factor in the commerce of the nation and in its economic relations to the farm.

It is doubtful, however, whether the mass of the dairymen of the country have kept up with the expansion and needs of their business, and this would seem to suggest that all educational efforts bearing upon the business of dairying should be directed toward the farmer or dairyman himself; but really we farmers of this day and generation have been and are so much the victims of "uplifts," of "efficiency," of "experts" and various patronizing and patronal efforts, that I as one of the sufferers do not have the heart nor the inclination to add the weight of my censure to his burden of sorrows, hence I will discuss the cow and let her owner have a temporary rest. Of course men who are producing and owning, feeding and milking poor cows must get some blame, if not directly at least inferentially, in any judgment that passes condemnation on the cow, for the cow, like the stream, cannot rise higher than her source. She is not a free agent. If her feed supply is short and her neck is enclosed by stanchions, there is no way by which she can help herself. When the pastures vanish in the summer, she would of course help herself to the growing corn or clover in the next field, but there stands the everlasting fence; and however much the cow and I may sympathize with the farmer under all the hard things said about him, the fence that separates the hunger of the cow from the bountiful growth of the corn field stands as proof against him.

There has always been and no doubt always will be a short supply of good cows, and too many of the other kind. Of course if we could divide cows into classes and put all capable of making a profit over all investment in the hands of wise, generous owners, and then classify all the others as a neighbor of mine does it, in "Bad, quite bad and d—d bad," we could, by sending the two latter classes to the butcher, put a lot of the other class into the profit class, but we cannot do this till we can persuade the owners of all cows to begin the work of classification and elimination. Indeed, it is a humiliating fact confronting us who defend the farmers, that very few of them know anything about the individual work or ability of their cows; and as this is fundamental in this operation of classification, it will appear as a perfectly logical and unavoidable conclusion that the man is in a large measure responsible not only for his discouraging ownership of the poor cow but for her production as well.

There would be some grain of encouragement in the cow outlook if we could see any prospect of a falling off in the production of the poor cows. Naturally, in time we would get rid of all classes under the profitable, but how shall we get away from the burden of their continued production? How shall we convince ourselves that we have poor cows, if we do not go about testing them, weighing them in the balance? Are we so wise in our day and generation that we can tell the measure of profit or loss lying potential in our cows by looking at them? I am sure when we are thoroughly honest with our judgments we know we cannot so pass upon the merits of our cows.

Then as soon as we shall come to judge cows by what we actually know they are doing for us, we can have reasonable expectations of improving our herds by more careful breeding and the lot of other essential things that are part of the business of breeding. The mere act of testing our cows to prove their worth, or their lack of it, means very much more than the one simple act; it means the first step in knowing, and other good steps are inevitable. The knowing will soon eliminate the poor cows and will inspire us in caring better for the good ones; and this better care is always one of those good deeds that brings its own reward. It will teach us the lesson of the importance of what we call environment in the business of dairying and breeding, and it will suggest to us that we are likely to produce best cows from our best ones. Thus we leave the first and probably the most important lesson in breeding—selection.

Having learned this as regards the cow as the mother of our improved young stock, we naturally learn that the sire must be equally as good or better. Absolutely, live stock breeding must be systematic and logical and the olden declaration that "Men do not gather figs from thistles" has never lost one particle of its truthfulness. And this better sire means back of him a good mother and, indeed, a long line of good sires and dams, for if he shall not have such a proven good long line back of him we have no assurance that he is going to be the good sire, that he has the inherited, prepotent, potential ability to do a sire's work in our scheme of producing cows that in their turn shall be producers of milk and of better offspring.

As a breeder and a student of the work of breeding, I do not hesitate to say that if we do not follow carefully along this line of selection of both the dam and the sire, we cannot expect the results of our breeding operations to be any more dependable and productive of definite results toward improvement than if we were to allow our herds and flocks to revert to the primitive accidents of natural selection.

We breeders and dairymen are confronted by the question of the production of this better cow, and better families and races of cows, by the urgency of necessity. The poor, unprofitable cow is an extravagance, a waste, a sin, and must go. The better cow is a necessity, a burden bearer, a living maker, a home and farm and soil and prosperity and good citizenship builder and she must come. If we as her owners are not qualified to produce her and environ her then of course the first move in producing her is to develop ourselves, which suggests to me an excellent place to close; but with the volunteer thought or suggestion that this human development shall not be narrowed down to one tiresome idea, to a single talent or a taste, but shall embrace and encompass the balanced up, the rounded out and polished off completion of our finest citizenship.

PORK PRODUCTION.

By George L. Gillingham, Moorestown, N. J.

With this business, as with all others, there are three things necessary,—knowledge, capital, and love of the occupation. Coupled with these are the man, the breed, the feed and the care. It will not take much capital to start, but it will take much knowledge, as well as love for the business, if one would succeed. Here is where the man comes in. If he is not one who is willing to attend to the small details, both in feed and care, he should let hogs alone and go into something that appeals to him more.

It is not my purpose to enter at very great length into the desirable qualities of the different breeds. Select the one you like best and admire the most, as one will always succeed best with the animals he likes. If lean meat for sausage is wanted, the blacks, such as the Berkshires and Poland China; if for lard, the reds, such as the Jersey Red and Tamworths; if for bacon, the Yorkshire and Cheshire, will be found best for these separate purposes.

In breeding, always select mature parents. Young sows should not be bred to bring their first young until at least one year old. We have found that old sows do best and should be kept as long as they do well, or do not get too fat or careless with their young, or too cross to be handled properly at farrowing time. It will of course be necessary to keep a young one—one or two—to take the place of any old one that has to be slaughtered on account of the above faults.

CARE OF THE MOTHERS.

In breeding and caring for the breeding stock, keep ever in mind the word motherhood; remember these mothers are performing a double duty. They not only have to keep up the wear and tear and animal heat of their own bodies, but are growing from five to 12 other bodies which you want to be born strong and well formed, hence these mothers must be fed liberally and treated kindly. Avoid too much corn or fattening grain. Wheat bran or middlings, alfalfa and clover hay, roots, and pasture in summer, and in spring, clover, pasture and green rye, are the ideal for this purpose, also oats and peas. Sow two bushels of oats and two bushels of Canada field peas per acre and when just in bloom, turn the sows in this and it will go a long way towards supplementing the feed bin and will be found to be an excellent milk-producing food for the nursing mothers.

These mothers during pregnancy must have all the exercise they will take and they will not always take enough, particularly in cold weather. To this end the sleeping houses should be removed quite a distance from the feed trough, compelling them to take exercise in coming to and from their food.

Do not crowd in the sleeping quarters; three or four at the outside are all that should be allowed to sleep in one house, as over-crowding is conducive of bad results. These sleeping houses should be warm and dry, situated in the feed or pasture lot, back to the cold winds and facing the morning sun.

Ten days or two weeks before farrowing each sow should be placed in a separate enclosure, that she may be contented with her new quarters before the pigs arrive, as she will not do well if she is working to get out and back to the herd.

After the young arrive, let the mother absolutely alone (unless your presence is needed) until she comes to the feed trough of her own will, as at this time she needs perfect rest for ten or twelve hours after her labor, and will do much better than she will if you try to be too kind to her. However, always have your sows gentle and tame, as there are times when your presence is needed and, if wild or cross, you can do nothing. I know of no animal that will respond to kind and gentle treatment better than the hog.

Let the first feed be very light; if in cold weather, this should be warm. It should be wheat bran or middlings, made into a thin slop. Gradually increase till she is on full feed, all she will take, which should be by the first week, being careful not to overfeed and get her sick of the feed, as this will cause her milk to dry up. See to it that she cleans up each feed and is ready for her next feed. By the time the pigs are two weeks old she may have a light feed of corn at night in cold weather.

As the pigs become older they will need other feed and will begin to eat when two or three weeks old. By having a small inclosure adjacent to the sleeping quarters, which they can enter without admitting the mother, and in this placing some soaked corn, wheat, or oats, they will soon learn to eat and lighten the drain on the mother and they will grow very fast.

The pigs will be ready to wean at eight weeks of age and the sows can be bred again for the second litter, as they will bring two litters per year. The first should come from March 1 to April 1 and the second from Sept. 1 to Oct. 1.

The pigs should then be liberally fed with good pasture in summer and finished the last month with corn. The spring litters should be ready for the butcher in October and November and weigh from 200 to 250 pounds and the fall litters in February and March and weigh from 150 to 200 pounds each. The mothers, if bred again, during the summer months, will need little food other than good pasture and clean water to drink, until about a month before the fall litter is expected. Then feed with protein or muscle forming foods, as in winter.

DISEASE.

There is very little satisfaction in doctoring sick hogs and, in most cases, particularly after they are sick enough to refuse food, it is impossible, hence prevention is much better than an attempt to cure after the disease is contracted.

With the heavy feeding recommended for the sow, particularly in cold weather, when the young stay close to their beds, they are frequently taken with the "Thumps." This is not a disease, as the term applies, but rather an ailment caused by the want of exercise, and breathing the same air over and over again in their beds. The best and fattest pigs are taken first and, when taken, soon die if not relieved.

Prevention is far better than cure in this case and exercise is the only prevention. The fall litters are seldom affected, as they soon leave their beds in the pleasant weather and follow the mother around the lot but the spring litters should be made to take exercise. See that they leave their beds at least once a day, till they are two weeks old. Compel them to follow the mother to the feed trough and let them remain there till she returns and follow her back. This exercise will have the desired effect in preventing the thumps. You can seldom, if ever, cure it after once taken.

All hogs in winter, when they cannot have access to the ground, should be supplied with a mixture for preserving the health of swine and particularly the breeding sows carrying young, as their systems need some mineral matter. If you have one that you find is not doing quite right—whose coat is rough and whose appetite is poor, it is this one that will call on you most for this mixture. It is made up as follows: Three bushels wood ashes, one bushel charcoal (small pieces), one bushel fine salt, one-half bushel air-slaked lime, five pounds spanish brown, two bushels flour sulphur, one-half pound copperas and one-fourth pound saltpetre. Pulverize the last two thoroughly. Mix on the barn floor and keep in a dry place and feed it to your hogs two or three times per week at least.

If, however, there is disease in your neighborhood and you are afraid the germs will be carried to your herd, use as a preventive four ounces black antimony and one pound sulphur, mixed, giving one tablespoonful to an eight-quart bucket of slop once per day for three days; then skip three days and give again. While we do not claim these remedies are infallible, yet we do believe from experience, when used intelligently, the danger from disease will be reduced to a minimum.

ROADSIDE IMPROVEMENT.

By Mrs. Edward M. Lawrence, North Lubec, Maine.

(Prize Essay.)

There was never a time in the history of the world when so many people were traversing the public highway as at present. During the summer months the railroads are almost deserted by those who are touring for pleasure and the commercial world is streaming back along the highway; for it is now pracical to combine business with pleasure by using automobile as carriage and to save the precious time that was once wasted because of the unaccommodating train schedule. The improved facilities for travel combined with the good roads movement make the question of roadside improvement timely.

If one starts to travel between two given points by rail, the choice of routes is limited. This is not true when travelling by the public highways, for often there are a half dozen or more from which to choose. Of course the good road bed and the surrounding landscape will always be of first consideration in making selection, but these things being equal, the condition of the roadside is sure to determine the choice. Even a few miles of extra travel seem an advantage in these days of mechanical power, pneumatic tires, and easy cushions.

Cleanliness is the first requisite for an attractive roadside. Waste of every description is not only unsightly and unsanitary, and, therefore, out of place, but it betokens slovenly habits, and gives travellers a bad impression of the inhabitants of the neighborhood. The careless scattering of waste paper has frequently resulted in serious accident, for nothing will more surely frighten a nervous horse. Broken bits of crockery, tin cans, and worn out machinery had much better be left in the individual back yard than dumped upon the public highway where they become an offending eye-sore to the multitude. No one has the moral right to mar the pleasure of others in this way.

Cess pools should be drained. Pig pens and compost heaps, factories that give forth offensive stench, and everything that would pollute the pure, fresh air should be removed from the wayside as far as possible.

Billboards should not be permitted. These ever present reminders of greedy commercialism mar and obstruct views that would otherwise delight the eye, and in these days of rapid highway transit they are an unbearable nuisance, for they compel travellers to strain the eye continually in discriminating search for the necessary guideposts.

Rocks that lie near enough to the road to prove a menace to the passing of vehicles should be crushed for the roadbed, or they should be rolled back to add to the rustic beauty of the landscape. All noxious weeds should be destroyed before seeding time. Trees and shrubs that interfere with, or cause a crowding of the traffic, and all that harbor insect pests, should be cut down in the driest, hottest season of the year to discourage sprouting. The stumps should be pulled or blown out with dynamite, and burned with the brush.

In clearing up the roadside, I would not be like the barber who cut off a man's nose and ears when he had only ordered a clean shave. As a rule, we do well when we preserve, as far as possible, what nature has donated, only restraining her too lavish hand where she would impede human progress. A group of shrubs, a boulder well beyond the reach of passing wheels, or a tree that harbors no insect pests, and that has been taught to grow beautifully, add real charm to the wayside.

In the matter of decoration, nature must be our instructor, for although she paints with a lavish brush, and selects the most daringly gorgeous colors, they harmonize and blend without flaw. That is why she has been the valued preceptress of every great landscape artist. She is never negligent, but provides in advance for the wonderful and varied color schemes that harmonize with the changing seasons. There are the delicate tints of spring, the gold of the blazing summer, and the purple and crimson of autumn; but when winter comes with her gray leaden skies, she indulges her love of harmony by dropping her brilliant coloring, and covering all with a white, fleecy blanket.

Sometimes it is necessary to draw aside a curtain, however beautiful, in order to afford a glimpse of something which it conceals. It may be necessary to sacrifice a group of trees in order to afford scope of view or to reveal a beautiful cascade or lake. Let us be quite certain before drawing the curtain aside, however, that what we wish to reveal is really more beautiful than the curtain itself. As I write, I remember, with bitterness, a neighbor who cut away some beautiful trees that clothed a jagged cliff. I could have forgiven him in time, had he not white-washed every protruding boulder.

We who are fortunate enough to dwell in beautiful Maine have more frequent occasion to consider tree pruning than tree planting. If the occasion for tree planting offers itself, we shall usually find the graceful elm with its scant foliage a happy choice in this cool climate where we have more reason to encourage sun than shade.

I believe it is a mistake to encourage the planting of fruit trees along public highways. The prevalence of insect pests makes all unsprayed trees a harboring place for them from which they breed a constant menace to orchards. The European countries that have long encouraged the planting of fruit trees along the highway, and have provided for their care at public expense, are finding that the clouds of dust raised by passing automobiles load the fruit with disease germs. We were told in the great Vienna hospital where we went with a friend who came near losing her life from eating the infested fruit that physicians were inaugurating a movement to have forest substituted for fruit trees.

Anything that adds to the comfort, convenience, or safety of travellers will increase their pleasure in traversing a given route. Guide posts with bold, black letters on a white background, giving accurate information, should be placed at every point where doubt could arise.

Bridge rails should be painted white, unless a very light concrete. The abutments should be of uniform pattern instead of being left to the wild fancies of the workmen; and they might bear the name of the town, instead of being decorated by the imprint of a child's foot or the workman's hand.

Telephone and telegraph poles could be made both picturesque and useful by painting them dark green to a height of about six feet and white the rest of their length. Watering troughs may be made an even greater attraction and convenience if neatly built and kept clean. The pails provided by the S. P. C. A. serve a double purpose in these days. A motorist remarked as he filled his engine last summer,—"It prevents cruelty to automobiles as well as to animals."

We now come to the consideration of the individual wayside home. Perhaps no nation has been more negligent of her duty in this respect than our own beloved America. Nowhere does our overwhelming commercial spirit manifest itself more obstrusively than in our great lack here. Now that we are no longer following closely upon the axe, we do well to consider means by which we may take almost immediate rank with the nations of the old world which now lead us by centuries of artistic landscape gardening.

Each individual home owner should realize that he owes a duty to the community in which he lives and to every chance traveler who may pass his abode. If he does his whole duty, his home will be beautiful without, as well as within. The more pretentious the house, the greater seems the necessity for artistic improvement, and if the house be modest, the more beautiful the outside, the more attractive it will appear. While we concede a man's first duty to his family, it is certainly true that where one sees the interior of a wayside home, thousands gaze upon the exterior, and the individual, the family, the community is most frequently judged by that. These things being true, we invite consideration of a few of the basic principles of landscape gardening.

The front, sides and rear of the dwelling must be considered. Graceful curves for walks and drives are always the rule. If the limitations of a city lot compel a straight walk, it is well to let it run past rather than direct to the house. Next, determine what views are to be screened and what are to be preserved, or what are to be revealed by pruning.

The open lawn should prevail and the planting should be confined to the boundaries. Let your view-point alternate from the house to the street. The orchard should take position at the extreme rear of the lot where the fruit will be sufficiently removed from the germ-laden dust of the highway, while at the same time it acts as a background for the buildings, and as a protection for the flower and vegetable gardens which should lie in front of it. A line of shrubs extending from the rear of the house should conceal the barn and out-buildings. Flowers may be planted in broken spaces in front of the shrubs.

Mass planting of shrubs may be used effectively, whether as screens or outlines. The tall grown varieties should be planted in the extreme rear in front of which the lower growing kinds should prevail; not too much crowded for grace and in front of these, plant the hardy perennial bulbs and plants selected for successive blooming. Almost any style of veranda may be greatly improved by the planting of climbers. These should never be attached to the building but to wire trellises, sufficiently removed to provide for the proper circulation of air which will enhance the growth of the plant, and will not menace the building with decay. They can be laid upon the ground while painting is going on. The name of the home as well as of the owner is a matter of keenest interest to travellers, and it ought to have a place on the mail box.

The name of villages and cities should be indicated by white cobble-stones set against a hill or terrace of green or by some other equally picturesque and simple method. Riverhead on Long Island and Wilmington, Delaware, have so constructed their water towers that they constitute their most decorative features. What an improvement over the unsightly tower that usually offends the eye.

God has certainly taken pains for beautiful Maine. You may see the careful tracing of His finger in her beautiful mirror-like lakes where magic lights and shadows entrance and mystify the beholder; in the picturesque rocks that present a stolid face to the maddened waves that beat them only to be dashed and broken in their demented fury; in the wonderful streams that here wind like silver ribbons for a few short miles between green meadows carpeted with velvet turf and gemmed with flowers, and there rush on regardless of wheels that would hold them in durance vile; in the sylvan solitude of her forest, vibratory with the song of birds, where the spruce and pine seem like sentinels standing respectfully aside to permit the passing of humanity, while the timid birches sly out from the shadows, crowding to the very public highway that their smooth, white limbs and delicate tresses may be admired.

I long to see the time when tourists may drive through our forests as they now drive through the forests of the old world, on finely macadamized roads, amidst majestic trees kept free from insect pests, underbrush and decaying limbs. Is it too much to ask that man shall cease to invade, or that he shall embellish rather than mar his surroundings, that the beauty of Maine, our Maine, may be enhanced, rather than destroyed.

REPORT OF PROCEEDINGS

OF THE

STATE DAIRY CONFERENCE AND ANNUAL MEETINGS

OF THE

MAINE DAIRYMEN'S ASSOCIATION

AND

MAINE SEED IMPROVEMENT ASSOCIATION

CITY HALL, LEWISTON,

DECEMBER 2-5, 1913.

TUESDAY EVENING, December 2.

The meeting was opened by L. E. McIntire, President Maine Dairymen's Association. Invocation by Dr. Leavitt H. Hallock, Lewiston.

ADDRESS OF WELCOME.

HON. W. B. SKELTON, Pres. Chamber of Commerce.

I regret that it appears to have been impossible for the Mayor to be present this evening and speak in his official capacity for the city of Lewiston, but I assure you who are here representing the two great associations which are now opening their annual convention, not only in behalf of the Chamber of Commerce, which it is my honor to be booked to represent, but in behalf of the whole city as well, that we bid you a hearty welcome to the city for the purposes for which you come, and that that welcome is not confined to these purposes alone, but it goes out to you, to the associations which you represent, and to every part of the state, among those who are interested in building up any of the great industries on which we rely for the state's welfare and financial and social growth. I was asked within a few days what I regarded as the greatest accomplishment of the Chamber of Commerce during the year and a few months and few weeks that it has been in existence, and I replied without hesitation that it was the fact that it had been able to get the active business and professional men of the city together and get them to understand one another better; to make them more intimate in their relations with one another; to make them realize that they are dependent parts of one great whole rather than independent units, each one striving for himself, for himself alone, and for himself without any regard to the interests of his fellow men.

That, ladies and gentlemen, is one of the great reasons why we welcome and invite conventions of this sort,—because we get together, locally and with those from other parts of the state, all interested in the same thing, whether it is accomplished by one vocation, one employment, one business, or another, and that is, the ultimate welfare of the whole state of Maine. These meetings, travelling as they do from one part of the state to another, as you alternate and as other associations alternate, from one place to another, carry with them a Gospel which is bound to instruct, an enthusiasm which is bound to inspire each community that is fortunate enough to be selected for one of the annual meetings of such associations. And I speak this not with any sense of flattery, not as addressed to these two associations alone, but to any and all of the state-wide societies which are interested in any general industry, for improvement in the state.

We are confronted by great and grave problems and the greatest of them, perhaps, from a public standpoint, is one of which your two associations and that which met with us two weeks ago, are engaged in a practical solution. It is the question of the high cost of living on which the changes have been rung so frequently and so continuously that we sometimes tire of it, but only to have it come back to us as a real and awful presence, in the next breath. Statesmen and publicists have suggested and are suggesting various ways, some practical and some theoretical, by which to deal with these things, based, many of them, upon the theory that the high cost of living is due to great combinations and political conditions. I am not going to undertake to gainsay the fact that to some extent the results which we are facing are due to such conditions. We all agree upon that. We do not agree so well upon the solution when we come to the political and governmental methods; and when I speak of political methods I do not mean in any partisan sense of dealing with these things. We have instances of the control of them by law suit, but that is often wasteful and expensive and not altogether successful. We hear much said about control of them by regulation, and so far as great natural monopolies, the railroads, the telephones, the telegraphs and the expresses are concerned, this is a natural method, a method which has come to stay, and one which is meeting with success. But when we go beyond it and undertake to meet the conditions as they exist in those lines of business which are strictly and properly regarded as private business open to general competition we enter upon a field which threatens us with opportunities at least of getting very far astray; and when we undertake to say what percentage of profit shall be allowed in a particular industry, what amount of success in dollars and cents any particular individual shall be allowed to acquire as the maximum, we are travelling upon a road which is likely to lead a long way, and finally remind us of that saying of Senator Ingalls years ago, that an act of God could not be repealed by an act of Congress. But when we come to consider the question from a practical standpoint, we have the soluton of it in the study of the old question of supply and demand to the largest extent that we shall find it anywhere. And it is that solution that these institutions and societies are applying.

We sometimes think that if we could arrange the political conditions as we believe they should be arranged, we would have no question about adjusting the matter of supply and demand; that it is simply a question of getting at the product which we have. I am not going to take your time for any extended discussion but I do want to call your attention to one instance, the figures of which I have happened to come across within a few days, to show how much we are mistaken if we believe that it is entirely a question of unlocking the available supplies which we have. Taking the beef industry, which is one that comes to our minds as quickly as any, when we speak of the high cost of living, in 1900 we had 62 beef creatures in the country at large for every 100 persons. Thirteen years later we had, through an increase in population and a decrease in supply, instead of 62, 37. In other words, a proportionate decrease of 40 per cent or of one creature for every four men, women and children in the country at large. Now we say that we are going to open up our markets and look to the rest of the world for the supply which we are failing to create ourselves, but let us see where we are going to find it. In the last ten years, in 11 of the great beef producing countries of the world there has been an increase in population of 20 1-2 per cent. In other words, under equal conditions there has been an average increase of 20 1-2 per cent in demand, but the increase in supply in that particular line of food stuffs, against the 20 1-2 per cent of demand, was only 8 per cent. The only real increase was in Australia, New Zealand and Canada. In the case of the countries of South America, Australia and New Zealand are called upon first by the European markets, which are suffering in the same manner that we are; and in Canada the increase in supply was 20 per cent, while her increase in population, or demand, was 35 per cent. So instead of being able to supply our wants she is falling behind in her own market. And when we take the South American countries that are particularly held out as our land of promise in this respect, as Brazil or Argentina, we find that Brazil increased her population 20 per cent and she decreased her supply 20 per cent; so we cannot expect much from her. And Argentina, which is especially referred to as our hope, during that time made no substantial change in the supply but increased her population, or her demand, something over 20 per cent. I have seen it estimated that we might expect eight million pounds of meat products a year from Argentina. Those are large figures, but when you spread them out over our population, just how much do you think it increases our supply? Just about 1-4 ounce per person per year. And that is the Argentina supply of meat stuffs that we are relying on when we expect to solve this question of supply and demand by legislation.

I have mentioned this question of beef supply simply as illustrative of what we must meet. We have got to come nearer keeping our own supply on a pace with our demand. And when I say this I know I am only emphasizing what is in the mind of every one of you, and what has induced you to perfect this organization. We have got to cultivate more acres and secure greater returns from each and every acre. And to the members of these two associations which are engaged in that very project of more production,—more in extent and more intensive production or farming, to you of these two associations I can say, we bid you a hearty welcome and hope that your labors here and the labors of your societies from the beginning of the year to the end may be crowned with that degree of success which your ambitions and your energies so richly merit.

RESPONSE.

By J. A. Roberts.

Representing the two large associated bodies gathered here in convention this week,—the Maine State Dairymen's Association and the Maine Seed Improvement Associaton, in their behalf I thank you for your invitation to hold their annual meetings in your city and also for the very cordial words of welcome you have given us.

I want you to know that we appreciate very highly the activity in our behalf of your Chamber of Commerce and of your city.

These two bodies, organized to extend and improve the dairy and the seed interests of the state, are without a home. They are dependent upon some city to furnish those conveniences necessary to display their exhibits and a hall where they may confer and discuss measures and methods to carry forward and make efficient their future work.

As you are aware, the dairy interests and the seed and plant interests stand among the most important of the various lines of farm work in this state, and their continued growth and development concern not alone their devotees but affect every other farm interest and every city business and profession.

The last quarter of a century has shown great advance in dairy work. In the hands of skilled men dairy animals have made great progress in their capacity for production. Dairymen have studied carefully the science of economical feeding and are realizing the necessity of keeping their stock under sanitary conditions and of making and handling the various products of the dairy under conditons of the utmost cleanliness. In all efforts at improvement, in the establishment of ever higher ideals, the Maine Dairymen's Association has been a strong and efficient leader. Its work and influence were a great factor in securing an appropriation to carry on breeding experiments at Orono.

The Seed Improvement Association is a much younger body. While it has taken a strong hold of the situation and has done good work, it may be truly said that its best work is ahead. Its work has been seriously handicapped by the unusual climatic conditions during the last two seasons.

Its purpose is to induce farmers to give more attention to the selection of seed, to plant only those seeds that are most vigorous and those strains that will make the largest yield. Also we believe that most of our seed should be raised in this state.

The relationship of city to country is one of peculiar significance in these days. It is safe to say that our interests are mutual and not antagonistic, as some men seem to think. One cannot exist nor prosper without the other. The country feeds the city; the city supplies the country with many of its necessities. They have a common interest in schools, in roads, in methods of taxation, in financial matters. The water that turns the wheels of your industry also falls upon our fields, giving life and conveying sustenance to plant and animal.

Not only do we feed you, but you come out and take from us many of our young men and women and set them at work upon your industries. Our surplus savings are left with your banks to invest. Our homes upon a thousand hills are opened to you as our guests. There never was a time when we were so linked together as now. And he who advocates one line of legislation for the city and another line for the country fails in interpreting the signs of the times.

It is right for you to ask of us better food products and to grade and pack them better than we have been doing. It is right for us to patronize your stores and your factories. It is also right for you to buy your food products of us rather than go out of the state. It is right that our banks afford us the same opportunities you enjoy. In all things our interests are mutual. Our future prosperity will depend greatly upon our recognition of this fact.

ADDRESS.

By LYMAN H. NELSON, Chairman Highway Commission.

Probably no question relating to the development of our country has received more general and widespread attention than the improvement of highways. I venture to say that even the tariff question with all its direct and indirect ramifications; or the currency question, dealing as it does so directly with the business world,—that neither of these appeal to such a multitude of people, appeal to the masses, to quite the degree as does the subject of good roads. And especially is this bound to be true wherever men are gathered together as they are here in the interests of farming and farming products. The question of road transportation has an immediate and direct bearing upon your activities. Bad roads mean the distribution of your product within a less radius and at greater expense than will be the case under better roads. No one will challenge the statement that the cost of transportation is an important factor in the cost of living, and that road conditions are a large part of the cost of transportation.

There is no need to argue at the present time the advantages of better roads. It is quite as needless as it would be to argue the benefits of general education. In each case, the gain is so apparent as to require no argument at all. Briefly then, everyone wants better roads.

BOND ISSUE MANIA.

In fact this subject has become almost a mania with some, and I venture to predict that if the enthusiasm in this direction is not soon tempered with prudence, this country and every municipality in it will be overloaded and sunk, not in the mire of bad roads but in the mire of good roads' debt. There are thousands of people in this country today who are advocating schemes for government and local bond issues of enormous amounts without any real regard as to how those bonds will ever be paid, and without a carefully worked out financial system. No less a man than James J. Hill in a recent address delivered before the Bankers' Association, while he did not mention the good roads movement in particular, did foresee the dangers ahead in the constantly growing increase of municipal indebtedness. Many states and counties throughout the Union are borrowing money right and left to build highways without any adequate arrangement either for sinking the bonds or for maintaining the highways after they are built. They are going headlong into this matter without regard and care as to the form of construction, and without regard to the great general principle that bonded indebtedness should be for permanent results.

AMORTIZATION.

The idea that in these great ventures we are doing things not only for our own good but for posterity—this idea, this principle of mortgaging the future is, in my judgment, being decidedly overworked. Most of us today are paying taxes in our own communities because of the errors of judgment of a preceding generation in loaning *our* credit for the development of railways and other enterprises, and for doing all sorts of things which have proved a failure and placed a burden upon us, which is not pleasant or agreeable for us to bear. I consider that there is a great moral question involved whenever any community considers the matter of issuing bonds for public improvement, and I believe that the principle of amortization, so-called, which means in brief, that the life of a plant like a waterworks or a gas plant or even highways shall be accurately measured in order to spread the burden of such investment over all the people who are likely to be alive during the life of such investments—I believe that this principle of amortization is wrong, that is, morally wrong, because it should be our purpose if possible to make life easier for the rising generation and to bear a little more than perhaps our just proportion of such debt, rather than to heap it upon those coming later, who for many reasons may be decidedly unwilling to bear the burden.

I have believed it right to sound this warning, not because Maine is at present indulging in any loose financiering for it is not, but because there is a tendency among certain people in this state not to be content with the plan already on its way to execution, who will advocate strongly in the next session of the legislature bonding schemes of many kinds that will then justify this brief consideration of this matter,

PROGRESS IN MAINE.

So far as the good roads movement in our state is concerned we have made already magnificent progress. We have authorized the issuance of bonds to the extent of $2,000,000, some of which have already been sold, and we have made substantial increase in the amount of money raised from direct taxation to be devoted to other highway matters. I venture to say that no commonwealth in this country has worked out a saner and more secure financial plan in connection with this matter than Maine. When I first proposed the idea of capitalizing the automobile fees by using them to pay the interest and the sinking fund upon the state of Maine bond issue of $2,000,000 for highways, the amount of money from these receipts was slightly in excess of $100,000 per annum, and some people to whom I talked concerning the bond issue believed that the high-water mark had been reached, that the automobile was largely a fad and that there was no certainty whatever of the continuation of its use and therefore the continuation of the fees received from its use:—*but* a year after this plan was first proposed and before a single dollar's worth of bonds had been sold, the automobile fees in this state had increased over 35%. The result is that there is absolutely no room for doubt that the amount of money derived from this source will positively and effectively take care of the $2,000,000 issue without a single penny of increased taxation upon anyone, and it will go much farther than this and leave a substantial balance to be devoted to the maintenance of the highways that this bond issue shall build.

The state of Maine has, therefore, taken a great step forward in its treatment of the highway problem. It has amended its constitution to permit the borrowing of a limited amount of money for this purpose. It has created a Highway Commission whose duty it is to take charge of all state matters relating to this subject. It has made substantial provision for maintenance of all highways to which the state may contribute. It has placed the responsibility for both construction and maintenance upon its Highway Commission. In short, it has developed and placed upon the statute books a law which completely revolutionizes the whole treatment of this subject from a state point of view.

The Highway Commission created under this act has been in existence barely four months, but during that time has been *busy* and has accomplished results which I feel sure will be highly satisfactory to the entire state. The department has been completely reorganized, and its corps of assistants increased in order to handle the vast increase of business arising out of the new law. It has perfected a system of accounts which will render it possible for any one of you to ascertain at any time promptly and fully what has become of every dollar of money passing through its hands, and the commission has proceeded under the new law to arrange for mapping the entire state and to lay out first a system of state highways, and second, a system of state aid contributory highways which, when complete, will show a system that will, we believe, adequately care for every sizable interest within our boundaries.

We have held hearings in various portions of Maine, all of which have been carefully and thoroughly advertised, and these hearings have been attended by persons in large numbers who were interested in the location of these main arteries. These hearings have had the direct result of greatly increasing the interest in the whole highway problem, because they have brought the question directly home to thousands of individuals. When people have learned that the state highway was likely to go this way or that way, every one in the community was interested. Naturally every one wanted the highway to go by his property and it is only by the weighing of the various interests and demands and balancing the economic interests and the interests of the state as a whole that the commission will finally determine some of these disputed locations. Certain it is that the only purpose of the commission is to so locate these main highways that the state as a whole will be best served.

STATE ROADS BUILT FROM BOND ISSUE.

I assume that you all know that a *connected* system of inter-county highways or trunk lines is not only required by the new law, but that these principal thoroughfares or state highways, as they are called, are to be built entirely from the bond issue and the bond issue is to be used for no other purpose.

HOW MUCH FOR EACH COUNTY?

Therefore, the question arises in every county in the state when the citizens attend our hearings and present evidence of the need of main arteries through their respective counties, How much money is *our* county to receive from the bond issue? You all doubtless know that the constitutional provision permitting the legislature to issue bonds for this purpose carries with it the requirement that the proceeds of these bonds shall be divided and expended equitably among the various counties, and undoubtedly you citizens of Androscoggin and Penobscot and Cumberland counties are quite as anxious to know about this as the citizens of Oxford were the other day when we held a hearing at Rumford Falls.

WHAT DOES EQUITABLE DIVISION MEAN?

I admit freely that this question of equitable division is the most difficult problem facing the Highway Commission today. What do the words equitable division mean and what was the intent of the law? While this is a question which, under the law, must be determined by the Highway Commission in conjunction with the Governor and Council, yet, because of the fact that it is a constitutional requirement, it is one in which every citizen in this state has a right to be interested, and it is therefore, in my judgment, a proper question for the consideration of the people at large.

To begin with, I think no one will challenge the statement that it was clearly the intent of the law that *all* counties should receive a fair and equitable proportion of this money. If this clause was inserted for any particular purpose it was to guard against the undue expenditure of this money in any *one* county or in any *one* section of the state. The whole state was to be benefited by this expenditure. Ever since the amendment was finally established in the Constitution, and approved as it was so overwhelmingly by the people in the election last September, those persons especially interested in the good roads program have given much thought and attention to this problem. It is true there are many different views as to what equitable division means. Some believe that these words are so indefinite in their meaning that almost anything which the State Highway Commission should do in the expenditure of this money would meet the requirements. In other words it is not at all necessary to try to find a scientific and proper basis for this division.

POPULATION.

In considering this question I think the average person would say that this money should be divided upon the basis of population of the various counties as that would appear to give the greatest good to the greatest number.

FARM TERRITORY.

But on examining the matter further it appears that a division in this manner might not properly take care of our large farming sections, where the need of good roads is most important, but where the population is small, and therefore it seems fair that the area of farming lands should become an element in developing a basis of division in order to properly offset the preponderance of population in certain localities.

ROAD MILEAGE.

Then again it appears that certain counties, having large farming area may have comparatively few roads, while other counties will have many more miles of highway for the same acreage, and it would appear that this element should also be given consideration, as the counties having a larger mileage of road should receive perhaps more consideration than the counties having a small mileage.

WASHINGTON EXPERT.

Good Roads Committee of the State Board of Trade took up
Almost immediately after the amendment was adopted the

this matter and sought the advice and help of the government experts at Washington. They sent a man down here, as you all know, who made an extensive study of the state geographically and economically, and later on we received a report of that department which was drawn with the idea constantly in mind of this question of equitable division of the bond issue. And it was by such a process of reasoning as I have just shown that the government expert from Washington laid out his basic plan for division of this money.

STATE BOARD OF TRADE.

The State Board of Trade Committee in making as it did an exhaustive study of this question believed that still another element should be added, namely, that of valuation of estates by counties, and they proceeded with the assistance of an expert engineer of Maine to work out an elaborate table of percentages, taking all four of these items into account, namely, population, farm area, road mileage and valuation, and reached the conclusion that the division of the bond issue based upon some such method would be equitable and fair to all concerned.

Population alone is unfair.

Valuation alone is unfair.

But when these essential elements are offset by farm acreage and road mileage the question seems to assume some form of equitability and justice.

NO DIVISION CAN BE ACCURATE.

Although the State Board of Trade recognized clearly that no absolute unvarying division should be made,—that there would be various considerations that would fairly lead to alterations in these figures, they believed that *some* basis should be established and that the division should come as near to this basis as the practical working out of the plan made possible. This method of division produced the following results:

Androscoggin	6.1 %	$122,000
Aroostook	10.45	209,000
Cumberland	12.89	257,800
Franklin	3.87	77,400
Hancock	5.05	101,000
Kennebec	7.6	152,000
Knox	3.28	65,600
Lincoln	2.87	57,400
Oxford	6.85	137,000
Penobscot	10.71	214,200
Piscataquis	3.61	72,200
Sagadahoc	2.31	46,200
Somerset	6.82	136,400
Waldo	4.4	88,000
Washington	4.87	97,400
York	8.32	166,400

NATURE OF IMPROVEMENT.

Hand in hand with the question of equitable division of the money itself goes the question of what shall be done with the money, and that leads directly to the question of the nature of the improvement of our highways to which this $2,000,000 should be devoted, and in this matter also there is among fair-minded men a decided difference of opinion. Some say that no road whatever should be built unless it is the best, the most permanent; that no road improvement should be made unless it is positively known that the results will stand the traffic of the particular locality; while others believe that the paramount consideration in the State of Maine is to make our highways safe; that we should adopt the slogan of some of our railways where each station bears the sign "Safety first;" and that this bond issue should be spent for fundamental permanent investment; that it should go first into widening and straightening our highways, reducing the grades and improving the drainage. We all know that the average farmer's wife of today drives her horse very little over the country road, and the reason is that the country roads are not safe at the present time for horse travel because of the automobile. Our roads are too narrow—too crooked to permit of clear vision of approaching motors and too narrow to allow safe passing. I believe that the first consideration is to make these highways *safe,* and that the matter of a smooth, hard riding surface, while important, and to be desired in the end, is really of *secondary* consideration.

If you adopt the first view that the money will be more wisely expended by building only the most permanent types of highway such as concrete, bituminous macadam, etc., the number of miles actually improved in this manner from the bond issue would be very small, probably not more than 150 to 200 miles, and while it is true that the comparatively few people living in the vicinity of these roads would derive much pleasure from them, the state at large would derive no widespread benefit at all. If, on the other hand, you adopt the second principle, and devote this bond issue to making fundamental improvements as I have suggested, widening, straightening, reducing grades, and putting in under and side drainage, and then surface these roads with the best gravel or earth that may be obtained within a reasonable haul, you will secure a vastly greater mileage of improvement and have adopted, I believe, the wisest and best course for the state as a whole.

GRAVEL ROADS.

I am firmly of the opinion, too, that first-class gravel roads will stand the traffic of this state practically everywhere. The gravel road in Maine has never been given a fair show. I do not know of a piece of this kind of construction that has ever received proper maintenance, proper care,—care such as the state of New Hampshire is now giving its gravel roads with daily patrol, and whether this type of construction will stand the traffic or not I believe it should be given a trial, because practically nothing will be lost in such trial. The money that has been spent in reducing grades, in cuts and fills, in under drainage, etc., will not be lost under any circumstances, and if the gravel top proves inadequate, you have still the best possible foundation for any other type of road which the community can afford to build.

Furthermore, I believe that when the bond issue has been expended along this line, the state has pretty nearly done its equitable and fair duty to all sections of the state, and has treated all sections alike. If it should develop that in some sections where the traffic is particularly heavy, the gravel road cannot be maintained, then will it not be a fair proposition that as the state has provided the foundation and drainage, the community where such heavy traffic exists shall bear the burden which its own traffic makes. For instance, take it in the case of Portland. Some people do not believe that a gravel road from Biddeford to Portland will stand the traffic. While I am unwilling to admit that it will not stand the traffic, at least until it is given a trial under the best method of patrol maintenance, still should it turn out that such a road cannot be maintained at reasonable cost, what is the reason? The reason can only be the excessive traffic, which is due very largely to the city of Portland itself. The traffic near cities is, of course, increased because of the great number of vehicles of all kinds that are operated from the city as a center, in and out, in and out, day after day, over a fairly well defined radius.

IF GRAVEL PROVES INADEQUATE.

Now, then, if the gravel road which the bond issue has provided is inadequate in any particular case, why should not the community directly causing the unusual traffic provide a more permanent surface? This could readily be done, it seems to me, without hardship to those concerned by the formation of a highway district.

If at some future date it should become necessary to form highway districts for the purpose here indicated, no such districts should be permitted without surrounding their charters with conservative limitations. Their borrowing power should be distinctly limited to a reasonable amount of money, and the use of that money should be as far as possible distinctly prescribed. Such bonds should be for a very short term and not a dollar of such money should be spent for anything except the most permanent construction. Not a dollar should ever be permitted to be used in the way of maintenance or expense to the wear and tear of traffic.

STATE MAINTENANCE.

Furthermore, under the new law the state is required to maintain the state highways, so that the expenditure for this purpose by any district under the district bond plan would end with the construction of the road, the state taking over its maintenance precisely the same as in other places.

FEDERAL AID PLAN.

Again, it is obvious to all conversant with the Federal Aid movement in Washington that the time is near at hand when the Government will adopt some measure of assistance in road building. Nearly all the schemes considered contemplate a system of trunk lines from state to state.

If, then, we have prepared for this by laying the foundation and a gravel top for immediate use, we are in the best possible shape to receive on this foundation such a more expensive surface as the Government would likely build.

WHAT THE COMMISSION HAVE ACCOMPLISHED.

The new Highway Commission have accomplished in the few months of their existence a great deal. They have completely reorganized the department and placed it on a proper business-like basis for handling the great increase of expenditure which is now permitted. They have developed a system of accounts adequate to the occasion, that will render it possible for every individual who is interested to know exactly what has become of every dollar of the state's money, and to ascertain this information promptly and completely. The commission has laid out a great many state highways on which surveying parties have been busy for some time, and will continue to be employed until the severity of winter prevents. Already several hundred miles of these state highways have been carefully surveyed and staked. It is the intention of the commission to plot the data turned in by the surveying parties during the coming winter, so that in the early spring of 1914 actual improvement of the highways can commence in wholesale fashion.

BASIS MUST BE REACHED.

It is, however, absolutely necessary that before we commence such wholesale construction the questions I have outlined in regard to the division of the bond issue and the type of improvement to be adopted shall be definitely determined, and I have no doubt that a satisfactory conclusion will be reached during the next few weeks, but in closing I want to urge that these are problems in which every citizen in this state ought to be directly interested, and that the commission will welcome the general discussion of this problem.

DO NOT BE IMPATIENT.

As chairman of the State Highway Commission I venture to request in conclusion that you be not too impatient of immediate results in highway work. It will take and it must take, in order to spend our money properly, at least five or six years to complete the state highway system as planned, perhaps longer than this, and some communities are bound to reap the advantage sooner than others. It is, of course, a physical impossibility to begin this work in all communities or all towns at the same time, and furthermore it is a financial impossibility because we are prevented under the law from borrowing more than $500,000 in any one year, but I firmly believe that this road building will begin in such wholesale fashion in the spring of 1914 that you will all be pleased with its results, whether the work is done in your own immediate vicinity or elsewhere, and the commission surely hopes that it will always receive your support so long as it continues to carry on this work honestly and efficiently. We are making a determined effort to keep politics out of this great business. We are all of one mind upon that subject, and are determined that only such men shall be employed as are the best available men, regardless of how they vote. We earnestly solicit your support of us in the position we have taken in this matter, for we believe that that is the only way in which this enterprise can be carried to a successful end.

WEDNESDAY, December 3.

BUSINESS MEETING OF MAINE SEED IMPROVEMENT ASSOCIATION.

ANNUAL ADDRESS OF THE PRESIDENT.

W. G. HUNTON.

The result of our labors for the growing season of 1913 is history today and we have gathered here from all sections of the state, to compare results, exchange experiences and accept advice. No true farmer was ever satisfied with his own accomplishment. He firmly believes that with each improvement in crop methods there is still opportunity for advancement. Nature has set no limit to her resources. Within half a century I have heard it claimed by men well educated by experience and of more than average ability in intellect, that 100 bushels of dry shelled corn per acre and a cow that could produce 500 pounds of butter, were the limit. Today this has been so far exceeded that we are not willing to prophesy in regard to the limit which can be reached. The climatic conditions of each growing season are beyond our control. All other conditions are those which make us responsible personally for the abundance of our harvest. Improved machinery and thoroughness in cultivation have become established facts. Without them we do not expect rewards; but there is much to be learned in the better feeding of our crops and in seed selection. We are all agreed upon this. It was this prevailing thought in the minds of all the progressive farmers of the state that led to the inception and organization of this association four years ago and influenced the legislature to appropriate money and enable us to show results. While these results have not been as marked and far reaching as perhaps many of us at first expected, let us remember that pioneer work is always slow; that certain lines of seed selection and propagation that at first seemed advisable were found faulty and had to be abandoned, that we were attempting to urge the producers to engage in strictly scientific plant breeding for which they had not the time or training. It must be left to the few to do this work and the work of this organization must be to take the results of their labors and disseminate them as widely and as quickly as possible. I believe this line of work will show in the next four years results that will astonish the most optimistic.

In comparing the improved seed with good average seed I have seen the yield of potatoes increased 18 bushels; barley, 7 bushels; oats, 12 bushels; and beans, 6 bushels. When we can have enough of this kind of seed to supply one-fourth of all of the farmers of Maine, what will it mean to the prosperity of our profession? To what extent will this alone contribute to the extension of our industry and the encouragement of our young men and women to take agriculture as an occupation? The agriculture of the future must be so conducted as to promise substantial financial gain, and not be a last resort for the unsuccessful and constitutionally tired. The present market prices of everything we produce are sufficient to warrant success by this method to any one who will diligently study the laws of nature and conform to them. We have the aid of our Federal Government, the assistance of our state, the active help of every other corporate interest in the state to urge us on, and the members ready to extend every courtesy in sending out to all the results from year to year. With these incentives can we doubt a good measure of success?

REPORT OF THE SECRETARY.

To the Members of the Maine Seed Improvement Association:

Upon the 25th day of next January this organization, the Maine Seed Improvement Association, will be four years old. They have been four years of varying success. In 1911 there were 156 members in good standing in the association; at the present time there are 125 members paid to the first of last

January. The greater part of this number are the true friends of the association. Since taking up the work of secretary I have taken in $4.00 in dues and fees.

The past two years have been unfavorable for the best farming interests, yet I know the men who have been trying to follow the methods necessary to produce good seed have been successful in their farm operations. The two hard seasons have shown many of our best men the absolute necessity of raising their own seed, and have made them better friends than they ever were before, of any effort to increase the probability of a profitable season's work.

I believe the Maine Seed Improvement Association is stronger at the present time than at any time since its organization, and that as we are able to show results, so will our membership and strength increase.

It is unfortunate when it becomes necessary to make a change in officers during the year. This year your secretary, Prof. W. L. Slate, was called from the state during the summer, making it necessary that a new secretary be appointed.

Taking up the work, as I did, in September, there was little time in which to familiarize myself with the duties of secretary, and at this time I wish to express my appreciation of the assistance given me by all with whom I have worked, and especially Dr. Leon S. Merrill and Prof. R. P. Mitchell. Dr. Merrill at all times has been ready with suggestions and advice which have made many of the rough places in the way to seem smooth. Mr. Mitchell has been of valuable assistance to me in my work as secretary.

Only one executive committee meeting has been held during the year. Mr. Frank Lowell of Gardiner, Mr. Guy C. Porter of Houlton, and Mr. R. L. Copeland of Brewer met at the State House on September 12th, for the purpose of arranging for the annual meeting. Substantial additions were made to the premium list, and a cup was offered, to be competed for by students taking agricultural courses in our secondary schools. The cup will become the property of the school which sends the student making the highest score in judging corn, potatoes and grain.

Because of the close relationship between the good seed and dairy interests, the office of Field Agent was done away with and the seed interests were placed in charge of the State Dairy Instructor and an assistant was employed to carry on the work of seed and plant improvement.

We have tried to work with all who have asked for help. We have inspected sixty farms; twenty-seven of these we have visited twice, and several, three times. Good work has been done by most of the men visited.

One line of crop improvement work which has been carried on by the Department is worthy of special mention. Last winter Mr. Thomas Dinsmore of China, Maine, offered a prize of $100.00 with the object in view of increasing the interest in growing our yellow flint corn. The prize was to go to the person who would raise the largest amount of shelled corn, over one hundred bushels, on one acre. Later, Mr. W. B. Kendall of Bowdoinham, offered an additional prize of $25.00 and a further prize of $25.00 if the winning acre should be grown upon Sagadahoc Fertilizer.

The final reports have not all been returned to the office, but three of the contestants have already reported yields of over 100 bushels shelled corn, and several others were very close to 100 bushels. These yields, in a year so unseasonable as the past, are very encouraging and should induce more of our farmers to grow corn.

The greatest criticism which I am able to make on the methods which we follow as growers, is one which I know to be true. From my own experience as a farmer, I know we do not pay sufficient attention to the preparation of the seed bed, nor do we follow the best methods of fertilization and cultivation of our crops.

The past two seasons have been a test of a man's ability as a farmer, and the one who has followed the teachings of our most practical and successful farmers, is the man who has seed which is of sufficient quality to be worthy of reproduction.

The greater part of the men who have been working with us have good seed, which will sell at an advance over the market price. There is a great call for native seed by men who desire to grow better crops but do not know where to find first class seed.

To bring the buyer and seller together, the Department of Agriculture intends to publish a catalogue of seed which may be recommended as being true to name, healthy, vigorous and a high yielding strain. The plan is to make in the catalogue a plain statement of conditions under which the crop was grown, and the yield as declared by the grower, and as observed by the inspector. The Department asks the coöperation and assistance of every member, to the end that a catalogue of Maine Seed Improvement seed be issued every year.

In bringing this report to an end I wish to make several recommendations.

It would seem to your secretary that more specific plans should be drawn up by the association to the end that results be more uniform.

That a more thorough study be made of varieties and strains in relation to the localities in which they are grown.

That the association should take some action to discourage the sale of potatoes for seed, which are infected with "blackleg" and other infectious potato diseases.

That the association should endorse the work of the U. S. Government in its study of potato diseases in Aroostook County, and encourage the work in every way possible.

It is the opinion of the secretary that there may be strains or varieties of potatoes which are more resistant to disease than others, and that the association should make an investigation of the matter and if such strains be found or originated, encourage their propagation.

I quote from Mr. Mitchell's report at the meeting December 4, 1912. "As a Seed Association we must have something to sell. For, say as much as you will, the success of this organization depends fundamentally on its profitableness to the seed grower." And I recommend that the association make a study of the seed markets and its demands; that plans be drawn up for producing seed which is wanted in the market, in quantities which will tempt the buyer.

In closing my report I wish to again thank all who have in any way assisted me—not only in preparing for this meeting but throughout the season.

Mr. President, I respectfully submit this report to the Maine Seed Improvement Association.

C. R. LELAND,

Secretary.

Voted, that the report of the secretary be accepted and placed on file.

REPORT OF TREASURER.

Bowdoinham, Me., Dec. 2, 1913.

RECEIPTS.

1912, Nov. 17, cash on hand	$83 95
1913, Jan. 9, received from retiring secretary, W. L. Slate	9 65
1913, Jan. 17, received from R. P. Mitchell, reimbursement on secretary's expense account	5 91
Total receipts	$99 51

EXPENDITURES.

1913, Mar. 21, paid R. P. Mitchell, balance due on expense account as secretary	5 91
1913, May 31, paid annual dues Maine Federation of Agricultural Associations	4 00
	$9 91
Cash on hand Dec. 2, 1913	$89 60

C. M. WHITE,

Treasurer.

Voted, that this report be accepted.

Voted, that a committee on resolutions be appointed by the Chair, this committee to hold themselves in readiness to consider anything that shall be introduced, and that the association will not act upon anything unless it comes through that committee.

The following committee was appointed: E. E. Philbrook, H. M. Woods, L. C. Holston.

A motion was made that the secretary be authorized to have printed the constitution and by-laws.

Dr. Merrill: I was wondering if it would not be well if a study could be made first of the constitution to see whether or not some changes might be desirable. I know there has been considerable discussion on some points in relation to the work of the Seed Improvement Association. There are some who feel that it would be a wise thing, if it could be done, to even change the name to the Maine Seed Growers Association. I am simply bringing out these points to show that there is an impression, among some of the members at least, that some changes ought to be made. It seems to me that before having the by-laws printed they ought to be read carefully by a committee, and it would be well to have the action authorizing the printing to be contingent upon further changes to be made at this meeting. I do not know that a vote to authorize the secretary to have the constitution and by-laws printed would necessarily prohibit that, but my impression is that unless further action is taken a vote to have them printed at this time would mean that they should be printed as they now are.

Mr. Leland: It was my idea in bringing up this matter at this time that the constitution and by-laws should be either read before the meeting or read by a committee and studied for changes that should be made. I have noticed this summer in visiting the members of the association that there seems to be a call for some changes. Just what those are I do not know.

Mr. Roberts: I think whatever amendments are made would be included, of course, in the printing. The printing would not be done until after this session, and of course if this body does not see fit to make any amendments, the present constitution stands.

Mr. Hunton: The secretary will please incorporate into the motion that the constitution and by-laws will be printed as finally left by this meeting.

Voted, that the secretary be instructed to have printed, copies of the constitution and by-laws as they shall read at the close of this meeting, and that they be distributed to each member of the association.

Voted, that the committee on resolutions, with the addition of the secretary, be a committee to entertain any proposed changes and report back to this meeting at a later session.

An invitation to hold the next annual meeting in the city of Bangor, from the Bangor Chamber of Commerce, was presented and referred to the executive committee.

WORK OF THE MAINE AGRICULTURAL EXPERIMENT STATION IN BREEDING OATS.

By C. W. BARBER, Assistant Biologist, Maine Agricultural Experiment Station, Orono, Maine.

Upon the acquisition by the state in 1909 of Highmoor Farm, located in the town of Monmouth, for the use of the Maine Agricultural Experiment Station in the investigation of problems pertaining to agriculture, plans for breeding oats were formulated. To know how to produce strains of oats embodying such characters as stiff straw, immunity to disease, and ability to give high yields of grain through successive seasons, is the problem. To date our efforts have been devoted chiefly to the task of building the foundation for such work. However, during the past season actual breeding of oats was undertaken in that crossings between many individual plants were made.

As an essential basis in experiments dealing with this subject it was necessary to introduce many varieties of oats possessing the characters and types that are desirable in crossing for the purpose of learning the ways and means of combining the strongest qualities into strains better adapted as a farm crop in our state. In 1910, as a beginning, a variety test of oats was instituted. Consequently the best varieties of oats procurable in the United States and Canada were purchased and subjected to field tests. These varieties were obtained from members of the Canadian Seed Growers Association, from seed dealers and growers in widely separated sections of the United States, including Maine. In choosing this original stock the basis of selection was the cropping ability and the general favor with which each variety was looked upon by farmers in the respective localities wherein each variety was grown. In general the results sought in testing varieties of oats according to plans of this Station include the determination of the yield of grain and straw produced by standard varieties, the most efficient methods of culture and rates of seeding and the soil conditions in which each strain grows most profitably. Specifically the aim is to produce varieties of oats that yield a large amount of good grain and prove most satisfactory as a crop amid the variable conditions on Maine farms. Such a comparative test of oats is of immediate value to the farmer in that it reveals the high yielding varieties already in the market and affords a source of supply from which good strains may be started on our farms. Before discussing in detail the relative worth of the varieties of oats in these tests it is well to speak of the general conditions amid which such work must be carried on and of the methods employed.

The soil of Highmoor Farm varies from a light sandy loam to clay loam. For the greater part the soil should be designated as a loam. The subsoil, judging from the appearances of successive crops, is also exceedingly variable in fertility and water holding capacity. During the time in which this farm has been managed by the Station a vast amount of work has been expended in uprooting the dead trees that were scattered throughout the fields and in removing boulders and rocks that hindered the efficient and economical working of the fields by modern implements. From this it will be inferred that the soil conditions as a whole varied a great deal and rendered exceedingly difficult the task of establishing a uniform environment for plant breeding work. Each working of the soil and the addition of fertilizers and green crops will tend toward the production of a fertile environment of a much greater uniformity than at present. In all of these tests oats have not been planted on the same piece of land in successive years. This, also, tests each variety in a wide range of soil conditions and affords a basis for judging to which particular type of soil it is best adapted.

The varieties tested in 1910 were sown on land that had been plowed the previous summer and kept clean by working over about once a week with cutaway and spring-tooth harrows. Before the farm was placed under the management of the Station this land had laid in sod for many years, becoming quite densely infested with witch grass. The summer fallow and clean cultivation resulted in freeing the field from this weed pest. Immediately before planting the soil was disked with a double action cutaway harrow, going lengthwise and then crosswise of the field. Following this spike tooth harrows were used to smooth and level the ground in preparation for the seed. At the time of plowing 5 1-2 cords of manure were put on each acre and at the time of seeding 900 lbs. of a fertilizer containing 3.3 per cent. of nitrogen, 10 per cent. of available phosphoric acid and 7 per cent of potash were applied to the 30 one-tenth acre plots in the variety tests of this year.

In 1911 the variety tests of oats were carried out on land which produced potatoes in the season of 1910. This land was plowed in the fall of 1910 and at that time eight cords of manure were added. This was thoroughly disked in. In the spring of 1911 the ground was again disked by means of cutaway harrows, the harrowing being done crosswise and lengthwise of the field. To smooth and level the field spike tooth harrows were used. At the time of seeding, fertilizer analyzing 4 per cent. of nitrogen, 8 per cent. phosphoric acid and 7 per cent. of potash was applied broadcast at the rate of 500 lbs. per acre. As in the year 1910, seed and fertilizer were sown by means of a grain drill.

In 1912 each variety of oats was planted in duplicate, one tenth-acre plot being sown in field 4A in the north half of the farm and its duplicate in field 4B in the southwest half. Field 4B being better drained was ready for seeding before field 4A. Field 4B produced potatoes in 1911 and in preparation for the oat variety tests was plowed in the fall of that year. Before planting this field was thoroughly harrowed twice, once lengthwise and once crosswise with cutaway harrows. Then smoothing and levelling of the land was accomplished by using spike tooth harrows. The soil is a medium loam, one which works up in excellent shape, becoming mellow and finely pulverized. Such preparation makes a splendid seed bed. This field is naturally well drained, having a good slope, so that no water stands on the surface.

Field 4A is not as quickly drained as field 4B and as a result could not be harrowed and seeded until nearly three weeks later. This field comprises practically the same soil conditions as field 4B. This field was harrowed three times with spring-tooth harrows and finally smoothed and levelled with spike tooth harrows. Owing to the frequent heavy rains and lateness of the season for seeding oats the soil could not be worked into the most mellow and desirable condition for a seed bed.

In the past season plots of 1-40 acre in extent have been adopted as the unit area for tests of oat varieties. Each variety is planted in four of these unit plots which are scattered throughout the field. This affords a wide distribution of each strain, subjecting it to variable soil conditions. Good evidence for the use of several small plots widely scattered in a field instead of one acre plots or larger for the testing of varieties has been established by workers in the Rothamsted Experiment Station in England. The percentage of error in the results of tests on several small unit areas is so low that it is impracticable and inefficient to use the larger areas. The small plots permit so much greater scope in plant breeding work for the season that many more varieties and developing strains may be grown each season. The field in which the tests of this past season were carried on contains the most variable soil conditions on the farm. The soil ranged from sand to clay. The land slopes to the west, presenting fairly level surfaces to abrupt slopes. Numerous depressions occur throughout the field, wherein sufficient moisture was maintained during the season, while the knolls became too dry for well balanced development of the plants. However, the distribution of a variety throughout this field insured the testing of each under the various conditions in which it was desirable to observe the behavior of the oat plant.

Each of these fields was fertilized at the rate of 500 lbs. per acre of a high grade fertilizer containing 4 per cent. nitrogen, 8 per cent. phosphoric acid and 7 per cent. potash. In past seasons the fertilizer has been applied in the drill at the time of seeding. This year the fertilizer has been broadcasted and harrowed in before planting.

The seed of each variety of oats to be planted in these tests is carefully cleaned and graded in a fanning mill in order that only heavy plump grains be sown. In regard to the question often asked about the relative value of heavy and light grains for seed it should be stated here that most investigations show in general a greater yield from the heavy seeds. The seeding of heavy well-filled grains is undoubtedly the best practice for farmers to follow.

All grain seed sown at Highmoor in variety tests and in larger fields is planted in drills seven inches apart by means of a grain drill. This machine drops the seed under forced feed through eleven spouts which lead to the same number of drills, each opened by a disc. Also fertilizer is spread in the drill. Both seed and fertilizer are put in the ground and covered at the one operation. This method of seeding insures a more even stand of grain than does the usual method of broadcasting. In the drill the seed is sown more evenly, at a more uniform depth, and is entirely covered, while in broadcasting a large percentage of seed is ordinarily not covered but lies exposed on the surface and fails to germinate. Further, in harrowing in seed after broadcasting much seed is buried too deeply and hence does not develop.

All seed oats sown at Highmoor are treated in a solution of formalin to prevent the spread of the fungus disease called loose smut, the spores of which, as is well known, are borne from year to year clinging to the grains. This treatment is carried out by soaking the oats for twenty minutes in a solution of formalin: 1 pint formalin to 42 gallons of water. This formula is recommended by Professor C. A. Zavitz of the Ontario Agricultural College.

In these tests all varieties of oats have been uniformly seeded at the rate of two bushels per acre; in 1910 the rate being two bushels by measure per acre and in 1911 and 1912 two bushels by weight per acre. For many varieties characterized by large grains two bushels per acre does not give a good stand. The basis for seeding oats should take into consideration the number of grains per bushel.

Our general practice in harvesting the oat crop is to allow the grain to develop to the thick dough stage before cutting. It is then cut with a binder, shocked and allowed to dry out for a few days. When completely dry the crop is hauled to the scales and threshing machine. Our threshing machine is small and great care is exercised to remove all the grain from it after each variety is threshed. This is absolutely essential in order to prevent the different varieties becoming mixed with one another.

All grain raised at Highmoor is recleaned and graded so that only heavy clean seed entirely free from foreign seeds is sown or sent out to purchasers. A common fanning mill is used to clean and grade grains. This machine is of moderate cost and works to a high degree of efficiency, leaving the grain clean and free from weed seeds and light unfilled grains.

Time will not be devoted here to a discussion of all the varieties grown in the tests each year but only those varieties that have been propagated four years will be described. Many varieties have been tested one or two years and then discarded owing to some marked weakness or undesirable character. Of the 21 varieties of oats tested in 1913, 11 have been in this experiment during four seasons, 8 during two seasons, one during three seasons, and one during one season. Among the varieties tested four seasons there are some very interesting types. First among the early varieties of oats is the Kherson. With short, fine, stiff straw supporting a small open head, characterized by short delicate drooping branches, the Kherson often surprises one in its cropping ability. The grain is long, slender, yellow in color and not particularly attractive to the average farmer because of its small size. Nevertheless, this oat is one worthy of attention. Seeded May 1 to 5, it is generally thoroughly ripe by August 1. At Highmoor this variety yielded from 48 to 69 bushels per acre during the last four seasons, giving an average yield of 57 1-2 bushels per acre. The average yield of straw during the same period was 2466 pounds per acre. In the season of 1913 this oat yielded 61 bushels per acre.

Among the medium late varieties are the Imported Scotch and Irish Victor. These mature generally about a week later than the Kherson. These varieties have a taller straw and larger, more plump white grains. The Imported Scotch has yielded from 60 to 71 bushels of grain per acre during the past four seasons, the average yield for the four seasons being 63 bushels per acre. The yield of straw averaged 2793 pounds per acre. The straw of each of these varieties is a little weak. In 1913 the yield of these varieties was as follows:

Imported Scotch,	grain	68 bu.	per	acre,	straw	2635 lbs.
Irish Victor,	"	67 "	"	"	"	3003

Of the late varieties of oats which mature 10 days to three weeks later than the Kherson there were several types in these tests. Only a few of these will be mentioned owing to the lack of space.

An oat which always attracts attention by its long head of the "Horse Mane" type, and tall stiff stout straw bearing very broad leaves is the Senator. However, this oat has never yielded very satisfactorily. The heads carry many spikelets but the percentage of barren grains is very high, so that this promising variety always fails to yield as high as one would estimate from its appearance. The grain is very large, the kernel being enclosed in a thick hull. Often the kernel of a mother oat does not develop, in which case the pin oat is generally enclosed within the hull of the mother oat. It is possible that under certain management as yet untried this variety might develop to be a high yielder. The yield of grain ranged from 38 to 63 bushels per acre, giving an average yield of 52 bushels per acre in the four years' test. The yield of straw amounted to 3000 pounds.

The Banner oat with a yield of 46 to 71 bushels per acre is one of the best late oats tried out in these tests. The plants are tall, leafy, possessing stiff straw, and carry open heads with stiff upright branches. This oat produced on the average 61 bushels of grain per acre and 2820 pounds of straw during the past four seasons. The grain is medium to large in size, plump and white. It does best on strong moist soil. The President oat is late like the Banner and similar in appearance, excepting that the branches of its open head are longer and droop more. Yield of grain, 50 to 68 bushels per acre. Straw (4 year average), 2722 pounds. The grain of this variety is large, plump and white.

The Prosperity oat is also a late variety producing tall leafy plants having stiff straw. The heads are open, spreading, with long branches, the grain is white, short and plump. During the four years' test the yield of grain ranged from 53 to 73 bushels per acre, averaging 62.5 bushels. Average amount of straw produced was 2768 pounds.

An interesting variety of oats which has been tested during three years is the American Clydesdale. This is not a pure variety but is a mixture containing plants of nearly every type obtainable. With an average yield of grain for three years amounting to 57 1-2 bushels per acre, the Clydesdale deserves to be listed among those varieties possessing greater cropping ability than the average oat.

A black oat, the Victor, is an interesting type. The straw is coarse, tall, and stiff and bears an open head with very long branches. This variety yielded 55 to 60 bushels of grain per acre.

The Lincoln oat resembles the President in general appearance, except that it does not grow as tall. The grain is short, very plump and white. During the past four seasons this variety has yielded from 48 to 70 bushels of grain per acre and an average of 2900 lbs. of straw.

Of varieties introduced since 1910 the Early Pearl. a medium to late variety, is very promising, judging from its performance in these tests. This oat has been grown for several years by Mr. R. L. Copeland of Brewer, Maine. It seems that this variety originated from a single plant found on the roadside and later propagated by Mr. Copeland. It has a uniform appearance and is very productive on fertile soils. In 1912 this variety produced 64 bushels of grain per acre and in 1913, 70 bushels per acre. These figures are the means of yield from two plots in 1912 and four plots in 1913. The straw of this variety is tall, stiff, and medium size, with the heads open, and erect. The grain is white, long, medium size, and well filled.

Other late varieties, the Siberian, Abundance and Silver Mine, resemble in general the Banner and President varieties in appearance. The yield has not been as great as that of these two varieties.

These tests will be continued in following seasons in order that each variety may be tested more than two years at least and preferably during five years. In such a period it may be possible to judge of the effects of certain seasonal changes on the cropping ability of these different varieties.

Plant Selections. Individual plants representative of different types are selected each year from the fields. The seed of each plant is kept separate and sown in a single row by itself. Hence all plants in a row are the descendants of one plant. Throughout the growing season notes are made as to the characters and general behavior of the plants in these rows. The plants of each row are weighed and threshed together so the progeny of the original selections are kept free from admixtures. Being self-pollinated the oat plant generally breeds true from season to season. Occasionally natural hybrids do arise through the crossing of plants in the field. To those self-fertilized plants which breed true Johannsen of the University of Copenhagen has given the name "pure line." The culture of the progeny of single oat plants in rows affords a good basis for the study of the characters of the plants and also forms a basis of measuring the value of the selections in respect to the yield of grain and straw. Individual plants, all the progeny of which the test of two years shows to be uniform in type and possessing the ability to transmit the character of high yield, are propagated the following season in plots of two-thousandth acre in area. This is necessary because of the small amount of seed available. If the test in plots of this area show the pure line to be worthy of further trial it is propagated in fortieth-acre plots. During the past season at Highmoor there were 49 of these plots representing the descendants of 33 plants selected in the season of 1910. Some of these appear very promising. These 33 pure lines represent all the plants out of 300 originally selected that were deemed worthy of propagation. Further, some of the 33 lines will be taken out of the test this year because they are no better than strains already on the market. One of these pure lines is worthy of mention here. M. A. E. S. 357 represents an oat characterized by tall stiff straw averaging 4 feet in height, carrying open, spreading heads. The grain is white, fairly long, plump and well filled. On two fortieth-acre plots during the past season this oat yielded at the rate of 81 1-2 bushels per acre. Eight of the 33 pure lines yielded better than 70 bushels per acre. Further, it is interesting to note that no commercial variety has yet equaled on two plots the average productivity of six of these pure lines. To be sure in these tests there is one oat which yielded in a single plot the same as the highest plot accredited to a pure line. However, the average of two or more plots shows the pure line to be the superior. Before a final decision is made in regard to these lines it will be necessary to continue the test during successive seasons. At present, suffice it to say, there is a great deal worthy of confidence in the strains of oats that have been developed from single plants. Next season's tests ought to settle the question fairly definitely.

Early and Late Seeding. In the year 1912, as stated in the first part of this paper, each variety of oats was sown in two tenth-acre plots: One was seeded May 4, the other May 23. Much question has arisen at times about the advisability of early seeding. In this particular instance it is interesting to note that the average yield of grain produced by the 17 varieties seeded May 4 amounted to 61.5 bushels per acre, while the average production of the late seeded plots of these varieties amounted to 52.5 bushels per acre. This gives 9 bushels per acre in favor of the early seeding. Further, the weight per measured bushel is higher for the early seeded grain, being 38.3 lbs. as compared with 34.2 lbs., the weight of the late seeded oats. Hence the quality of the early sown crop of oats may be considered better than that of the late seeded crop.

Weight of Grain Per Measured Bushel. By means of the standard grain bushel and scale the weight of grain per measured bushel has been determined for each variety in the tests during 1910, 1911 and 1912. The figures given here represent the weight of the cleaned grain in each case. During three years the Swedish Select Oat produced grain of the average weight of 43 lbs. per measured bushel, the Senator averaged 40, the Banner 39, the President 40, the Victor 40, the Imported Scotch 36, and the Kherson 34 1-2. The late maturing oats are always heaviest, the early maturing the lightest. Between the two types there is also considerable difference in the weights of a definite number of kernels, as is shown in the next paragraph. It should be noted that during the three years mentioned there is little difference in the weight per bushel from year to year.

Weight per 1000 Grains. During each of the seasons 1910, 1911 and 1912, 1000 average grains have been selected from each variety of oats grown at Highmoor. Among the more important of these we find the weight per 1000 grains to be as follows: For three years the average weight of 1000 grains of the Swedish Select Oat amounted to 35 1-2 grams, the Senator 42, the Banner 30, the President 36, the Victor 34, the Imported Scotch 24, the Kherson 17. Here it is obvious that the long slender oat of the early type is much smaller than the plump short oats of late varieties. The Senator oat is the largest grown at Highmoor as is noted above and, also, as is certain from an examination of the grain.

Percentage of Hull. An interesting character of oats is the hull, which is known to vary considerable in thickness, according to the variety. Per cent of hull determinations have been recorded for three years for each variety and are given in the following figures. Of the Swedish Select oats 22.8 per cent. is hull, the Senator 29.9 per cent., the Banner 25.3 per cent., the President, 24.4 per cent., the Victor 27 per cent., the Imported Scotch 26.4 per cent., the Kherson 28.6 per cent. and the Prosperity 25.9 per cent. It will be noted that the Swedish Select oat possesses the thinnest hull. However, there is considerable variation in the per cent. of hull of a variety from season to season. Much depends on the development of the grain. Under normal conditions each year one would expect a considerable degree of uniformity in the per cent. of hull.

Yields of Protein, Carbohydrates and Fats per Acre. A chemical analysis reveals many interesting figures in regard to the percentage of protein, carbohydrates, oats and crude fiber in different varieties of oats. In the grains of some varieties these percentages are high.

In the following table the figures of the chemical analysis of a few varieties are given. These figures represent the mean percentages determined by the analysis of each variety during 1910, 1911 and 1912.

	Protein.	Carbo-hydrates.	Fats.	Crude fiber.
Kherson	16.5%	58.21%	4.17%	11.26%
Irish Victor	14.4%	58.64%	5.19%	12.12%
Prosperity	15.7%	58.18%	5.08%	9.72%
Swedish Select	16.9%	59.40%	5.3 %	7.67%
Victor	14.9%	58.6 %	6.58%	10.40%
Imported Scotch	14.3%	59.03%	4.9 %	9.86%
Banner	15.1%	58.77%	4.98%	9.5 %
Senator	14.5%	58.23%	4.23%	10.59%

In comparison with certain feeds on the market today it is obvious that the above named varieties of oats, as far as is shown by chemical analysis, are valuable because of the possibility of growing this crop in Maine instead of purchasing the high priced feed on the market. Of course the true value of a feed is expressed in terms of the digestible nutrients it contains and not so much in the chemical analysis. However, the excellent qualities of oats as a feed for live stock are well known. The above named varieties lead one to believe that these oats afford a source of protein and carbohydrates which may be produced on Maine farms at a cost equal to if not less than the amount paid for feeds of no greater value sold in the market. Whether or not the farmer can produce oats profitably for feeding live stock is a question largely dependent on his system of farm management. It is not impossible for fertile soils to produce an average of 60 bushels of oats and even more, per acre, in successive seasons. Many farmers throughout Canada are practising the sowing of mixed grain, for example, wheat and oats, wheat, oats and barley, barley and oats, etc. It is a fact that greater yields are obtained by seeding these mixtures than by either one alone. Obviously it is essential to sow varieties that mature at about the same time.

Oats, wheat and barley are admirably adapted for growth amid the climatic conditions of Maine. These plants thrive in a cool, moist climate and therefore it seems that these crops should be more extensively grown and carefully handled in Maine.

PLACING IMPROVED SEED ON THE MARKET.

By R. P. Mitchell, Freedom.

The placing of improved seed on the market is a question of great importance to the farmers of the state, and particularly to the members of this association. The purpose of this association is primarily to improve the crops by the selection of good seed and to place this seed on the market. Up to the present time, after three years of eminent success, the work of this association has in a very large degree been confined to the improvement of our crops. The disposition of seed, in excess of what has been required for the production of their own crops, has been done almost entirely by the individual members of the association, occasionally assisted by the agent of the association, or some other person familiar with the work. So it is quite safe to say that up to this year, for several reasons, no organized effort has been made to market the seed produced by the members of this association. Perhaps the most important reason is that very little good seed has been available.

There have been, however, in the minds of the men who have been active in the management of the Maine Seed Improvement Association, certain definite plans that have advanced the work of the association very markedly: For instance, the classification of members according to the quality of the work they are doing.

There are three great essentials that must exist in order that the work of the marketing of improved seed may be successfully and effectively carried on.

First: The seed must be pure and free from all foul and light seed and disease in order to maintain the high standard of excellence already established.

In making inspections this summer, I found a great majority of crops, especially the oats and other small grains, containing weeds and disease, although taken as a whole the crops were far in advance of what the average farmer was growing. The potatoes, especially in Aroostook and Waldo Counties, were infested with blackleg. In talking with some of the growers in regard to this disease they said that they had found it was cheaper to stand the loss incurred by this disease than to treat the seed before planting. This, no doubt, is true in a large majority of cases at the present time while the disease has not gained much headway, but it seems to me that from the standpoint of good seed production, this unwise practice should be abandoned, because if Maine, and particularly Aroostook County, is to hold its prestige as a source of seed for southern growers, this disease—blackleg—which is so serious in the South, should be stamped out before it has gained any more headway.

Also, in selling seed stock it should be true to name. Too many farmers are apt to lose sight of this important fact, with the result that Maine is going to suffer very materially in years to come. The present time is feeling the effects of this unwise practice.

Light seeds in oats are very common and this condition lowers the percentage of viability and must necessarily diminish the yield. Earlier planting, and more general use of the fanning mill, will remedy this condition in a very large measure.

Second: The seeds must be adapted to the locality in which they are to be grown. Seeds from the southern part of the state are not adapted to the climatic condition in the central or northern part of the state. For this reason, the state has been divided into zones, so that growers in different parts of the state may know where to purchase seed that will grow well, and mature.

Third: Perhaps the most important essential of all, the seed must be efficient. By efficiency, I mean power to produce large yields.

In studying the several varieties of grains grown throughout the state, I find that there are nearly as many different varieties of oats grown as there are growers. In too many cases there is no knowledge of seed whatever, and no earnest disposition to improve.

Very little thought has been given to the efficiency of seeds by our farmers as a whole; but you will readily see that this is of vital importance. I might illustrate by drawing an analogy. The dairymen of this state long ago realized that something must be done to improve their dairy herds and in order to find out which cows were profitable and which were not, dairy testing associations were formed and through the work of these associations a large number of our farmers have been able to weed out those cows that are not efficient. They have learned that one cow producing 12,000 pounds of milk of average test is equivalent to six cows producing 5,000 pounds of milk. In other words, one 12,000 pound cow is six times as efficient as a 5,000 pound cow.

The average yield per acre of oats in Maine, in 1912, was 34 bushels. The best varieties of oats recommended by the Experiment Station, approximate an average yield of 60 bushels. Figuring the cost per acre the same for both, which is true, because the same preparation must be made whether you raise 10 bushels or 70 bushels, the 60 bushel oats, at market quotations, are four times as efficient as those producing 34 bushels per acre.

With flint corn, in 1912, the average yield was 40 bushels per acre. In this very poor corn year, official yields have been reported of more than 100 bushels per acre. Applying the same test to corn as to oats, the 100 bushel corn at market prices is nearly four times as efficient as 40 bushel corn.

It has been demonstrated this year with potatoes that an increase of 50 bushels was made from selected seed. These few examples will serve to illustrate the value of pure seed. The question now arises, How can we place this seed on the market so that the majority of farmers can secure it? There are at the present time a few farmers who are raising and selling pure seed, but they can only supply a very small part of what the market demands. It is surprising to learn that the seed houses here in Maine are able to procure very little seed of good quality at home and in order to meet their demands they are obliged to buy from outside the state. I have corresponded with the large seed companies here and without exception they say that could they secure good Maine grown seed of the same quality, they would much prefer to buy it. This is perhaps the reason why we find so many varieties of different grains. Some of these varieties are giving excellent satisfaction and others are no improvement on the old varieties.

There are two ways of placing improved seed on the market that are being successfully operated at the present time. The Canadian Seed Improvement Association, made up of farmers, is selling pure and guaranteed seed. This association is very similar to our own association, but a little farther advanced perhaps.

The other way is that of the association in Wisconsin, made up of graduates of the Agricultural College. This association is similar to the Maine Agricultural Students' Association, but older and more thoroughly organized. This Wisconsin Association is doing excellent work, as well as the Canadian Association. We, however, are more fortunate than either Wisconsin or Canada, for we have both these associations.

The Maine Seed Improvement Association has started this year with an inspection and inventory of the best seed and at the present time considerable excellent seed of all reliable varieties can be obtained by applying to the State Department of Agriculture.

The amount of seed is not as large as was hoped for, because no work was done until a large part of the planting was done, but next year will see a great increase in the amount of seed for sale.

In conclusion, use the best seed obtainable; be sure that no disease is present and that it is true to name. Get seed that is adapted to the locality in which it is to be grown, and be careful in the selection of seed for the succeeding crop. With these points continually in mind, the Maine Seed Improvement Association will be the one great factor in increasing the yield of Maine crops and profits, as well as placing improved seed on the market.

BUSINESS MEETING OF MAINE DAIRYMEN'S ASSOCIATION.

The annual business meeting of the Maine Dairymen's Association was held at City Hall, Lewiston, commencing Wednesday afternoon, December 3d.

The meeting was opened by the president, Mr. L. E. McIntire, who gave the annual address, as follows:

ANNUAL ADDRESS OF THE PRESIDENT.

One more year has passed and the Maine Dairymen have met again for their annual meeting. It has been a pleasant, and we hope a prosperous year for the dairymen of the state. The question that interests all dairymen is, How can we better our condition, or, in other words, increase our profits? How can we do it? In the first place, we must have confidence in our business. In the second place, we must put something into that business. We cannot expect to get something out of a business proposition unless we put something into that business. We have got to adjust ourselves to our conditions and have a thorough practical knowledge of our business to the smallest detail, also a determination to overcome all difficulties.

The time has been when dairymen could buy cows cheaper than they could raise them; that time is past. There is no question but that the right kind of a dairy cow, properly handled, will make a profit. The question is where and how to get them. If we have cows, some one has got to raise them. The milkman who sells whole milk is not the best fitted to raise his own cows, but he is in a position to pay good prices for cows that have quality.

There are hundreds of farms in the state of Maine that are adapted to some kind of stock growing, that are practically lying idle at the present time. What we need most is young men with a liking for the business of farming, and a desire to help build up the agricultural interests of the state of Maine. The young men must be equipped with a thorough practical business training, and a knowledge of the work they are to do. In other words, they must learn the business of farming.

The young man who has a liking for dairying and a desire to grow up and develop a valuable, profitable herd of dairy cows, must remember that it will require years of study and hard work to complete that task, but it has been done, and will continue to be done by men with a determination to do things. There is something more needed in this work. These young men must have some money to work with.

What has been the condition in our state in years past? A great many farmers by working early and late, and denying themselves and their families every comfort, have saved a few hundred dollars, or possibly a thousand or two. What has become of this money? Has it gone to build up a better herd of cattle? to build a silo? to underdrain the land, or add comforts to the farm home? No; in the majority of cases it has gone to the savings bank to receive a dividend of 3 1-2 or 4 per cent., eventually to go west or south and be invested in some great enterprise in some other section of the country. Under such conditions could one expect or even ask a bright, able young man to take up a business that his own father did not have confidence enough in to invest his hard earned dollars in promoting and building up that business.

But the scene has changed, and today we see scattered over this grand old state of Maine, happy, prosperous farm homes managed by men who have had confidence in their business; men who have found out that farming is a business, and in order to get something out one must put something in. What has brought about this change? In a majority of cases a son has taken hold with the father on the home farm, or has bought a farm of his own, and with the aid of new ideas and better business methods has brought the business up to a point where a dividend can be declared on the amount of money invested.

With the fact before us that there are less cows in the state today than there were a year ago, and with the demand there is for good dairy cows, also beef, it surely needs no argument to show that the growing of live stock is a good profitable investment in the state of Maine today.

The problem that confronts us at the present time, is how to get the money that rightfully belongs in the state of Maine back into the hands of good, live young men, and set it to work on some of our Maine farms; producing something that the markets are calling for, and for which they are willing to pay a price that will ensure a good profit.

We dairymen, and the farmers of the state as a whole, regardless of whether they are potato growers, fruit growers or breeders of live stock, owe it to ourselves and our state to so educate ourselves and our sons that we can manage our business in such a way that at the end of the year we can stand up and say, from that business we can declare a dividend; and by so doing we have not only been helped as individuals, but we have added to the wealth of our state and have helped to make it a brighter, happier, better state in which to live.

We have our College of Agriculture, with able men at the head of the different departments, all working to educate and improve those who come within their reach. The extension work which is being carried on in different sections of the state, by the College of Agriculture, through practical farm demonstration work, along different branches of farming, is bound to be one of the greatest helps that the farmers of Maine have ever had. We have our Department of Agriculture, headed by a Commissioner who is not only able but anxious to do all in his power to build up the agricultural interests of the state. All this help is for the benefit of the farmers of Maine. Many secondary schools are teaching agriculture, and by so doing are awakening a desire for more agricultural knowledge in the minds of our boys and girls in the state of Maine. With all the assistance we have in sight at this time, there never was so favorable an outlook for the farmers of Maine, especially for the breeders of live stock, as there is at the present time.

And now, Brother Dairymen, when we separate to go to our homes, let us have faith and confidence in our business and a determination to talk dairying, live dairying, and work to promote dairying and the breeding of live stock until Maine is the leading dairy state in the country.

REPORT OF THE SECRETARY.

To the Members of the Maine Dairymen's Association:

A meeting of the executive committee was held at the office of the Commissioner of Agriculture, Augusta, July 21st, at which time arrangements were made for the annual meeting, including the program and premium list. It was voted to accept the invitation extended by the Lewiston Chamber of Commerce, to hold the next annual meeting in that city. Mr. F. S. Adams, State Dairy Instructor, was directed to visit Lewiston and make all necessary arrangements. The date of the meeting was fixed for December 2-5, inclusive.

Voted, to invite the Maine Seed Improvement Association to unite in holding the conference.

Voted, to invite the Maine Creamerymen's Association to participate in the conference, following the usual custom in this respect.

Voted, to hold the banquet Thursday evening.

The secretary was instructed to secure, if possible, Mr. Orin Bent as judge of the butter and cheese.

Voted, that the arrangement of the program shall be in charge of the secretary and that the securing and arranging of exhibits shall be in charge of the State Dairy Instructor.

Voted, that all arrangements not otherwise provided for at this meeting shall be made by a committee, consisting of the secretary and the State Dairy Instructor.

The premium list was revised and several new premiums added and others increased in amount.

The amount received from membership fees was $67, which was paid to the treasurer, Rutillus Alden.

The annual reports of the association for the years 1911 and 1912 have been printed in one volume and distributed to the members.

Your attention is called to the fact that several special committees were appointed at the last session, as follows: Committee on breeding experiments; committee to secure appropriations made by the state, for the use of the association; committee on new legislation; committee on barns at the University.

The secretary desires to report that while the National Congress has not yet passed any legislation for the support of extension work in the various states, an extension bill (the Lever Bill) is now before Congress and the prospects for its early passage seem favorable, and it will be desirable for the association to consider the advisability of reaffirming its attitude on the question.

The secretary also desires to bring before the association the question of resuming its plan for holding county dairy meetings in each of the counties of the state during the year.

The relations of the association to the Department and the College of Agriculture, during the year, have been of the most cordial and coöperative nature.

Respectfully submitted,

LEON S. MERRILL,

Secretary.

Voted to accept the report of the secretary.

REPORT OF THE TREASURER.

Dec. 6, 1912,	Amount on hand from last year	$192 17	
Dec. 3, 1913,	Received from L. S. Merrill, Secretary	67 00	
			$259 17
Dec. 3, 1913,	Paid Oxford County Creamery for butter used in judging	35	
	Paid dues, Maine Federation of Agricultural Associations	4 00	
	Paid expenses attending meeting of executive committee	6 20	
	Paid for postage during the year	9 60	
			$20 15
	Balance on hand		$239 02

This report was accepted and placed on file.

The following committees presented their reports at this time:

REPORT OF VISITING MEMBER TO COLLEGE OF AGRICULTURE.

To the Maine Dairymen's Association:

Following my plan of last year, I made my visit during Farmers' Week, last March. This annual short course in Farming, or Farmers' Meeting, certainly improves from year to year in attendance, and interest in the lectures and demonstrations. Speaking from my own experience, I would say that it would be for the interest of all the farmers, if possible, to attend these meetings.

I was somewhat like the small boy who went to the circus where there were entertainments going on in three rings at the same time; it was hard to tell where to go, as lectures and demonstrations were going on in different rooms at the same time.

This shows the diversity of farming in Maine, which certainly is a good advertisement for a state where so many branches of farming can be carried on successfully.

I decided that as I represented the Dairy Association, it would be well for me to stay close to the cow. I visited the stable and noticed the marked improvement in the herd for the past few years. I recall a grade Holstein cow with a record of over 15,000 pounds of milk and over 500 pounds of butter fat. In connection with this I am pleased to say that the last legislature made an appropriation of $5,000 for the purpose of carrying on experimental work in stock breeding. At the present time these experiments are well started.

I then attended a meeting in one of the rooms and heard a successful dairyman of Maine, E. C. Patten of Topsham, tell how he managed his farm for efficiency and economy.

I was also much interested in a demonstration of stock judging in the Pavilion. One of the animals used was a Guernsey bull 13 or 14 years old—Canada's Jewell—who has quite a number of daughters in the A. R. of M. and others coming along. This should be a good object lesson to all the dairymen in Maine,—the value of keeping a bull after his worth is known.

Immediately after the stock judging, there was a demonstration in home mixing of fertilizers, under the direction of Prof. Simmons, which was certainly very instructive, and should have been witnessed by all the farmers who mix their own fertilizers.

After this visit I am more than ever convinced that the College of Agriculture is in a position to help the farmers and is willing to help along all branches of farming. It is up to us as farmers to try to get in touch with this help and apply it to our business.

F. S. ADAMS,

Visiting Committee.

The report was accepted and made a part of the records.

Mr. L. E. McIntire, for the committee to secure the appropriation made by the state for the State Dairy Conference, stated the following:

I can report in a very few words. We went to the State House and did everything we could to secure the appropriation but we have to report that we failed. The matter was taken up later, however, and we received every attention. Our bills were finally all paid, and a report of the meetings for the two years was printed. I presume the members have received copies. This was done with money gathered from different appropriations where it had been left over. We have received the kindest support all along the line.

Voted to accept the report.

REPORT OF COMMITTEE ON BARNS AT THE UNIVERSITY.

The following report from the committee on barns at the University of Maine was presented by Mr. McIntire:

Dr. Merrill and I went to Augusta and did what we could but we failed to get an appropriation at the last legislature. Something had to be cut out and that seemed to be what was in line to be left out. But if the members all look at it as I do, we never will give up until we get an appropriation. In my opinion the barns are not only needed, but it is a business proposition. If an individual was situated as the College is, needing the barns as badly as they do, it would be a good business investment to build them; so I am going to urge the members of the association never to give up until we get the money and have the barns.

Voted to accept this report.

REPORT OF COMMITTEE ON BREEDING EXPERIMENTS.

Your committee begs leave to report as follows:

I. HISTORY.

In accordance with the plans laid before the association at its last meeting the committee undertook an active campaign to obtain an annual legislative appropriation of $5,000 for the purpose of carrying on investigations in animal husbandry at the Maine Agricultural Experiment Station. As is known to all members of this association such an appropriation was made by the last legislature.

At this time the committee wishes formally to express its thanks to the members of this association for the aid which they rendered in properly placing this matter before the legislature. The committee also wishes to express its appreciation of the interest and help given in this movement by many other organizations and individuals throughout the state, including particularly the Portland Board of Trade, the Portland Farmers' Club and other similar bodies.

II. PROGRESS.

Immediately after the appropriation was made by the legislature, active work on the project was begun at the Experiment Station. Owing to the fact that the undertaking of this new work involved a considerable increase of staff, the moving of the biological laboratory into new and enlarged quarters, etc., most of the time and energy during the first months were taken up in purely administrative matters connected with getting the investigation started on a sound basis. This preliminary organization work is now practically completed and the investigations are moving forward along definite and well coördinated lines. The work being done under the appropriation is organized under four general lines as follows:

1. *The study and analysis of existing milk records, in order to find out the normal laws of variation in different breeds of cattle in regard to the production of milk and butter fat.*

This work is necessary as a preliminary to any exact scientific study of the inheritance of milk production. To mention specifically but one point here,—it is absolutely necessary that any milk record be subjected to a correction to take account of the age of the cow at the time when the record was made. In order to make a scientifically accurate correction for age it is necessary to study thoroughly the laws which relate milk and fat production to the age of the cow. On this particular phase of the problem it is expected that one or more bulletins will be issued during the next calendar year.

2. *The study of inbreeding in dairy cattle.* Attention has been concentrated on this phase of the investigation during the past summer and fall. Extensive data have been accumulated regarding inbreeding in Jerseys and a new method of measuring the degree of inbreeding in a particular case has been worked out and the results published in Bulletins 215 and 218 of the Experiment Station. A further bulletin giving the results of applying this method of measuring inbreeding to the Jersey breed will, it is hoped, appear some time during the next calendar year.

3. *The inheritance of characters other than milk production in cattle.* Investigations along this line are being carried on in the hope that by the study of other characters, which are more easily recorded and observed than milk production, light may be thrown on the method of inheritance of milk production itself. Whether or not this proves to be the case, it is certain that investigations along this line will broaden and deepen our knowledge of the fundamental laws of inheritance in cattle, and while it may not be apparent what the usefulness of such knowledge will be, past experience plainly indicates that there has never been a time when real knowledge of fundamental natural processes did not in the long run prove of practical value.

4. *The inheritance of milk and butter fat producing ability.* Work on this, the main phase of the whole project, is being conducted along two general lines. The first of these is the analysis of existing records in the advanced registries of the Jersey and Holstein breeds. The second is the carrying on of actual breeding experiments with the University of Maine herd. Owing to a complication of circumstances that need not be here discussed, there has been some difficulty in getting these experiments properly under way. It is, on this account, a great satisfaction to the committee to be able to report at this time that they are now moving forward satisfactorily. The University of Maine has made provision for the purchase of a small herd of registered Hereford animals, which will be used in the cross-breeding experiments to test out, by Mendelian methods, the way in which milk and butter fat production are inherited when a high producing and a low producing breed

are crossed together. It has been pointed out in previous reports of this committee that such experiments are absolutely essential to gain a complete understanding of the process.

III. THE FUTURE.

While your committee feels that, with the granting of the appropriation for breeding experiments by the legislature one of its primary reasons for being no longer exists, we nevertheless wish to point out that the need for a continued interest and support for this work on the part of the Maine Dairymen's Association is just as great as ever. It needs no emphasizing before this body that the carrying out of breeding experiments with dairy cattle is bound, in the nature of the case, to be a slow and time-consuming process, in which quick results are not to be expected. The work has been well started. If it is to continue to be successful, and valuable to the live stock interests of the state, it is essential that it be adequately supported. Specifically, an absolute necessity of the immediate future will be the provision of barn space. Unless the University of Maine gets new barns within two years from this time, it will mean the curtailing of the breeding experiments and consequently a greatly prolonged time before definite results can possibly be reached. Your committee desires especially to bring this to your attention as an additional reason why the University should be provided with adequate barns.

Respectfully submitted,

RUTILLUS ALDEN,
W. G. HUNTON,
F. S. ADAMS,
RAYMOND PEARL.

Voted that this report be accepted and the committee continued.

The following committees were appointed by the Chair: Committee on Resolutions, L. C. Holston, A. E. Hodges, Dr. Raymond Pearl; committee to secure new members, F. S. Adams, R. P. Mitchell, Rutillus Alden; committee to sell banquet tickets, L. S. Merrill.

F. S. Adams: At a meeting held at the Agricultural Department in the State House the first of November, to which the officers of the Dairymen's Association were invited and at which the most of them were present as well as other prominent dairymen in the state, in discussing the program for this meeting it was voted to offer three prizes for essays from the boys in the secondary schools taking the agricultural courses; a gold watch for the first prize, a silver watch for the second prize, and a fountain pen for the third prize. These essays were to be on dairy subjects, and the subjects were sent out from the Department of Agriculture. One was "The Production of Clean Milk," and the other "The Building up of Dairy Herds." In answer to this we received essays from four schools in the state,—Bucksport Seminary, Hartland Academy, Good Will High School at Hinckley and Kent's Hill Seminary; one from each of the first two, seven from Good Will and three from Kent's Hill Seminary. After the essays had been carefully read by several men, individually and collectively, we decided that the first prize should go to a boy from Bucksport, the second to a boy from Hartland Academy and the third to a boy from Good Will Farm. I want to assure you that these were excellent essays. You will have a chance to judge for yourselves. It is necessary to have some one appointed to secure the prizes, and I move that the president appoint a committee at the present time to secure these for the boys. The Maine Dairymen's Association pays for these prizes out of the funds in the treasury. This motion was carried and the president appointed F. S. Adams, Mrs. G. H. Dunn and Mrs. W. G. Hunton as this committee.

Voted, that the committee on barns at the University be continued, and that the appointment of the members of this committee be left to the incoming president.

An invitation from the Secretary of the Bangor Chamber of Commerce for the annual meeting of the Maine Dairymen's Association to be held in that city in 1914, was read.

CONSTRUCTION, COST AND EQUIPMENT OF THE MILK ROOM.

By Henry G. Beyer, Jr.

In this talk I conceive I am wanted to outline a milk room for the average dairyman keeping from ten to twenty-five cows.

These are times when most cities derive their milk supply from remote farms. The keeping qualities and healthfulness of milk depend largely on its cleanliness, and as the source of milk becomes more and more remote from the consumer, the consumer is necessarily demanding better keeping qualities and greater cleanliness in his milk. The consumers' demand for clean milk has become so pressing that legislatures and boards of health are making more and more stringent laws in regard to milk production, and these laws are bearing harder and harder upon the producer.

The production of clean milk is a struggle against bacteria entering the milk. Visible dirt in the milk, although disgusting to the public, is not the actual source of danger. It is the invisible dirt or bacteria which are the real source of danger, and which have to be guarded against.

In my own dairy practice I have for several years had the number of bacteria in my milk counted at stated intervals. Our aim has been to keep our bacterial content below ten thousand, which is the standard for certified milk in most cities in this country. To accomplish this we have made a great many small experiments, discarding the fore milk, using covered pails, taking care not to feed to raise a dust before milking time, etc.

These all help to obtain clean milk; but, of all the practices by which clean milk may be produced, the two things which will aid most are washing the cow's udder and flanks with a wet cloth, so that it is thoroughly moistened before milking, and then chilling the milk.

Chilling the milk takes place in the milk room, and therefore the milk room has one of the most important functions to perform in the production of clean milk. In fact, unless the milk is chilled, no amount of cleanliness in the cow barn can prevent enormous bacterial growth. The washing of the cow keeps the original number of bacteria small, and the chilling of the milk prevents them from increasing in number.

To get down to the milk room proper: The first and primary consideration is a good, efficient cooler. The ordinary forms of cooler on the market depend on running the milk in a thin layer over metal cooled by either flowing water or ice water. If a man has a source of very cold spring water, and will let this flow in a large stream through a cooler, it will give him pretty satisfactory results. If a man depends on ice water, in order to get much efficiency he must keep the water constantly stirred.

In the ordinary, round, conical shaped milk coolers I have taken a good many temperatures of the milk. When the ice water was stirred once in six minutes, which would be done by one man stirring the ice water every time he entered the milk room to dump a pail of milk, the temperature in the can was about 65 to 70 degrees, not nearly cool enough to arrest the growth of bacteria. If the ice water inside the cone was not stirred at all, the milk ran into the can at the bottom at 73 or 75 degrees, there being only from 28 to 35 degrees of animal heat taken out. If the ice water was stirred continuously and vigorously by a man constantly there, the milk ran out at about 38 degrees, in which case 60 degrees of animal heat were taken out. The temperature of 38 degrees is plenty low enough, and the increase in bacteria in twenty-four hours would be hardly perceptible at this temperature.

It is, however, impractical to hire a man for the special purpose of stirring ice water during milking time. This can be done in many ways more cheaply: A small gasoline engine such as is used to run wind mills, costing about thirty-five dollars, can be installed to do this. The cost of operation of one of these engines is surprisingly small. A tumbler full of gasoline will run an engine of this sort for ten hours, and it is easy to rig such an engine as this to stir the milk in a conical cooler.

Perhaps the best form of cooler is the zigzag plates with the water running in a stream inside the plates, and the milk running on the outside. These coolers are small in area and are therefore easy to wash. A round cooler is always a hard thing to wash, but these zigzag coolers are small and easy to handle, and contain no cracks or crevices to catch dirt.

If a man chooses such a cooler I would strongly recommend that he have an ice water tank below the level of this cooler, with a little rotary water pump driven by an engine or motor. The pump may be connected to the cooler by two pieces of rubber hose, one leading from the ice water tank and the other taking the ice water back to the tank, the water passing through the cooler in the meantime. A cooler of this sort costs from eight to twelve dollars, depending on the size and construction. The pump costs about twelve dollars, and one of the thirty-five dollar engines above mentioned will do for power. The ice water passes rapidly through the cooler, and such a cooler will cool milk down to 36 or 38 degrees, or in other words, almost down to freezing. The ice water tank can then be used to set the milk in over night. This is easily the simplest and handiest form of cooler I know of, and the most economical on ice. There is no preparation for cooling the milk necessary, except to hang up the cooler and connect the rubber tubes and start the motor. The supply of ice water is always on hand in the tank, and no fresh water has to be cooled to ice temperature twice a day, thereby wasting ice.

The ice water tank serves the double purpose of being a source of ice water to cool the milk, and also forming a tank to put the milk into after it is cooled. This system, therefore, uses no more ice than when the cans of warm milk are placed in it immediately.

In the construction of the ice water tank I recommend a little extra care. The tank should be large enough to hold all the cans, and preferably made of two inch pine plank, lined with zinc. Outside the two inch plank I would put some tarred paper, and outside of that matched boards. Any of the waterproof felt papers would be much superior to simple tarred paper. The cover and the backs should fit tight, and be made of two layers of matched boards with felt or tarred paper between them, the lower layer of boards forming a shoulder to make a tight joint with the edge of the tank itself. There should be an overflow pipe at about the height that you desire the water to stand around the can, and the overflow should be of good size to prevent the danger of flooding the can with water. There should also be a pipe from near the bottom of the tank which should lead to the ice water pump, and also a chance for the hose coming back from the milk cooler to return its supply to the tank.

In regard to the cost of such a tank, I have no figures available, and believe that each man had best get his own estimate from a carpenter and plumber. I simply state that I believe it is the cheapest satisfactory style of tank.

I would in no case recommend a concrete tank, as the loss of ice is very considerable.

In regard to the construction of the milk room itself: I would recommend that the floor be of concrete, with a drain in the center, the floor sloping toward the center drain. By setting a good trap in this drain no criticism can be made of its being unsanitary, and it is certainly a great convenience. For the walls and ceiling I believe the cheapest satisfactory construction is to stud with 2x4's, and nail a good brand of wire lath to these, using a cement plaster to plaster the walls and ceiling. The cement plaster will present a surface which may be finished smooth like concrete, and to all intents and purposes the walls will be as permanent and as useful as concrete walls. The cost of such plastering should not exceed eighty cents a square yard for the lathing and plastering. The cost of the floor will probably be in the neighborhood of $2.00 a square yard. In this concreting the thing of prime importance is the quality of sand used to get the surface. Concrete poorly mixed and made with a poor concrete sand will wear away rapidly, and according to the best information I can get, the wearing qualities of concrete depend chiefly on the kind of sand used, even more than they do on the kind of Portland cement used. Any good brand of Portland cement will do.

Of course an abundant supply of hot water is greatly to be desired, but on the average farm it is impractical to have this in the dairy. In such a milk room as I describe, however, a pail of water and a mop for the floor and walls, and taking the milk cooler into the kitchen to wash, together with the milk pails, is all the labor required.

Of course, a few wooden racks to hold milk pails and what few other things are necessary should be built; but I would recommend that they be not fastened to the floor or walls, but just stood in the corner, so they can be moved to wash underneath and around them. The cost of these is very little.

The separator is necessary on many farms, but there is nothing in particular which need be said of it in connection with the consideration of the milk room.

It is my judgment that a milk room with cement plaster walls, cement floor and a milk cooler through which ice water can be pumped from an ice water tank, which is likewise a refrigerator, is all that is necessary to care properly for the milk.

A milk room of this sort can be built and equipped at a cost of from one hundred to one hundred seventy-five dollars.

DISCUSSION,

Opened by DR. E. M. SANTEE.

I am sorry that Mr. Beyer is not here, because I will certainly have to take issue with a number of things he has said in his paper. The first thing I would criticise would be his tank for storing the milk. Under no circumstances would I have any wood that was not absolutely necessary in the milk room or about it. Perhaps up to the time that the Van Gilder or hollow wall machine was invented, his assertion in regard to cement might hold true. It will not hold true today because by the use of a Van Gilder machine, or any other machine of that type, a tank can be built for half the money that a pine plank tank, zinc lined, would cost, and be infinitely preferable because always sweet and easy to keep clean, and it will be there when Gabriel blows his trumpet while the other will decay in a few years.

Next, in regard to the walls, by the use of a hollow wall machine we can build outside walls of a dairy for less money than they can be built of wood alone, much less of wood plastered with cement. I have been in a great many milk rooms of the last mentioned kind and I have yet to see one that had lasted a year which was free from holes made in the plaster by something having been hit against it. The hollow wall concrete, 3 inches inside and 4 inches outside, is amply sufficient in thickness, costs less money, is very much more satisfactory, is absolutely indestructible and to my mind altogether preferable.

A very important thing in connection with the milk room is the disposal of the sewage and I would like to take a few minutes of your time on that subject. It is a subject which ought to be discussed in meetings of this kind. In the old days when the dairyman fitted up a drain of that kind he depended upon running the water into some flowing stream. I do not know what the law is in that respect but in my own state of New York it is against the law to do that now and it should be, because there is no excuse for polluting the water for our neighbors when we can take care of the waste much more easily by the use of the single box septic tank. I am sorry I have not time to discuss this tank. I am much in favor of the single box, concrete septic tank, built just outside of the dairy wall if you care to have it there, or as far away as you care to buy pipe to carry your sewage to it. The estimated cost of materials of one built for Mr. Ogden last year was $3.60. Any one who knows enough to pile one stone upon another can build a septic tank by following simple plans, which are easily to be had.

Another thing on which I want to take issue with Mr. Beyer is the necessity of carrying the milk utensils to the kitchen to be washed. There is nothing in the world that costs the dairyman so much as useless steps; and remember those steps are taken twice a day at least on every dairy farm and on some oftener than that. And when for an expense of $36 we can get a small steam boiler which will furnish the hot water and the heat and the steam for sterilizing, I think we are very short sighted dairymen to carry our utensils to the kitchen to be washed. That was tried at Good Will for a good many years. Now we have the sterilization and it makes a wonderful difference not only in the time but in the efficiency and the results, because of course the utensils cannot be sterilized in the kitchen as a rule. Live steam is infinitely preferable and takes very little time, so I would always have a boiler in the milk room, or rather, I should say, milk house, with two rooms. I would never build a house without two rooms, one for the care of the milk and the making of the butter, etc., and one for the care of the utensils,—where the utensils are washed and stored.

Another thing which I decidedly object to is tarred paper. On my own farm in Central New York we make butter for a fancy trade, and at one time I conceived a notion that it was costing me entirely too much for turning the crank and so I bought a gasoline engine. A gasoline engine is all right in the other room, to pump the water, but it must not get into the milk room. The very first batch of butter that went to the city brought back this response from nearly all our customers, in one form or another,—"Somebody spilled some kerosene into the butter or the cream." They got that odor which they thought was kerosene but it was from the fumes of the gasoline engine. It is not safe where we are attempting to produce a good product to have any odor of that kind about the butter. So in the milk room I would avoid tarred paper. Use a plain paper rather than a tarred paper, if it is necessary to use anything of that kind. Also, I would object to a wooden rack, on the same theory that I objected to the wooden tank, the wood is so absorbent and so soon gets to be sour and disagreeable and bad for the room. A simple little rack is made of one-half or three-fourths inch galvanized pipe with a flange on either end of it. A rack of this kind secured to the wall with simple wood screws and out ten inches or twelve, is permanent and inexpensive, easily washed and always out of the way. It is easy to invert the utensils on it.

Also an ordinary concrete sink will save many times the cost of it in the convenience in washing utensils. I would have it double with a steam jet in one end of it; the first sink for the washing and the second for the rinsing; and then a small table at the end made of concrete. The steam should be connected with the cold water pipe so that by turning on the cold water and the steam hot water can be had, by shutting off the cold water steam can be had, and by shutting off the steam cold water can be had. Ours is arranged that way and has proved very satisfactory indeed.

The other articles of equipment are good and all right in every way. I would add salt to the ice water.

I could not quite agree with Mr. Beyer that you could use the water continuously, over and over, because I have never yet been able to employ help who were careful enough in handling the milk not to spill any into the water, and in that way even ice water would get very bad after a time.

The figures in regard to the cooling are very accurate. I was perfectly dumfounded the first time I tried setting a can of milk. In New York we have 40 quart cans, and I set one of these cans in a barrel tub filled with ice water to the neck of the can and left it five hours. At the end of that time there was milk in the center of that can at a temperature of 72 degrees. I agree with Mr. Beyer about the stirring of the milk in the can and about the necessity of circulating the water. In the South you will find a great many plants where a system of circulating the water is adopted; sometimes it is done by a gasoline engine but more often you will find it being pumped by a boy who takes charge of the weighing and recording. A boy 15 or 16 years old, a son of the family if there is such an individual, looks out for that part of the work. But the gasoline engine makes a faithful worker and a very satisfactory one if the fumes of the gasoline are kept entirely away from the milk room.

In regard to the figures given on building, I am inclined to think they are very low for that kind of building. Last year, while connected with the New York Department of Agriculture, the concrete demonstration work was done by the speaker. At Kinderhook, we built of hollow wall construction a milk house 12 by 16, a little bit larger outside on account of the thickness of the walls which were 9 1-2 inches thick. The total cost of material for the house, including the boiler equipment and all the other equipment already discussed, also a cooler, was $123.44. I have not included the labor for the reason that there is such a difference in cost of labor in different places; and it makes a difference if we can do a part of the work ourselves on the farm. At Good Will we have recently finished a dairy very much larger than that; not because it was needed so much, as a dairy, but you will readily see that our problem there is very different from that of the ordinary dairyman. There we have the boy to look after, and the boy comes first. It is the education of the boy we are aiming at. We had to have a laboratory and we had a dormitory over it; that house cost a great deal more. I have not the exact figures, but the material cost somewhere in the neighborhood of $600.00. It is made of double wall concrete. I want to say a word about the advantage of that double wall. We find the house very cool in summer and very easily warmed in winter. Because of the air space the heat is kept out in summer and the cold in winter, and that is the reason why I should use this kind of a house rather than the one advocated by the writer of the paper.

In regard to the storage tank, I have never found a great deal of fault with the ordinary four inch thick single wall storage tank. It is not very bad in the consumption of ice, although the double wall with the air space is still better. But there is a vast difference between putting a tank of that kind inside a hollow walled building and putting it inside a building like the one described in the paper. The ice would melt very much faster in the latter than in the double walled concrete.

Ques. I would like to ask about the septic tank.

Ans. I will be very glad to tell you more about the septic tank. It depends for its success practically upon just one thing, and that is the exclusion of a circulation of air; because the bacteria that destroy sewage, the anaerobic bacteria, while they can multiply in the presence of plenty of oxygen still their deadly enemy, the putrefiers, multiply so much faster that it would be like attempting to start a rat farm and a cat farm together,—it would not succeed. The whole method of disposing of sewage by a septic tank is to allow your friends, the anaerobes, to multiply and destroy the organic matter. They do not destroy the mineral matter, but there is very little mineral matter going into a septic tank. It is just as good for the farm home as for the dairy. The first question that always comes up is, How often does it have to be cleaned? About once in 360 years. If you are so tender of the feelings of your children's children's children's children, that you do not want them to have to do that, do not install the septic tank.

Another question that very frequently comes up is, What is the best disinfectant? If you should put a disinfectant in you would kill your friends, the anaerobes. You do not want to put in any disinfectant. An ordinary disinfectant used on the farm may be allowed to run into the tank because it would be so diluted that it would not have much effect on the bacteria.

Another question is, Does it freeze in the winter? It does not freeze in the winter for the reason that all of the fluids that go into it are so much warmer than the freezing point, and bacterial action creates heat. It has been used nine inches under ground in places where the thermometer went to 45 below zero without freezing, and a thing that has always been surprising to me is that the outlet pipe, the bottom of which is only 12 inches under ground, does not freeze. Even that has never made any trouble to my knowledge.

As to the method of installation, for a family of six the size should be six feet long, three feet deep and three feet wide.

and I would not build one any smaller. It should be made of concrete or any other substance which could be made tight; but concrete is the cheapest and it is there for all time, while lumber rots out and metal rusts out. It should be covered with a reinforced concrete slab, and then you can just forget that it is there, so far as ever having to go near it again is concerned.

Perhaps what goes on in the septic tank ought to be discussed. When the sewage goes in, being heavier than the liquids there, it settles to the bottom and there the anaerobic action takes place. These bacteria absorb the animal and vegetable matter in the sewage, and in the absorption multiply themselves, and gas forming bacteria and water are the result. The gas forming bacteria, being lighter than water, go to the top and form a brownish green scum. I have seen it two or three inches deep after a few years of use. Between this green scum at the top and the solids at the bottom there is a clear liquid known as the effluent. At the point where it is clearest this should be taken out, because if you empty a gallon into a tank after the tank is full, a gallon must go out. Experiments have shown that a pipe about 12 inches down from the top will accomplish this the best. The inlet pipe should have an elbow which would deflect the sewage downward so it would not flow across and go out before it is treated. The bottom of this pipe should be 18 inches down from the top of the tank and 18 inches up from the bottom. Then the question is, How do you get the effluent out at a point higher than it comes in? The source is always higher, and the source forces it up and out. The sewer pipe should be tight, of course, and it should go to a point about a rod from the top of the tank on about a level so that it may make a quick descent, because the liquid will back up in the inlet pipe until it goes back to the level of the bottom of the outlet and you can readily see that if you have a long and gently sloping descent, it would not be very long before there would be trouble with stoppage. The inlet pipe should never be less than four inches in diameter and the outlet pipe should be from three to four inches, the inlet pipe going to within a rod of the tank and then quickly descending, and the outlet pipe not tight but with loose joints because you want to get rid of that water as quickly as possible. While the water is almost as good as the average drinking water in the city, there are still a few struggling bacteria left in it, enough so that we want them to become oxygenated as soon as possible; and by having this open jointed tile almost level the water soaks out at the joints. If you have a large fall the effluent rushes to the bottom and there is a wet spot. The theory is to have it go out so gently that when it comes to the first joint as much as the soil will absorb will soak into the ground. The effluent should soak out through the joints as it comes to them.

As to how much of that pipe is required, on my own farm in New York, where I built the first one, I tried this experiment to find out how much pipe was necessary: I put in 48 feet of pipe, ordinary land tile one foot long, and in each joint I put a piece of tissue paper, marking the pieces 1, 2, 3 and on to 48. and left them all winter. Then I took it up to see how far those pieces of tissue paper had been carried along in the pipe, and as I remember it, it was 23 feet. Beyond that they lay right in the tile where they were placed, showing that they had been soaked with soil water rather than the current from the tank. This was in soil which was very loose and gravelly. I have installed these tanks on ordinary clay soil where the hard pan did not come up so high, with twice 48 feet of pipe, with perfectly satisfactory results. At Good Will we have now about 100 feet already installed and I am watching it to see how much more we need.

Ques. Do you stop the end of the tile up?

Ans. We put a stone over the end, covering it up level. We leave no open space at the end because we calculate to have the tile long enough so that no water can get to the end. I would as soon have glazed tile as anything, as the water gets out through the joint openings. I think Dr. Jordan was the first to explode the old theory of water soaking through land tile.

Why I became so interested in this subject is because the Department asked me to talk about the disposal of farm wastes at Farmers' Institutes, and I talked it and I guess I could have talked it yet. When I talked about the old fashioned tank there was not a farmer in the audience who paid any more attention to it than as though I was talking about Greek; so through Prof. Ogden of Cornell I got on track of this single tank and I am satisfied there is no excuse for the old fashioned double tank or the syphon. After drawing plans for over 3,000 I think, I am satisfied that it is perfectly satisfactory everywhere. You cannot go to a Farmers' Institute and advocate a thing which the farmer puts in and spends anything on without hearing from it if it is not all right.

Ques. Do you get any odors?

Ans. Not a particle. There is no odor from a septic tank because there are no putrefiers and it takes those to make odors. The very few that get a start there are destroyed by the anaerobes; but give the putrefier a chance and he will kill the anaerobes. So far as any odor or sanitary conditions are concerned I would just as soon have a septic tank in the cellar. There is absolutely no objection to having a septic tank immediately outside the cellar wall.

Just a word in regard to putting on the cover. I would always have a manhole on one end of it, that could be turned back. This should be about two feet wide and as long as the tank is wide; and should not be fastened to the tank. It is a simple matter to make this portion of the cover loose; just cover the top of the side walls with paper before the cover part is poured and the trick is done.

MILKING MACHINES.

By Prof. L. S. Corbett, Orono.

The labor connected with the routine work of milking is one of the most exacting operations on the ordinary farm. No one task about the farm is quite so uninviting or even loathsome to the hired man as milking by hand the long line of cows twice a day, three hundred and sixty-five days a year. It is very difficult for the dairyman to get and keep good, reliable, cleanly, gentle, efficient milkers who will stay with him the year around. The labor cost of milking is considerable, much more than the ordinary dairyman realizes. In order to get the best results, each cow should be milked regularly and by the same milker. She should be treated kindly and milked out as clean as possible. In many cases it is necessary to keep more help than would otherwise be needed in order to have men available at milking time. Frequently the number of cows which a dairyman can keep is limited by the number of milkers which he is able to obtain. Not infrequently a man finds himself with insufficient help for milking his herd and occasionally a man gives up the dairy business simply because of the impossibility of getting satisfactory help at prices warranted by the returns from the business.

Manual labor is one of the most expensive things which the farmer has to buy and, wherever possible, he makes use of machinery in doing his work. In this way he lessens the number of men he has to employ. During the past few years many of the common farm operations have been made easier and very much cheaper because of the improved machinery which has been developed for agricultural purposes. If the milking could be done also by machinery the work would be made very much easier and the cost of the operation might be very materially decreased. This operation, however, seems until recently to have baffled agricultural inventors. The nervous, sensitive disposition of the individual cows, together with the lack of uniformity in the form and size of the udder and teat, has made it very difficult to invent a machine which would milk different cows satisfactorily.

The idea of milking by machinery is not new. Many types of machines have been tried and pronounced worthless. Accordingly the question is being asked, "Are the machines at present on the market a success?" Manifestly there is no specific answer to such a general question. Automobiles are generally considered a success though many find them both troublesome and expensive and there are wide differences in quality among the various makes. It is probable that the different milking machines on the market are likewise of unequal efficiency.

All milking machines fall into one of two general classes. (1) Those which mechanically force the milk from the teat after the manner of hand milking. (2) Those which depend on the action of a vacuum producing an effect similar to that of the mouth of the calf.

While it is possible that some representatives of the teat compressing milkers are in use in this country all of the tests of milking machines thus far reported, with the exception of those of the "Murchland" and "Thistle" at Guelph, have been made with machines having the action of the mouth of the sucking calf. The calf takes hold of the teat and by contracting the muscles of the mouth draws the milk from the teat. This result is caused by the removal of air in the calf's mouth, or, in other words, the creation of a vacuum. On account of outside pressure the milk from the udder is forced into the empty mouth. When the milk flows into the mouth the calf swallows, thus giving relief to the teat. The operation of the milking machine is based on practically this same principle. A vacuum is formed by ejecting the air from a large pail which is connected to the teats of the udder by rubber tubes having mouthpiece attachments at the ends. The milk is forced from the udder to replace the air drawn from the pail and the piston intermittently cuts off the connection between the vacuum and the teat, thus momentarily relieving the air suction from the latter.

There are three main parts to the milking plant, namely, an appliance for producing vacuum, or both vacuum and pressure.

the vacuum system, or vacuum and pressure, and the milkers.

The vacuum and pressure may be produced by several methods. A steam ejector and an air pump make a very satisfactory form of power in a practicable dairy as the use of steam is necessary for the washing and proper cleaning of utensils. Especially is this true of the machine milkers.

The air pump is perfectly efficient for creating vacuum and can be operated by any kind of farm motive power. A three horse power electric motor is both convenient and economical. Where electricity is not accessible the gasoline engine is a very satisfactory source of power and could be used for many other purposes on the farm.

The vacuum system is made up of gas piping to which is connected a reserve tank, a regulator, vacuum indicators and stanchion cocks. The gas piping runs in front and above the cow stanchions. Between every two cows is placed a stopcock to which the milkers are attached. The reserve tank is placed in the piping system close to the source of power. It increases the vacuum space in such a way as to handle any sudden inrush of air, as at the time of attaching the milker to the cows, etc. The tank itself is merely a fifty-gallon air-tight galvanized-iron water tank, such as is commonly used for heating water in kitchens and bath rooms. In close proximity to this vacuum chamber is the vacuum regulator or safety valve. It corresponds to the safety valve on the steam boiler and guards against too great a vacuum, which is injurious to the udder and teats of the cow.

The milker consists of a heavy tin receptacle or pail surmounted by a tightly fitting lid and a pulsator which is attached to the stopcocks on the piping which is over the stanchions, or is on the lid of the pail. The pulsator contains a piston which intermittently cuts off the vacuum when the milk cocks on the lid lead to the teat cups. Four metal cups having rubber mouth pieces are connected to the ends of these tubes and are attached to the teats of the cow. Half-inch rubber hose five or six feet long connects the milker with the stanchion cocks of the piping system.

In operation the pump draws the air out of the piping system, the stanchion cock is opened, exhausting the air from the pail and, by opening the milk cocks, the vacuum is extended to the teats of the cow. The amount of vacuum created as indicated on the vacuum gage should be about sixteen inches which is equivalent to about eight pounds atmospheric pressure. The exact amount may be varied slightly from this, depending upon the animals in any particular herd, but it should be regular from milking to milking. The number of pulsations or cut-offs by the piston per minute can be regulated. Fifty-five pulsations have been found to give the most satisfactory results. The suction is applied to all four teats at once and as the air is drawn from the teat cups the milk is forced out to fill up this space. It is thence drawn into the empty pail. The inspection glasses on the wall of the pail near the lid, or on the lid, enable one to see the milk as it passes from the udder into the pail. By this means, together with the condition of the udder and the characteristic sound produced by the suction at this time, the operator can determine when the cows are milked dry.

The teat cups and mouth pieces are the most important parts of the milker. The cups must in every case fit the teats snugly and be flexible and of the right size. If too tight, a congestion of blood will occur in the teat with resultant disastrous effects on the milk flow and on the animal. On the other hand, if too large, air will penetrate the vacuum and the teats will be drawn out abnormally. In some makes of machines the teat cups must be selected for each individual animal on account of the varying size of the teats. The ability of the operator, together with his care in attending to the proper fitting and adjustment of the teat cups and mouth pieces, will aid greatly in the completeness of milking. In other machines there is a so-called "Universal" teat cup which automatically adjusts itself to the teats of different sizes.

There are but few parts to the milking machine that wear out rapidly so that the maintenance of a mechanical milker is slight.

We will now consider the effect of machine milking on milk secretion. It is very difficult to draw conclusions comparing the results of machine and hand milking from data compiled in different years, as many outside factors must be considered as possibly affecting the lactation. It has long been advocated that one man should milk the same cows continually on account of the disastrous effects of a constant changing of milkers. The constant alternation of machine milking and hand milking would apparently have the same or more serious effect on the cows.

To show the effect of alternate hand and mechanical milking a very good example may be had from the results obtained with cows in the Nebraska University dairy herd, which was subjected to this treatment for a period of six consecutive weeks.

In this experiment the two methods of milking were so radically different in operation that when the milker was substituted for hand labor the cows did not milk out completely. The amount of strippings increased as the experiment progressed, plainly indicating that the method was detrimental. The total amount of milk was practically the same in each case, but the percentage of butter fat was materially lowered. It would be extremely interesting to know what became of this fat, but we have no means of determining this.

The condition of some of the cows in this experiment was so unsatisfactory after two weekly substitutions of machine milking that the attempt was considered a total failure. Not only was the amount of strippings increased, but the udders became congested and the milk was drawn with difficulty even by hand. This is perhaps an extreme case, but the result is no worse than we would expect if constant changing from one method to the other was practiced. Milking in the morning by hand, for instance, and with machinery in the evening, a practice that might appear advantageous where labor is concerned, would not be at all satisfactory when the effect on production is taken into account.

The significant point brought out by this experiment is that when machine milking and hand milking are carried on irregularly and interchangeably, the machine will not draw all of the milk and in consequence more strippings are obtained. It is very evident that we cannot make a comparison between two methods of milking by alternating these methods.

The most important question as to the practicability of machine milking is whether or not cows can be milked satisfactorily by this method for an extended period of time. The results obtained in different investigations furnish a vast amount of material that has a bearing on this point and should enable one to form a correct judgment on this question. The University of Wisconsin has determined the value of machine milking by comparing data that show the decrease in the production of the cows during the periods of machine-milking and their total production during that time. The weekly production of the cows in their herd when they were machine milked decreased on the average 2.9 pounds of milk and 0.12 pounds of fat. The figures for the average weekly decrease in production for cows kept under similar conditions as these, except that they were milked by hand, were the same as these, that is on the average 2.9 pounds of milk and 0.12 pounds of fat. There is therefore no difference between the results obtained by hand milking and the average data given for machine-milked cows.

The weekly production of the cows during the period when they were milked by machine was, on the average, 145.8 pounds of milk and 6.19 pounds of fat. The data obtained on hand milking were slightly above these figures; the difference, however, is too small to be considered.

Cows are easily broken to the use of the milking machine. Some of them, however, become accustomed to it more readily than others. Briefly, it may be stated that the more milk the cows give the easier it is to get them used to the milking machine. Occasionally there is a cow which refuses to be milked by machine.

Whether or not a cow gives down her milk for the milking machine during its first usage depends on the milker and on the individuality of the cow. When the milking machine is first used the operator should be the herdsman, or a man with whom the cows are acquainted. If this strange machine, with a strange operator, attempts to do the milking, the cows will be much more suspicious and even afraid, than if the regular attendant accompanies the milking machine. The regular herdsman knows the temperament of the different cows and he can approach each cow sympathetically. By gently handling the cow's teats and udder she gives down milk before the milking machine is attached. The teat cups are then put on and the milk is extracted before the cow realizes what did it. As soon as the cows have been milked a few times with the machine no difficulties are encountered by reason of any of them refusing to give down their milk.

Generally speaking, it may be said that the cows of the dairy breeds which yield a fairly large flow of milk readily give down their milk from the beginning.

Some experience is necessary before the operator can properly attach the teat cups. In the first place the operator should use care to allow as little barn air as possible to enter the cups while there is a vacuum in the pail, thus allowing dust and organisms to enter. During the attachment of the teat cups the barn air is prevented from entering the pail by bending the rubber tube between the teat cup and the connector. By using care and with a little experience practically no barn air need be drawn into the pail. If the teat cups are not properly attached they are more likely to fall off during the last part of the milking period when the udder is limp.

Before the cups are attached to the teats the operator should see that the teats are in proper condition and that they enter the teat cups straight without being turned and twisted.

The teats of the cows are not always in equally good condition to be milked by the machine. If the cows have been exposed to damp and cold surroundings the teats are short, and the covering of the teats is curled and contracted. When the teats are in such condition it is important that the operator bring them into normal condition before the teat cups are attached. This can be done by gently rubbing and slightly pulling the teats with the warm hand of the operator. The teats should be clean before the teat cups are attached. Unclean teats are usually contracted as previously mentioned, and contaminate the milk.

Such contracted teats milk with difficulty. The teat cups do not get a firm grip nor a good symmetrical hold and they are likely to give trouble by falling off. As a result, one side of the teat may be pulled into normal length before the other, and thus cause the end of the teat to turn and partially prevent the proper discharge of the milk.

When the operator learns the action of the milking machine on the different cows and the appearance of each cow's udder when full and empty, he can tell without much watching when the milking is completed. An experienced operator should watch the inspection glasses. When the milk stops flowing past the inspection glass probably the cow is dry. The fact that the milk has stopped flowing is not a sure indication that the cow is milked dry. Occasionally the teat will get into such a position that the milking can not be completed. Before the teat cups are detached the udder should be gently massaged. If there is any more milk in the udder it will then be extracted. When the operator is satisfied that there is no more milk in the udder the vacuum is shut off with one hand, and with the other hand the teat cups are removed.

Some recommend that one man attend to the milking machine and another do only the stripping. By this method the man who does the stripping may not get to strip the cow until sometime after the milking machine has done its work. This interval of time may cause the cow to take the milk again. It may be the means of drying up the cow, and it may cause diseased udders.

When the milking of a cow once has started, it should be continued without intermission. For this reason all the cows should be stripped as soon as the teat cups are detached. Some who have been interested in the milking machine have questioned the advisability of stripping after the milkers with a commercial herd. They maintain that the labor required for this purpose is too expensive, considering the small amount of milk obtained, but we know that the last milk drawn from the udder is much richer than the fore milk and the loss of butter fat would be greater than the comparative weights of fore-milk and strippings would indicate. Furthermore, leaving milk in the udder would have a retarding influence on the milk flow, causing the cows to dry up earlier than necessary. Any factor that tends to decrease production, even though a temporary financial gain results, should not be tolerated, because the continual loss in production would eventually become quite marked and would in time undoubtedly affect the dairy qualities of cows so managed.

The germ or bacterial content of the milk drawn by machine depends in the main on the care of the milk tubes and teat cups; these should be rinsed first with cold water, then with a hot solution of sal soda or other cleaning compound and finally with hot water. The rinsing may be accomplished by alternately plunging in and withdrawing the teat cup from a pail of the fluid so that air and fluid are alternately drawn through by the milking mechanism. After this rinsing the motor and vacuum pump should be stopped and the teat cups and rubber tubes placed in a brine solution composed of nine parts of water and one part common salt. In addition to the rinsing which the milking machines receive at the barn after each milking, the teat cups and rubber tubes should be cleaned by hand once a week and the remaining parts of the milkers should be carefully washed each day. The brine solution greatly restricts bacterial growth, is harmless and is not noticeable in the milk if the tubes are rinsed in cold water before using. The use of brine for keeping the tubes free from bacteria is a most important step in milking machine hygiene. It should never be omitted and great care should always be taken to have all the air forced out of the tubes when they are immersed in the brine. If this is not done, some portions of the tubes may be protected from the brine by an air cushion, leaving good conditions for germ growth. Carelessness in this regard will cause large fluctuations in the bacterial content of the milk.

Examinations by Dr. Alexander, the Station Veterinarian at Wisconsin, showed that machine milking had no appreciable effect upon the physical condition of the cows in the University herd, nor did it in any way affect the udder in the majority of animals. It was apparently responsible for some improvement in the udders of three of the cows and in two cases possibly caused an aggravation of previously noted abnormal conditions. The conclusion would seem warranted, therefore, that little is to be feared by adopting machine milking as regards the health or the contentment of the cows used and that no bad effect on their udders may be looked for, provided the condition of the glands is normal at the outset and the cows are carefully stripped.

We have so far considered the efficiency of machine milking and whether or not cows can be satisfactorily milked by this method so far as maintaining a normal production is concerned. The economical side of the question will appeal to the practical dairyman, that is, whether or not cows can be milked as cheaply by this method as by hand.

The installation of the milking machine in a herd of around thirty cows, will involve an expenditure of about five hundred dollars, if the cost of an engine or other power required for running the machine is included. This is a large sum of money to most dairy farmers and many of them will hesitate to spend this amount for a milking machine, especially so long as they have no absolute certainty that the machine will prove a success under their conditions and render it unnecessary to continue milking by hand in their herds in the future. To the interest of five hundred dollars, or perhaps twenty-five dollars a year, should be added the cost of operating the machine, expenses of repairs, depreciation of machine, etc., and this sum should be compared with the saving that may be reasonably expected by the change from hand to machine milking. The cost of power for running the machine with a three horse power electric motor is, on the average, four cents per hour or six cents per milking in a herd of thirty cows, making a total of about three dollars and sixty cents a month. This cost is estimated on a basis of five cents per kilowatt.

The average hand milker will milk from eight to ten cows per hour. With two milking machines an efficient operator can milk from twenty to twenty-five cows in the same time.

The experience of practical dairy farmers and the results of careful exhaustive trials agree in showing that so far as the machine itself is concerned, the problem of mechanical milking may now be considered solved, although minor improvements in the present machines are needed and will doubtless be made before long. It will, therefore, depend on the individual dairy farmer whether machine milking can be made a success under his special conditions of dairying.

The adoption of machine milking can only be recommended under conditions where the farmer is able to give personal attention to the operation of the machine, or has reliable, intelligent help who can and will follow the directions of the manufacturers as to the care of the machine, manipulation of the udder, stripping the cows, etc. Where such is the case we can recommend the milking machine for the general dairy farmer who has a large herd, or for farmers owning smaller herds, that is, from twenty to thirty head, who will be able to attend to the milking of the herd, alone or with the help of a boy, by means of the machine and thus avoid keeping extra help for this purpose.

Properly cared for and handled, the milking machine will prove a valuable aid in the solution of the hired help problem on many dairy farms and will become an important factor in the further development of our dairying industry.

GREATER CORN YIELD FOR MAINE.

By Prof. G. E. Simmons, Orono.

The interest in corn production in this state is increasing from year to year, as the value of corn receives higher recognition, not alone as a grain but as a product that may be canned, or may be placed in a silo for the benefit of feeders, particularly of the dairy cow. Let us review the present status of corn-growing in Maine:

Maine's yield, per acre, is forty-six bushels for 1910 and forty-four bushels for the year 1911, averaging about forty bushels during the past eleven years. The average farm price of corn, on the first day of December each year, during the past eleven years, has been about seventy-two cents per bushel. This compares very favorably with the North Central states, which include the so-called corn belt states.

The section of the North Central states, east of the Mississippi river, yielded on an average, for the eleven years ending in 1911, thirty-five bushels per acre and the farm values of those years on the first day of December were forty-four and three-tenths cents per bushel. For the states west of the Mississippi river, the average for the same eleven years was about thirty-six bushels per acre, which was valued on December first at forty and four-tenths cents per bushel, on an average. This shows the possibilities in this part of the country in the production of corn, and also the advantages in the sale of the product. Sweet corn, one of our important products in this state, gives us the rank of third in production of canning corn, Illinois and New York only, being ahead of us; and in quality, Maine corn is recognized as first class.

Upon what does the greater corn yield depend? Aside from climatic influences, we might state that it depends upon the preparation of the soil, the selection of seed, the cultivation of the crop and the harvesting of the same. In the discussion of this problem, three specific divisions confront us: Growing corn for grain, growing corn for ensilage, and growing corn for canning purposes.

To avoid confusion, I will discuss these in three separate divisions.

I. Growing the corn for grain. We recognize the fact that our seasons are short, that the crop growing period is limited and that we must get our corn into the ground at the earliest date upon which the soil will permit. Therefore, the more preparations that can be made for the corn crop in the fall preceding, the better we will be prepared for our spring work in order to secure early planting. Many men are successful in using sod land, that has been thoroughly covered with stable dressing since the preceding hay harvest, and which has been allowed to remain in this condition for a period of time sufficient for the development of the second crop after the application of the manure. The soluble portion of the stable dressing is taken up by the roots of the growing plant, which accumulate food material in the plants themselves and conserve much that might be wasted under other conditions. The coarser part is then turned under with the second growth of grass that has been procured, in this way increasing the organic material that is so necessary for the development of good crops.

In case the land is infested with witch grass, thorough and repeated harrowing with the disc or spring-tooth harrow should be given, before the land is frozen. The freezing and thawing throughout the winter will have a beneficial effect upon the soil, particularly if it is a clay soil, by breaking up and fitting it for a better seed bed. As soon as the soil is in condition in the spring, it should be thoroughly worked up and pulverized, with whatever implements are necessary to bring about the best results. The disc, followed by the spring-tooth and later by the smoothing harrow, usually brings about good conditions. In planting, there should be applied about four hundred and fifty pounds of the fertilizer, running something like a 5-8-7; 800 to 1,000 pounds are sometimes used for sweet corn. If the dressing has been quite heavily applied, a reduction to three per cent in the ammonia might serve the purpose. I would suggest that part of the nitrogen be in the form of tankage.

For our conditions, about half nitrate of soda and half tankage would serve the purpose. This would also make the fertilizer run somewhat better, if applied by a machine.

Should a good clover stubble be turned under for corn it would be equivalent to the use of a 1 1-2% application of nitrogen. A rotation including clover is a desirable one for corn. The corn should be planted about two inches deep. If planted too deep, a long continued rainy season would probably cause the corn to rot badly. If too shallow, a dry season may cause the corn to perish at germination time.

QUALITY OF SEED.

To secure improved quality of seed, field selection and ear selection should be resorted to. The simplest method of improving a variety of corn is that of going into the field, before the corn is harvested, and selecting the best ears for seed. The ears are marked and at harvest time are gathered and stored. The success of this method depends wholly upon the ability of the grower to recognize the best corn. The following factors should be considered in the seed selection:

First, the type of stalk. A medium height, sturdy appearance, should be chosen. The ears should be at a convenient distance from the ground, for ease in gathering, particularly when you expect to harvest corn by machinery, for ensilage purposes. The ear should be of good shape, having a medium sized, short shank. The stalk selected should be from a hill having a full stand of stalks and surrounded by other full sized hills, producing good ears. Ears indicating early maturity should be selected, on account of our short seasons. These ears are usually of medium size, as very large ears generally take a longer period of growth before maturity, and are not always safe in planting a crop that one expects to mature year after year. After husking the ears a further selection should be made, throwing out those that are not of a desirable type. The ears should be of such a type, with straight rows, even sized grains, good depth, somewhat wedge shaped, on a cob of medium size, that is cylindrical, and gradually tapers to the tip, which should be well filled out. The base of the ear should be well filled over with corn, the number of the rows at the base the same as the number carried out throughout the balance of the ear. Large cob and shank should be avoided in the seed corn.

A great deal depends upon the care of the seed corn, after harvesting. It should be harvested early enough to avoid freezing in the field, and then carefully preserved in a place where the temperature is not low enough for freezing—not lower than fifty degrees—and where it can be so placed as to receive a free ventilation. The method of tracing it up by weaving the ears with a twine string, and hanging up the lots in such a way that the air can get to them to dry them out thoroughly is preferred over the ordinary way of hanging up the ears in traces. The heavy coarse cob and the large shank that goes with it cannot be detected so well while the husks are on as they may be when stripped of husks. This condition is not noticed until the corn is shelled for planting. The coarse cob is an indication of low shelling percentage. The ear with the big cob at the butt is usually shown either by an extra row of corn, running an inch or more down from the base, or by a very open conformation of the ear indicated by wide spaces between the rows. As the yield of corn is the objective point and the cob is altogether waste, the greater proportion of corn to cob that we secure, the more profit there is in this enterprise. Seed grown in the same locality and under similar environments should be used if at all possible.

TESTING.

The corn, previous to shelling, should be tested ear by ear, for germinating qualities. This may be done by selecting six grains from various parts of the ear, testing them by one of the ordinary methods of seed testing and using only the ears that give a very high percentage of germinating power. This will guarantee a better stand and as the stand is one of the factors governing each yield, it is a very important factor.

SHELLING THE CORN FOR PLANTING.

Of course this should be done by hand as injury to the seed will not occur as it would if the corn were shelled by machinery. The coarser grains at the butt and the smaller grains at the tip should be discarded. First, because if it is planted by a machine, the number of grains in the hill will be more regular if the grains are all of uniform size. Second, the tip grains may not be mature, and on account of their smaller size, will not furnish plant food material as freely to the growing plant in its early life history as the better sized grain. We must bear in mind that good, rugged, rapid growing plants in the early part of the season are necessary for maturity and large yield.

PLANTING.

Information from various sources indicates that from three to four grains of corn to the hill, when the corn is to be harvested for grain, gives better results when the corn is planted about three feet apart in the row, with the rows three feet apart.

Where the corn is grown for ensilage, there should be the same distance between the rows, while a little larger yield may be secured by planting in drills, planting one grain to about nine or ten inches in the row. In experiments a number of years ago, the Maine Experiment Station secured greater returns in the production of sweet corn, by planting the rows three feet apart and the hill of single grains nine inches apart in the row. The present practice at Highmoor Farm, where the corn is planted in hills, is to plant in rows three feet apart, and the hills from thirty-four to thirty-six inches in the row, and three grains to the hill.

CULTIVATION OF CORN.

The two primary factors in the cultivation of corn are the destruction of the weeds and the pulverizing of the soil, maintaining a loose mulch on the surface to prevent the loss of water by evaporation. The deep cultivation of the soil should take place before planting. Many farmers desire also to cultivate the corn the first time quite deeply but after that, a shallow cultivation of from two to two and one-half inches in depth is desirable and effective. Even before the corn is through the ground, a thorough harrowing of the land, particularly if there has been a preceding rain, is quite profitable. This will not destroy the corn and will not displace the hill if carefully done. After this a weeder or very light smoothing harrow can be effectively used even after the corn has come up. There is little injury and but very little loss from harrowing the corn over after it has reached the height of two inches or more. Shallow cultivation about once a week should there be heavy showers of rain will prevent the growth of the weeds by destroying them when quite small and will also maintain the mulch. This should be continued as long as the team can pass through the rows of corn without damaging them. Where a two horse cultivator is used, it will pass over the corn very nicely, even if the corn is from three to three and one-half feet tall. In case of drought, the shallow cultivation becomes more important.

HARVESTING THE CORN.

The time of harvesting sweet corn for canning purposes is governed by the instructor for the factories, who recommends the corn to be sent in, at whatever time he deems advisable. For growing mature corn for seed, the harvesting should take place as late as the season will permit or earlier if the corn is mature enough, as poorly matured corn is very apt to shrivel up and show a lack of maturity by being loose on the cob.

Corn for the silo should be allowed to reach the glazing stage in order that food value should be combined with succulence, to secure the greatest economic returns. The following will give one illustration of the desirability of up-to-date methods of cultivation of sweet corn.

On one of the demonstration farms near Waterville, the demonstration comprised one acre of sweet corn in comparison with the balance of the field. The first seed corn secured only tested out fifty-eight per cent germinating corn. This was discarded. The next lot tested out ninety-eight per cent. This was used.

From the acre on which the directions of the demonstrator were followed, sixty-eight dollars was the amount of the returns from the sale of the crop. On the adjoining acres, the average per acre was thirty-nine dollars. There was no appreciable difference in the land, and the difference was directly the result of the improved methods of cultivation. Well prepared soil, good seed, thorough tillage and judicious harvesting are the watch words to success in corn growing.

THURSDAY, DECEMBER 4.

COW TEST ASSOCIATIONS IN THIS COUNTRY.

By A. M. GOODMAN, Bureau of Animal Industry, Washington, D. C.

I am sure it gives me a great deal of pleasure to be here this morning for at least two reasons,—one from a personal standpoint, as I have a very pleasant recollection of about two weeks I spent with Mr. Adams among the Maine dairymen last spring, and also because I am deeply interested in the work for which this day of your meeting has been set aside.

What I have to say to you this morning will be of a rambling and general nature. I may in the course of the few minutes which I have at my disposal get down to some hard facts, but there will be a good deal of generalization.

The State Dairymen's Association of Maine is one of the very first associations of its kind to devote a part of the time of its annual meeting to advancing the cow test association, or the dairy improvement association work. I must say that this is a very commendable step for any dairymen's association to take for there is surely no more simple, no more efficient and no more economical way of improving the quality and general standard of the dairy herd than through the coöperative cow testing associations. A short time ago I had occasion to collect some data from the records in the Department files and it occurred to me as I was going over those records that if any one not more or less familiar with the dairy statistics were to go over the reports of the census of 1910 he would be horrified to find that the average production of the so-called dairy cows of this country was so low. The report for 1910 showed an average production of 3,113 pounds of milk and 145 pounds of butter fat per cow per year. That is terrible, but it is true and we have to accept these figures whether we are proud of them or not. However, we are not bound to keep these records as low as that. They can be raised and I think they are gradually being raised in a great many localities. I am always impressed with the number of so called dairy cows that there are throughout the country that are pulling the general average production downward. There are a great many cows, as you all know, that stand way above the figures quoted. When we take into consideration that there are plenty of cows making records of 600, 700 or 800 pounds and there is one cow that has made over 1,000 pounds of butter fat in a year; and when we consider that there are many men making a good margin in dairying, we realize that there must be something in the dairy business if we go about it in the right way. So far as I have been able to find out, the thing that is lacking in dairying, generally speaking, is business methods. I am not here to tell you that you are all wrong, for you certainly are not any more wrong than the general run of people in other communities, but we find throughout the country a lack of application of business methods. I appreciate the fact that there are a great many things that take the farmer's time so that he cannot keep complete farm accounts,—or at least, he thinks he cannot. Night comes and he is tired, and there is just about one thing in the world he can think of, and that is, how soon he can get to bed.

I do not wish to criticize unfairly, I was brought up on the farm; but there is no getting around the fact that one of the things we need on the dairy farm is more systematic management. And I thoroughly believe a man can well afford to take a small amount of time from the day to attend to the business end of the work.

Now it seems to me there are three main ways of increasing the income from dairy herds. The first is to sell the product at a higher price; the second is to buy the feed and the other supplies more cheaply; and the third is to give better care to better cows. We will discuss these three propositions briefly.

We all know there have been milk wars and rumors of milk wars, but the price of milk has been increased very little by the holdups we have had in the milk market. The price of commercial feeds, also, is well nigh beyond the control of the average buyer. It is true, however, that the dairyman can raise more clover than he is raising; he can also raise more silage, for I am convinced from what I have seen and heard since I have been here at this meeting that there can be better corn raised in Maine than is being raised.

The third proposition, however,—giving better cows better care, is something that can be done. It is the most pliable, by all odds, of the three propositions, and for that reason it should be the one to which the farmer first turns his attention. By way of example: The Blacksburg Experiment Station in Virginia conducted some observations a few years ago and found that by intelligently expending $4.10 per cow on the cows of that locality, an average increase in their production worth $9.84 could be had. You may say to me, "That is pretty far South;" but I will also say that there are some very good dairy herds in Virginia that are very well cared for. However, to come nearer home, and to take a state of good dairy standing, I will turn to New York State. I do not think there is any question of its standing as a dairy state. There are cows that are kept well and cows that are kept poorly in New York. Prof. H. H. Wing conducted an experiment in Central New York a few years ago, I think in 1904, and he found by a careful study covering a period of four years that milk and butter fat could be produced as much as 20 per cent cheaper when cows were well cared for and fed a well balanced ration than when poorly cared for and fed an unbalanced and insufficient ration.

Now if we are going about improving the herd, there is one thing we must do above all other things, and that is, we must either keep or have kept a record of the cost of production. We have got to have a record of what every cow produces and how much she consumes, and I recommend to you that you have it kept through a cow testing association for there is no more simple, and no more efficient, and no more economical way to have a record kept than through a coöperative cow testing association.

I think it is only necessary for me to speak in a general way of the cow test association, as the most of you are familiar with it. It is an organization of dairy farmers who are really interested in dairying and want to know the facts about their herds, and who employ a man to find out these facts for them. That is in brief. To go into the history of cow testing associations a little bit;—the first cow testing association in this country was organized in 1905 at Freemont, Mich. Among the very first states to take up the work after that was Maine. There were no organizations formed between 1905 and 1908. People seemed to want to find out what that one association would do. In 1908, through the efforts of Dr. L. S. Merrill, a number of associations were organized in Maine, but for one reason or another, which I may not thoroughly understand, some of them went to the wall. However, I am very glad to say that the test association work is coming back and getting on a good footing.

The figures that I have here are from the annual reports of the various field men, over the United States. I am sorry to say that they are not up to date—but up to July 1st, 1913, *California* had 4 cow testing associations; *Illinois,* 2; *Indiana,* 2; *Iowa,* 8; *Kansas,* 1; *Kentucky,* 1; *Maine,* 3; *Maryland* 3; *Massachusetts,* 3; *Michigan,* 5; *Minnesota,* 12; *Nebraska,* 3; *New Hampshire,* 1; *New York,* 21; *Ohio,* 1; *Oregon,* 1; *Pennsylvania,* 2; *Utah,* 1; *Vermont,* 19; *Virginia,* 2; *Washington,* 1; *Wisconsin,* 15.

There are several states with more associations than Maine, and several with less. Maine is in a class with three other states—Maryland, Massachusetts and Nebraska. Last year these associations tested about 53,000 cows; this may not seem a very large number, but if 53,000 cows were turned out in one barnyard they would make quite a showing.

For many years the work had drifted along, but in the last few years the state and federal authorities have laid more stress upon this work and now nearly every state has a man who is taking an active interest in the work and is responsible for the success or failure of the associations in his state. I might say that this year, for the first time, the men who are interested in the cow-testing association movement had a conference in connection with the National Dairy Show at Chicago. There was a good attendance and everybody was enthusiastic. There were men representing the work from California to New Hampshire. We were all sorry that Maine was not represented, particularly as Mr. Adams was to appear on the program. We heard from Mr. Adams to the effect that he was doing several other things at that time so it seemed necessary to excuse him.

It is certainly an inspiration to any one to attend a meeting such as the one of which I speak. I would like to read a paragraph from the address of Mr. Searles of Wisconsin. This is not anything that stands out in a class by itself, but it is a fair representation of what the men who were speakers at that meeting said:

"One of our members states that before he had any records of his herd he had priced one of his cows to a neighbor for $150.00. The neighbor declined to purchase. After the owner of the cow had been in the association a year and the record of this cow was known, she was sold to the same neighbor for $275.00. Another patron, with a herd of 40 cows, was advised to change his feed ration, and was shown by figures that the new ration would cost $15 less per month. The ration was furnished, and at the close of one month, an increased production was shown, amounting to $16.30, making a total earning of $31.30 or nearly enough to pay for the association work for the whole year."

Mr. McKerrow, from Minnesota, said that within six months they had brought into one county—Fremont—30 pure-bred bulls, as a direct result of the cow-testing association. That is a great showing.

There is one thing that a great many people want to know and that is, what good the testing association is, year after year. I have some charts from an association which I think will tell you. The Newaygo County Cow Testing Association in Michigan was the first organized in this country, and is still doing business.

These charts were compiled in the Dairy Division offices. We have worked out the records of this association to date and expect to publish them soon. One reason why I am particularly interested in showing these charts, here, is that the records are of small herds, such as you have in Maine. The herds are all small; 4, 6, 9 and 12 cows. Somebody says that you cannot do anything here, as you have small herds. Well, 8 or 9 cows is a good-size herd.

HERD NO. I.

NEWAYGO COUNTY DAIRY TESTING ASSOCIATION, MICHIGAN.

YEARLY AVERAGES PER COW.

Year.	Number of cows.	Pounds of milk.	Fat test.	Pounds of butter fat.	Price of fat—Cents.	Value of fat.	Cost of roughage.	Cost of grain.	Total cost of feed.	Profit.	Returns for $1 worth of feed.	Food cost of 1 lb. of fat—Cents.	Food cost of 100 lbs. of milk—Cents.
1906..	9	5773.9	3.91	226.0	22.8	$51 64	$24 01	$6 08	$30 09	$21 55	$1 71	13.3	52.1
1907..	12	5823.6	3.79	220.5	28.9	63 81	29 64	8 72	38 36	25 45	1 66	17.3	65.8
1908..	12	6156.1	3.94	242.6	26.6	64 93	24 64	9 69	34 33	30 60	1 89	14.1	55.7
1909..	11	6687.1	4.02	269.1	30.8	82 89	27 41	14 50	41 91	40 98	1 97	15.5	62.7

In the herd, the record of which is given on this chart, the number of cows that completed the year's test was nine. There were more in the herd at the beginning but some were sold out when their records were known. The number of pounds of milk the first year was 5,774, running up to 6,687 at the end of the fourth year. The butter fat was 226 pounds, going up to 269. The cost of feed went up from $30.09 to about $41.91, an increase of nearly $12.00, and the profit in the course of 4 years went up from $21.55 to $40.98.

HERD NO. 2.

NEWAYGO COUNTY DAIRY TESTING ASSOCIATION, MICHIGAN.

YEARLY AVERAGES PER COW.

Year.	Number of cows.	Pounds of milk.	Fat test—%.	Pounds of butter fat.	Price of fat—Cents.	Value of fat.	Cost of roughage.	Cost of grain.	Total cost of feed.	Profit.	Returns for $1 worth of feed.	Food cost of 1 lb. of fat—Cents.	Food cost of 100 lbs. milk—Cents.
1906...	5	4492.4	4.13	185.5	23.6	$44 02	$20 68	$10 30	$30 98	$13 04	$1 42	16.7	68.9
1907...	6	4825.6	4.14	199.8	29.5	58 94	20 08	12 27	32 35	26 59	1 82	16.2	67.0
1908...	9	5077.8	4.24	215.1	27.4	58 85	20 34	11 71	32 05	26 80	1 84	14.9	63.1
1909...	10	6005.7	4.39	263.7	31.3	82 56	21 35	14 56	35 91	46 65	2 29	13.6	53.4

The next herd shows very much the same conditions, going from less than 5,000 pounds of milk to over 6,000. The increase in cost of feed, as you see, is $4.93 in four years, while the profits have increased $33.61.

We will turn over the charts very rapidly. The same thing stands out in each herd. There is a small number of cows in the herds which have been left after weeding out and the herd gradually built up again, largely as better stock has been bred to fill the places. You will say to me that I am calling your attention ony to the best herds in the association, the herds that showed the greatest increase. That is true, I will grant you, but we are interested in getting figures that will show actual results. The Government is not paying men to go around and advertise a proposition that would not hold true, any more than a good business house is. So we have taken the average of all the herds that have been continuously in the association for the entire four years. There were only 8 herds that staid in year after year. There was the same shifting that seems to have to occur in every association—an assorting of dairymen as well as an assorting of cows. The men in the association, now, are the survival of the fittest, as are the cows. The shiftless farmers have drifted out and the men who have staid are the men who are really dairymen.

NEWAYGO COUNTY DAIRY TESTING ASSOCIATION, MICHIGAN.

YEARLY AVERAGES PER COW.

Summary of the 8 herds which have been in the association CONTINUOUSLY since its organization.

Year.	Number of cows.	Pounds of milk.	Fat test—%.	Pounds butter fat.	Price of fat—Cents.	Value of fat.	Cost of roughage.	Cost of grain.	Total cost feed.	Balance, over cost of feed.
1906......	58	5752	3.94	226.8	23.3	$52 88	$21 48	$9 93	$31 41	$21 47
1907......	70	5935	3.96	234.9	29.1	68 27	26 67	13 07	39 74	28 53
1908......	76	6223	4.16	259.1	27.2	70 60	24 03	16 22	40 25	30 35
1909......	83	6362	4.28	272.1	31.1	84 67	25 96	16 17	42 13	42 54

The averages of these eight herds show the same characteristics that were shown in the charts of the individual herds; the pounds of milk running from 5,752 to 6,362 and the pounds of butter fat from 226.8 to 272.1, an increase of nearly 50 pounds. The percentage of fat in the milk has been increased a little. I have not spoken before of the price of the fat. That also has increased. You see, the price that the farmers received has gone from 23 cents to 31 cents a pound. That, of course, would make the value of the fat higher, but at the same time, you are all aware of the fact that the cost of feed has gone up since 1906. You notice the farmers have had to pay more for their feed. The roughage is charged at a higher rate. It has gone from $21.48 to $25.96. The cost of grain has gone from $9.93 to $16.17, partly because of the increased price and partly because of more liberal feeding. The total cost of feed has gone in the four years from $31.41 to $42.13. There is one thing, the profit, in which you ought to be interested, and it has gone in the same years from $21.47 to $42.54. There are a number of ways of figuring the average increase. We may subtract the first year's record from the last and divide the result by 3 and get an average which shows that there has been an increase of $7.02 per cow per year since the association was started. Or if we go at it in a slightly different way, and find the difference between the first year and the second year then the difference between the first and third and divide that by two, the difference between the first and fourth, and divide it by three, and then total these averages and divide by three, we find that there is an average increase of $6.17. You see that the increase has been a perpetual one. It has come gradually but continued year after year.

Now think what these figures mean. These men have increased the profit from their cows, practically 100 per cent. Now, if a man is making a little money from his herd, it seems to me there is a chance for him to make more. There are some interesting things on these charts from both mathematical and business standpoints. The profit has been increased at the rate of over $6.00 a year. It has cost the farmer something; it has cost him some good, hard earned dollars, and at the same time think what he gets back. In four years he has doubled the earning power of his herd. If it cost him five dollars a year, that was a good investment, because he has doubled the earning capacity of his cows; if it has cost $25 for the four years the money has been well invested, but as a matter of fact it has cost only about four or five dollars. That was one of the early associations organized on the plan of $1.00 per cow. They could well afford to pay two or three dollars a cow. We will say that they paid $2.50 a cow; they have doubled the earning power of their cows and at the same time have been getting over 200 per cent on the money invested.

I want you to look at these charts and think about them, and if there are any questions I can answer I will be very glad to do so. I want to say again in closing, that there is no more simple, no more efficient, and no more economical way of improving the dairy herd than through the dairy testing association.

WHAT THE COW TEST ASSOCIATION HAS DONE FOR ONE FARMER.

By A. E. Hodges, Fairfield.

I have been asked to say something on cow test work and I have decided that the way I can arouse the most interest among farmers who are not members of a cow test association will be to tell them how it has benefited me.

I have no apology to make for this attempt, as I am a farmer and not an orator, and you will have to excuse the rather free use of the personal pronoun, as it is only by giving you my own personal experience that I can show you what a help the cow test association can be to the dairyman who will take an interest in it.

I have kept cows since I was old enough to milk. I used to think I had some good ones, but it was mostly guess work. I used to think that if a cow gave a big pailful of milk when she was fresh she was profitable.

When the Waterville association was started I heard for the first time that there was such a thing in the world. It sounded good to me and I, with some of my neighbors, attempted to start an association of our own, but didn't succeed in getting cows enough to start. However, that attempt set me to thinking and I began to weigh each cow's milk separately and took samples of milk to the creamery occasionally, to be tested, and so followed cow test work the best I could alone.

About 18 months ago I moved to a farm near enough, so that I was able to join the Waterville association, and I soon found out there was a whole lot I hadn't learned about cows. When the tester came to my place the first time, I asked him how some of the other members were feeding their cows, and when he had my records for that day made out, he and I went over them together and I saw that the herds that were making the most profit were not being fed as mine were. I had usually fed equal parts of cottonseed and bran, when the cows were in the barn, and equal parts of cottonseed and gluten when they were on pasture; six quarts a day to each cow, whether she gave one pound of milk or 40, and there were not many that gave 40. I thought no grain and any old kind of roughage was good enough when they were dry. I always had plenty of udder trouble; took it as a matter of course. Well, the tester figured out several different rations for me and I began trying them; I soon saw that some of the cows began to respond. I began to take more interest in them and watched the milk sheets closely and I saw some things that begot more interest still.

After several months the individual sheets began to tell some stories and I found I had some cows that were not paying any profit and others that were not paying enough, and that set me to work to find a remedy.

I used to keep the tester up nights, every time he came, holding long talks with him, asking him how this one and that one handled their cows, and getting hold of some of the things he had learned at the College of Agriculture, and, in short, considering each cow separately and trying to find out what I must do with her.

Now, what is the result? I have doubled the value of my herd and increased the net profit per cow 50 per cent. How? I sold all that were not paying a fair profit and made up my mind not to keep a cow the second year that did not pay $50 a year net. One cow whose best year was 8,000 pounds of milk and 300 pounds of fat, I increased to 11,000 pounds of milk and 453 pounds of fat. Several that had never given over 35 pounds of milk in a day I sent up to 60, 65 and 72 pounds per day. Now I did it through the cow test association, by learning better ways of feeding and caring for my stock, and in no other way.

We have a little meeting over in our association once every month when the members get together, and the Department sees to it that we have one or two first-class men to talk to us on dairy and other farm matters, and right there is where I have gained help for a large part of the improvement I have made. The College of Agriculture is brought to my door every single month.

We members talk over our problems and exchange our best ideas with each other and get out of the old ruts. Through these meetings I have learned much about the whole business of farming; how to care for the cows, how to produce better feed for them and more of it at less cost; to improve my land; to care better for my horses; to make a little profit out of a few hogs and to raise calves in such a way that they will make profitable dairy cows.

I don't want you to think that I have become an expert dairyman in 18 months, but I do know that the cow test association has given me a big boost in the right direction. I have heard several farmers say, "Oh, that is all right enough for the man who has plenty of money and can afford to hire a young man to putter around testing his cows."

I am speaking from the standpoint of a man heavily in debt, who is trying to win out, and also to bring up his family to have the advantages that belong to a farmer's family, and I know that if I live 20 years, the money that it costs me to belong to this association will return to me many times. I know that I shall be thousands of dollars better off because of what I am learning through this association.

Milking and other chores have changed from drudgery to something to be enjoyed. The hired men take more interest; they watch each cow and her milk sheet and grain rations as closely as I do. Isn't that worth the $3 a month it costs me to pay the cow tester? Go and ask the men who have belonged to an association two or three years. You will find that the men who are sticking to it and taking an interest in it are becoming the most successful dairymen in this state. They will tell you that they could not keep house without it.

I have just one more point to make and it looks to me like the best one yet. Some one has said that if a man can make a better mouse trap than his neighbor has, though he live in a wilderness, the world will make a beaten path to his door. If we have some good cows in our herds, those who read our farm papers will find it out, when they read the monthly reports of our testers, and the men who want first-class cows are pretty sure to go where they are, even if they should happen to be 40 miles from a railroad. I received a letter a few days ago from a man who had heard of my herd of cows through the cow test association, inquiring for heavy milking cows. I wrote him what I had and he came to see them. When he got there

I had the individual records of those cows for nearly two years to show just what they had produced in milk, butter fat and net profit. The result of this free advertisement was the sale of two grade cows for $275 and the assurance that if they proved satisfactory he should come back for more.

Ques. What breed of cows do you have?

Ans. The most of them are Holsteins.

Ques. What kind of grain are you feeding?

Ans. I feed a combination which varies sometimes but the basis is 200 pounds of bran, 200 pounds of Ajax, sometimes 200 and sometimes 100 pounds of hominy, 100 pounds of cottonseed meal and 50 pounds of oil meal. We vary the proportion a little for some cows.

Ques. Why do you use hominy?

Ans. I use it in place of corn meal. I think the cow needs something to keep her body in good flesh, and it is generally considered that hominy is not as heating as corn meal. It is a safer feed than corn meal for a heavy milking cow.

Ques. Is there any difference scientifically between hominy and corn meal?

Ans. I think that some of the heating properties are taken out, like starch and ammonia, in hominy, but I am not sure of this. I feel that it is a safer feed.

Dr. Woods. As a rule, in the goods from which hominy comes as a by-product a rather better quality of corn is used than in the ordinary feeds. A part of the hominy is being manufactured for human food; and it is almost impossible to tell by chemical analysis the difference between a poor corn which has been ground up and a better grade of corn from which part of the starch has been taken out for human food purposes. If hominy was made from exactly the same corn the resulting product from a hominy feed might not be very different from that of a straight corn. I should very much question whether in any accurate feeding test, especially in such a formula as that mentioned, we would find any practical difference in the safety of the hominy and the corn meal. As the hominy feed is usually drier,—contains less water—100 pounds of it will analyze a little bit better than the ordinary corn meal. The corn we buy at this time of year will carry a high percentage of water, and it is not nearly as economical as that which is drier. If we could foresee this and had storage room so that we could buy corn of the 1912 crop we would get in 100 pounds of it more nutriment than in 100 pounds of the corn we are buying today, because it has not dried out; but in the summer of 1914 it would be the same kind of corn we are talking about. At this time of year it is not economy to buy much corn if we can help it. Hominy meal might analyze as good as the straight corn meal we are buying.

Ques. How much of the grain do you feed to a cow?

Mr. Hodges. I feed as a usual thing about one pound of grain to four pounds of milk until I reach about 14 pounds of grain. If a cow gets pretty low in production and is quite a ways from calving I give her perhaps more than is economical if she happens to be thin. If she is in good order I dry her up, and I do not always feed grain all the time a cow is dry. If she is in pretty good condition on ensilage and roughage, especially if I have clover hay, I would not give her much grain. If I thought she needed it to get her into good condition, I should feed her some other mixture to get her into shape to calve. If you put fat on a cow's back when she is dry she will take it off and give it to you when she is giving milk.

THE BENEFITS OF COW TEST ASSOCIATION WORK TO ITS MEMBERS.

By W. W. Abbott.

The first cow test association that was started in Maine was the Waterford and Norway Dairy Testing Association. It began its actual work Feb. 1, 1908, and has run continuously, with no break in its work or records, from that date. It was for several years something of a struggle to keep the number of cows necessary to carry on the work at a reasonable cost. Many men seemed to get the idea that it was a sort of get-rich-quick scheme, and all they had to do was to join the association and the tester would do the rest. To get any benefit from a cow testing association this will not do,—you must get busy yourself, study your own records as well as those of the other members, and study the feed rations of the other members, observing closely the different methods of feeding and the results. Weigh your milk each day, keeping daily records, add these records up at the close of each month and you will be surprised to see how closely they will compare with those of the tester.

Another thing, some people seem to think that if a cow is tested once, or for one year, they know all about her and it is not necessary to test her any longer. I will cite one or two instances in our association. The first year of our association work one member had a cow that gave 404.4 pounds of butter fat. The third year of this work this same cow, with the same care, increased to 593.5 pounds of butter fat. Another cow in the same herd in 1908 produced 354.2 pounds of butter fat, in 1909, 398.6 pounds, in 1910, 404.8 pounds, in 1911, 466.5 pounds, and in 1912, 489 pounds. Now any dairyman can see what those records mean and what it would mean had this man stopped at the first year. Each year fewer have dropped out and we have had less difficulty in replacing those that have left the association. This last year only three left and we were unable to take on all who wished to join, and by November of this year we had received several applications from some of the very men who joined when the association first started and after a year or two dropped out. Now they wish to be taken back at the first opportunity, and I predict that in the near future it will be necessary to have two associations to cover the ground that is now being covered by one. This will be much better all around, not only as regards the tester but on account of the members getting out to the meetings, etc.

One reason of our greater prosperity we consider to be the marked improvement in the herds of the various men who have belonged to the association from the first. This has told its own story and has done more to influence the dairymen in our section in favor of cow test work than any amount of talking could ever do. I know of one man who is not a member, in our town, who says that the association has been a benefit to him, although he has never had a cow tested.

The greatest help, possibly, of the cow testing work, is enabling us to tell our good cows from our poor ones, so that we can get rid of the poor ones and keep the best. We can guess which our best ones are, but we cannot always guess right. One of our members found at the close of a year's work that the cow which he had considered his poorest one was in reality making the greatest profit; while his best one, as he thought, because she produced a large quantity of milk, was making the least profit. It is not the amount of milk a cow gives, unless we are selling milk, that we should look at, but the profit she makes.

Another important item in our work is knowing the cost of feed and the amount returned by the cow above what is expended on her feed. If a cow produces a large amount of butter fat and we have to give it all back to her in her feed, what are we making out of the transaction?

No small advantage of this work is the meetings where we get together, compare notes, talk over the dairy business and listen to a good speaker from the Department.

One of the greatest helps in this work, to my mind, perhaps because I am particularly interested in that, is the assistance it gives us in the breeding of our dairy animals. It is the only way to breed intelligently, with any degree of certainty as to what the result will be, for "As the twig is bent so the tree inclines." However I would not advise bending it quite as far as was suggested in a little anecdote. An old gentleman on the train was very much taken with a bright little child who sat near him. After a while he leaned over and said to the mother of the child, "Madam, I hope your baby will grow into a good and honest man." "I fear not," said the mother. "Why so," said the old gentleman; "'As the twig is bent so the tree is inclined,' you know." "Yes," replied the mother, "but this particular twig is bent on being a girl and we are inclined to let it have its own way."

I have a cow that one year freshened in November and in December produced 1.45 pounds of fat per day. Each month for seven succeeding months she increased in butter fat production until in the following June she was putting up 1.85 pounds. This is not a large amount, if we do not consider her time of freshening. In a few days she freshened again. This cow has a five-year-old daughter which this year, freshening in June, produced 1.35 pounds of butter fat per day in July, and in August, in spite of the severe drought and poor feed increased to 1.94 pounds. Her two-year-old daughter last year, seven months after calving, put up her highest amount of butter fat for the year.

Another characteristic of this particular family is their high test. The old cow averaged 6.1 one year, and her daughters 5.88 and 6.48. I had another cow that would never give over 35 pounds of milk per day, but she tested high and would hold such a steady flow throughout the year that it was nothing unusual for her to produce over a pound per day four to six weeks before freshening, and the second year she was the highest producing cow in the association. Her daughter, due to freshen the 15th of September, in August produced 1.99 pounds of butter fat per day.

I am not giving you these results from my herd because I consider them remarkable but simply to show the true value of cow testing work to the dairyman who is trying to build up a herd of profitable dairy cows. These are only a few instances of what I found to be true by careful study in the majority of cases as well as in my own herd. These are results which in the first year's work you would not get much benefit from, but which in succeeding years are very valuable, each year making them more so. We are thus enabled to look back for generations, keeping and breeding only our best cows that have the power to transmit their good qualities.

Still another advantage is in the buying and selling of our dairy stock. Any of us would be willing to pay more for a cow with a good record or for a calf whose dam and grandam had good records. And so it is with the selling. If we have stock to sell from cows that have made good, and we can look back to generations back of them that have made good, we can ask more for them, and get it too.

To illustrate the mistaken idea that some people have about this work I should like to tell you a little story of something that happened near me. One of our members had a cow which he sold after he had had her a year or two as he found she was not worth keeping. After this cow passed through several different hands, each person thinking that was all that testing amounted to, the man who first sold her heard of her through a neighbor of his who is something of a cow doctor and had called to see this cow. The cow was sick and could not get on her feet. The man who then owned the cow said, "I want to get her up if I possibly can; she never has done very well but she is a great cow because she has been tested."

Now I firmly believe that the dairyman who belongs to a cow testing association, who studies his records, his feed rations, the results of breeding, and keeps only his best cows, breeding them to still better sires, will keep steadily improving his herd all the time. Good cows pay and pay well if we use them well, and why not have all good cows? The dairyman who cannot get any benefit from a cow testing association will never make cows pay and had better go out of the business.

THE RELATION OF THE PATRONS TO THE TESTER.

By H. M. Look, Norway.

The first cow-testing associations were organized in Maine about six years ago. The plan in use is similar to that used in Denmark where cow-testing work first started. Since then the work has been extended to all of the more important dairy sections of this country. These associations are organized and their work is in harmony with the work of the various breeders' associations and cattle clubs; in fact, they do much to help these organizations by encouraging the breeding of pure bred stock, by proving that dairying is a profitable investment and by teaching better and more improved methods.

In making an association successful much depends upon the members of the association and the work of its official tester. Any member that studies his herd records and gets enough out of the work to make it profitable for him is a desirable and useful member of that association. If he learns something from the work he will be able to help other members. The statement that a chain is no stronger than its weakest link holds true in this case. The member that does not study his records is not receiving any benefit from the work and is not able to benefit others.

The tester can play an important part in keeping up interest in the work. If he wishes to succeed I believe he must have confidence that his daily toil is of financial value to the dairyman. He must believe that the records he is making represent good averages of the cost of feeding and profit and of milk and butter fat production.

The figures that our experiment stations have worked out show that by testing one day in each month, as is the practice in our dairy association, the variation from actual production will not exceed three per cent. This being the case, it will be admitted that these records are near enough for all practical purposes. The tester has many people's problems to study; his members are men of all ages—from very young to very old men and their ideals are different. Some have been in the business a long time and have developed fancy herds of pure bred stock with well equipped barns. Others are only beginners in the business, with a small herd, probably grade cows. These things must all be taken into consideration by the tester in making criticism of the herdsman's work and in giving advice on the feed, care and management of cattle. The tester can make public his reports and in this way he can get a larger number of people interested in the work.

The benefits of cow-testing work have already been discussed. About the best evidence we have of its value is that the dairymen who have belonged to these associations the longest are the most interested members we have at the present time. These men have learned from their own experience that a comparison of ideas is always educational.

It may be well at this time for me to express my appreciation of the good work being done by the present administration of the State Department of Agriculture, for the interests of the dairymen of the state. They have coöperated with our cow testing associations and have worked in a faithful and capable manner. They have accomplished much in a short time.

Improvement in the work can best come about through the aid and coöperation of the members. In our association we endeavor to make our herd records as near uniform as possible. Once or twice a year we make a standard price for all kinds of roughage. The idea is to charge up feeds of the same quality at the same price. In this way it is much easier to judge the comparative value of the different herds.

The reports sent out by our dairy association each month are not much proof of the value of the herds unless they are followed up each month. In some cases we find that our highest paying herds are fed at a loss for one or two months out of the year. The yearly records are the most important.

In closing, I wish to emphasize the importance of united effort—the importance of better methods and, last but not least, the importance of being a good coöperator.

Mr. Cummings. I am a member of the Waterford and Norway Dairy Testing Association and I am more or less interested in it; perhaps more than I was once, and perhaps less than

I ought to be. I thoroughly believe in it and believe that it is worth all it costs to the members. I know that it has been worth considerable to me. I believe I am learning better how to breed for better quality; and when I have some stock of ood quality I know it, and if I had not belonged to the association I certainly should not. I believe the work ought to be extended.

Dr. J. A. Ness. I believe the cow testing work will bring valuable results if the patrons will coöperate with the tester and get into the game for all it is worth. This is something that has done wonders for the dairymen. I will cite one instance, where a man who is now the president of our National Association had a cow formerly owned by a Maine man. He sold her first bull calf for $5.00. She made a good record the second year and he sold her calf for $50. Her next bull calf sold for $500.

The cow test association work certainly enables a man to know which his best cows are. He cannot afford to feed or keep anything but the best. I was pleased with the last statement of Mr. Look, to the effect that he considered the year's test was the really essential one for any cow. The cow that can stand up and do a year's work, or two or three years' work and increase her production year after year is the most valuable one.

DOMESTIC CHEESE MAKING.

By F. L. TIBBETTS, Dexter.

There is a popular opinion that domestic cheese making has become a lost art, but the agricultural returns of the 12th census show that in the year 1909 there were 15,670 farms upon which dairy cheese was being made, and it has been my privilege to meet with some fine cheese makers in this state who are anxious to improve their product and I hope that there will be more interest shown and a helping hand extended, to progressive cheese makers, that they may become more proficient along these lines.

Domestic cheese making is an old story with me. It has been carried on with us for thirty-two years. My mother, Mrs. L. H. Tibbetts, was considered an expert cheese maker. She began making cheese in a small way, using home-made presses, drains and sinks. All these utensils were made of wood. The drains were square, the bottoms being covered with slats; the sides were bored full of holes. I need not describe to you the old-fashioned presses as nearly every old farm-house attic boasts of one or more of these treasures. But with these crude utensils she was able to supply her table with an article of food which was a delight to all.

Later on my father enlarged his dairy and commenced to sell his surplus cheese for the small sum of 8c. per pound and in those days was able to make a fair profit, even at those prices. They kept steadily improving and making improvements in the equipment, adding tin drains in the place of wooden, also a gang-press. These proved to be great labor-saving devices and at the same time being more sanitary, improved the quality of the cheese.

Mrs. Tibbetts and myself began making cheese on our home-farm, using the same formula employed by my mother with the exception of changing from the home-prepared rennet to that which is scientifically extracted and which is much more convenient to use. Of course we have had the advantage of my mother's life-time of experience and we have had an opportunity to take advantage of her improvements as well as to profit by her mistakes.

We have done away with all the old wooden utensils and have installed zinc sinks and are daily striving to improve our cheese in every possible way and by so doing have been able to increase the price to us from 8c per pound to 22 wholesale and 25 retail, thus showing that this subject should appeal to the wife of every farmer for the art of making good cheese is a benefit to the family, financially as well as otherwise.

Experience has shown that any one can make a success of cheese-making if he will give it the energy and attention that it requires. People are just beginning to realize that cheese is fast becoming one of the most important items of food. More cheese is being consumed by the American people today than in years gone by when it was cheaper and poorer in quality. That is as it should be, for good cheese, as a regular diet is palatable, nourishing and healthful and the consumer cannot buy anything for his table that will give greater value for his money; but care should be exercised by the consumer in selecting his cheese. However, the farmer is independent and can produce his own and therefore know just what he is using.

The directions for successful cheese making are difficult o state for much depends on the good judgment of the maker, and this judgment can only be acquired by actual experience and practice. The ordinary process employed in making American cheese in a factory, is not suitable for the private dairy. An outfit for making cheese on a small scale, for family use, can be made at home, for you would use only small quantities of milk, but in manufacturing domestic cheese for the market and making it a profitable business, one must have a suitable outfit to save labor; also a curing room that can be kept at an even temperature. Another important factor which I wish to emphasize is the matter of cows, the source of the milk. From experience we have found that the best results can be derived from Holsteins, therefore we have kept culling our herd until we have nothing else. Of course thoroughbreds would be preferable but good results are obtained from grades. Then, too, the care of the cows is a factor that must not be overlooked.

They should be carefully fed and any vegetable or grain that effects the quality of the milk should be carefully avoided. The cleanliness of the stable is another factor that plays an important part. Modern inventions have also added to our success. During the past year we have installed a Sharples Mechanical Milker and find that it is very satisfactory. One feature of this machine is that it keeps the milk from all contact with the air during the process of milking. Another thing, we found that it was becoming almost impossible to hire farm help where there were a large number of cows to milk night and morning.

As soon as the night's milk is brought in it is strained into a large tin vat in a cool room, and while it is still warm, to it is added one teaspoonful Rennet Extract to 50 pounds of milk and it is allowed to set for forty minutes; then being ready to "cross off." This is done by the use of regular cheese knives, cutting the curd into discs. The curd is left in the vat until morning and then the drainers are placed in the curd sink, placing a cheese cloth in each. The night curd is dipped into each of them. The morning curd is treated in the same manner, then dipped in with the night curd to drain. Great care should be taken not to break the discs in handling the curd, for cheese is often spoiled by improper draining. The cloth should be gently lifted from the sides of the drainer and the curd moved toward the center with a perforated skimmer and after it forms into lumps it should be twisted up in the cloths and have a weight placed upon it. For ten five-pound cheeses we use eight drainers. After becoming packed together, it should be cut into pieces the size of an egg, continuing this process until it is very firm, when it is ready to scald. Then it should be cut into thin slices, placed in the vat, and water that has been heated to 135 degrees poured over it. Then let cool and once more dip into the drainer and let drain 1-2 hour under weight. It is now run through the curd chopper and salted, using four table spoonfuls salt to 7 lbs. curd, then placed in the hoop and pressed until the next morning when it is taken from the hoops and placed in the curing room where the cheese are turned and greased every day to prevent moulding and cracking. If properly cured they will have a bright golden finish and will be ready for the market in two weeks. The curing room should be kept at a temperature of 70 degrees.

At this point I wish to call the attention of any of my hearers who may have aspirations to go into domestic cheese making for the market, to the matter of marketing itself. Too much care cannot be exercised in selecting the market, for it will be found that in selling a superior article to many they will handle it for a while and create a demand for the same and then will commence, if you happen to have sold to an unscrupulous dealer, to palm off upon their customers an article which costs them much less and which they will claim is yours, thus doing damage which will take years to remedy. In finding reliable dealers we have been greatly aided by the Department of Agriculture and by the experiment department of the University of Maine, both of which have always been very willing to aid in many ways and from their suggestions we have derived great benefit.

As domestic cheese makers we have always tried to keep abreast of the times, improving the plant and the quality of our product and have been able to dispose of all our output with satisfaction to ourselves and a list of customers in many states.

In closing, for the benefit of the farmer who is progressive and is looking for a business that will be lasting and financially satisfactory, I know of nothing better than that of domestic cheese making and trust that something in the foregoing may aid such an one in his experience.

Ques. How much milk do you take to produce a pound of cheese?

Ans. We have tried it very many times and it varies somewhat, although what causes the variation I do not know unless it is the time in the period of lactation. The least amount which we have tried is 7 1-2, and ordinarily we have to reckon on 10 pounds. I do not think on an average it will take quite ten pounds but it will take from 8 to 10. We have never tried it when it took over 10.

Ques. What make of rennet do you use?

Ans. We are using the standard extract. We buy it in New York.

Ques. Do you think that the making of cheese is more economical than selling the milk at Borden's Condensed Milk Factory, if you are within easy distance of the factory?

Ans. We belonged to a testing association for something like two years and I can give you somewhere near the records of 13 of my cows that finished a year's record at about the same time, and perhaps you can judge from that. They netted me aside from the feed something over $1,500, in making cheese about 7 months and selling the milk in the winter to Whiting. We reckoned nothing for the whey and said nothing of the work. Whiting paid up to $1.90. We lived within three miles and the team took it for nothing. In figuring on selling the milk it would have been considerably less than $100 apiece for the cows to pay; and I am of the opinion of a great many people, that it is not a good idea to carry everything off from the farm. Of course some of us have to do it but I think quite a good deal of having even the whey. We carry about ten hogs on a small pasture and what whey comes from 20 cows with very little grain.

Ques. Have you ever tried raising calves on the whey?

Ans. Some of the finest cows in our herd were raised on nothing but whey for drink. Of course we used grain to substitute for the fat.

Ques. How long do you give the calves milk before putting them on the whey?

Ans. We carry them on milk two or three weeks and then change them carefully to whey and use a mixture of grain.

Ques. What do you use for greasing the cheese?

Ans. At present we are using compound lard mostly. We use sometimes the suet from a beef cow, but in winter it is too hard.

Ques. How heavy are the weights you put on the curd?

Ans. I believe they weigh 20 pounds each. The tin drainers are all in two long sinks connected together. My wife found it very hard to lift those weights, so I arranged some pulleys and they are both lifted at once with a crank.

THE CARE AND IMPROVEMENT OF SEED POTATOES.

CLARENCE A. DAY.

Figures are dry facts and census reports are dry books; but the last census report contains some figures which are of great interest, showing as they do the importance of the potato industry and the leadership of Maine as a potato producing state. The following are from the census report for the year 1909:

	Acreage.	10-year inc.—%.	Yield.	10-year inc.—%.	Value.	10-year inc.—%.
U. S.	3,668,885	24.8	389,194,965	42	166,423,910	69
Maine.........	135,799	89.2	28,550,837	191	10,224,714	175

Average yield per acre.

	Bushles.	10-year inc. —%
U. S.	106.1	13.1
Michigan......................................	104.6	29.3
New York......................................	123.2	27
Maine (except Aroostook)........................	183.9	-
Maine...	210.3	73.6
Aroostook......................................	231	-

The report shows that, although a few states have a much larger acreage and produce more bushels in the aggregate, Maine leads the country in the rapidity with which the industry is growing and in the average yield per acre. Indeed, the average yield is almost twice that of the whole country. "Aroostook far exceeds any other county in the United States in the production of potatoes." When the relative amount of improved land in the several states devoted to the potato industry is considered, the position of Maine becomes more remarkable. Less than one per cent. of the improved land in the

United States was devoted to potatoes in 1909, while in Maine, five and eight-tenths per cent. was so planted, and in Aroostook, seventeen and one-tenth per cent.

These figures are a source of pride and gratification to all her citizens; but even in Maine, a decided improvement in yield and cultural methods is possible, although the problem of the high cost of living demands that the larger production be obtained without a corresponding increase in expense. There are four principal lines along which progress may be made,—by improvement in soil fertility; by improvement in methods of cultivation and crop rotation; by preventing injury by weeds, insects and plant diseases, and by the use of better seed.

The last is the one with which we are at present concerned, and is perhaps the method by which the greatest increase can be obtained at the least expense. Rental, fertilizer, preparation of the seed-bed, cultivation, spraying and harvesting cost practically the same whether the seed be good or poor, and improved or selected seed sometimes yields twice as much as that of inferior quality.

This subject of better seed at once resolves itself under two heads,—the care of seed and its improvement. The care of seed may properly be considered first, bearing in mind the fact that the tuber is not properly a seed at all, but is an underground branch corresponding to the new wood growth of an apple tree, while the eyes are really buds. Care begins in the field in the fall and ceases only when planting is over the next spring.

Select the tubers to be saved from the best portion of the field. After they are mature and do not peel or bruise easily, dig them carefully, sort out all scab, blackleg and rough, diseased or inferior stock, and store in a dry, cool, well ventilated cellar. Care should be taken that the potatoes do not heat and decay during the sweating process which they must undergo. Potatoes which have been heated or chilled will not sprout evenly and make a good stand even though they remain sound.

During the winter, the cellar should be kept as near the freezing point as possible, to prevent sprouting until the potatoes are taken out in the spring. Not only are the sprouts which first start from the eyes of the tubers the most healthy and vigorous, but the nourishment required for their development is drawn from the parent tubers which are weakened to that extent. If several long sprouts have been broken off, or if the potato has grown shrunken and soft, it becomes unable to start strong, thrifty plants and maintain them until the root system has sufficiently developed to absorb food from the soil, or until the sprout has pushed to the surface and spread its leaves which elaborate part of the plant's food. The growth is weakened and uneven and the result is loss instead of profit.

When the potatoes are taken from the cellar in the spring, they should first of all be run over the rack, removing all defective tubers. Put up those to be disinfected for scab and blackleg, in two-bushel sacks. The sacks may then be lowered by blocks and tackle into kerosene or gasoline barrels. They should be completely covered with the formalin solution, made by the addition of 1 pt. of formalin to 30 gallons of water, and allowed to remain for two hours. They may then be lifted out in the same manner and spread on the potato house floor, a canvas or the grass outside, to dry. It will do no harm to soak the tubers for more than two hours. Indeed, some farmers find it a saving of time to put the tubers in soak in the morning before they go into the field, change them at noon while the horses are eating and again at night. Some of the mixture will be wasted each time but it may be used as long as it lasts.

If the seed is affected with blackleg, it is necessary to go a step farther than in the case of scab. This fungous disease does not appear to live from one season to the next in the ground but only in the tuber. It is much more serious in the South than in the North, and must be stamped out if Maine is long to continue the important seed trade which has developed with the Southern States in the last few years. Anyone who will examine a potato affected with blackleg will find, perhaps an eighth of an inch below the surface, and spreading in all directions from the point where the tuber is attached to its stem, a thin discolored layer which indicates the presence of the disease. When a potato having this appearance is cut into it should be rejected and the knife dropped into a pail of the mixture kept by the side of the cutter for that purpose. Several extra knives should also be kept on hand. Great care should be taken that disinfected seed is not stored in barrels, bins, and boxes which have contained potatoes unless they, too, have been disinfected; otherwise all the work of disinfection may be easily undone.

After the tubers have dried off they should be cut into large, blocky pieces, having at least one eye, and that as nearly in the center of the outside surface as possible. The small eye nearest the stem is weak and should be disregarded in cutting, or, if the potato is large, may be cut off and thrown away. Just as the buds nearest the end of an apple tree twig of the present year's growth are the strongest, and will grow the most rapidly, while those near the base will remain dormant, unless the ones beyond them are pruned away, in the same manner when a potato is planted whole, two or three sprouts will grow from the seed end and the others remain dormant, yet when the tuber is cut all will start and grow vigorously. Large, blocky seed works better in the planter, supplies more food for the young plants, and is less likely to be injured by dry or wet weather, fertilizer or disease.

A great many farmers use some kind of drier to take up the moisture from the cut surface and to aid it in glazing over. Sometimes, dry dust which has gathered under the rack is used for that purpose. Such a drier is liable to contain vast numbers of germs and spores causing potato diseases. Its general use cannot be too strongly condemned.

Lime is often used as a drier, but it should not be used for the following reasons: First, lime, whether air-slaked or hydrated, is more or less caustic and may injure the seed; and second, its use in the ground induces scab. It does not cause scab, but because of its "sweetening" properties, makes conditions favorable for the growth of scab and that at the very point of attack. Do not use lime; use gypsum, or land plaster. It is cheaper, more satisfactory, and has no injurious effects.

Some growers consider sulphur the most satisfactory drier yet tried. It is to a certain extent a disinfectant; a very little does the work very well indeed, and cut seed seems to keep longer and in better better condition when it has been used. The cost is higher than that of gypsum, and on a windy day, sulphur and fertilizer are rather trying on the eyes of the man who is operating the planter.

It is the custom in some places to turn the potatoes down on the grass two or three weeks before they are to be planted and allow them to sprout. The potato sunburns or turns green, and a short, stocky, green sprout is formed. This hastens the appearance of the plants above the ground and when the field is planted by hand, is quite satisfactory, but if the sprouts are too long and a planter is used, a great many are broken off and the plants come up unevenly. Cut seed should never be treated in this manner as the hot sun will soon dry out the moisture and destroy the bud. When planting by hand in the hot sun, the seed should be covered as soon as possible and even then the seed pieces may be spoiled if the soil is hot and dry. If the sun is bright and hot, it is well to cover the seed which stands in barrels in the field waiting to be planted.

Men differ as to how long cut seed should be kept before planting; some would plant it as soon as cut while others would keep it for perhaps a week. The best time would seem to be after three or four days or as soon as the cut surface had dried. Seed planted while wet is more likely to be burned by any fertilizer with which it may come in contact, or to have its moisture absorbed by the dry earth in time of drought; while that kept for a long time may heat and decay.

Cut seed may best be kept if spread about six inches deep on the bottom of a cool, dry cellar. If it is necessary, on account of wet weather or other causes, that it should be kept for any length of time, it should be shovelled over every few days. If the seed is stored in barrels it should be kept in a cool, dry place and turned from one barrel to another every day to permit the air to circulate and prevent heating. It is a very dangerous practice to store cut seed in sacks, especially fertilizer sacks which have not been thoroughly cleansed, since any high grade fertilizer will injure the seed with which it comes in contact. Piling one sack upon another is also dangerous. Should seed heat or show signs of decay, no one should hesitate to reject the lot and buy new stock.

It will usually be found very satisfactory to plant the rows thirty-two inches apart and the seed ten or twelve inches apart in the row. As to depth no fixed rule can be stated, but the grower must be guided by his own judgment, always bearing certain facts in mind. In order that it may sprout, the seed must have air, moisture and heat. In any well prepared seed bed, it can easily obtain air, but it may be covered too deeply to secure heat, or too lightly to obtain moisture. Usually potatoes planted early in the spring should be covered lightly as it is still cold except on the surface; later they should be covered more deeply since the soil is warmer and the surface is likely to dry out. In a wet season they should be covered more lightly than when it is very dry; and seed planted on heavy clay or clay loam should be covered more lightly than that planted on light or sandy loam. Generally speaking, it would be better to cover too lightly than too deeply since in a hot, dry time, more earth could easily be added, while if the weather continued wet for several days, it might be difficult to remove any earth from the top of the row, with either weeder or drag. And in using the ridge method of cultivation or in controlling witch grass, drags and weeders should be kept strictly off the field.

As a final caution, utmost care should be taken that the seed does not come in contact with fertilizer in the drill. Any high grade fertilizer may injure the seed. It should be thoroughly mixed with the earth, either before or after the seed is dropped. Perhaps more people fail to get a good stand for this reason than for any other. As an extra precaution against fertilizer injury, many leading growers are either sowing part of their fertilizer broadcast or putting it on top at the time of the first cultivation.

So much for care; now for improvement. How shall the busy grower improve his seed at slight expense? This question may be answered by the Yankee method of asking another,—What does the farmer need in the way of improved seed? Let us see. Two classes of people are interested in the potato industry—the producer and the consumer. It is an axiom of trade that to be successful in business, one must supply the consumer with what he wants, when he wants it, and as he wants it The first thing then, is to discover what the consumer demands.

The market, today, calls for a white potato; the day of the red or dark varieties is past, except in the southern seed trade. The tuber should be of medium size, weighing from five to seven ounces; smooth, shallow-eyed, that as little as possible may be wasted by peeling, oval-oblong, of good quality, mature, and free from frost, bruises and disease.

There are also certain qualifications which the producer desires in the variety which he is to plant. It should be vigorous and productive, yielding a large number of medium sized tubers in each hill, for it is upon the yield that his success depends. It should be of upright growth, for tops of that type are easier to work among, less likely to be injured by the sprayer and less likely to blight. It should be tough skinned, not peeling or scarring easily, even though dug while green. It should be disease resistant and on this point varieties differ widely, and it should be early, medium, or late, according to local, market or climatic conditions.

Bearing these requirements of both consumer and producer in mind, the first step is to choose the variety. The grower may be well pleased with what he has already or he may need to try out several varieties before he finds one which is satisfactory. The variety having been chosen the next step is to secure the very best seed obtainable of that variety. Here, again, the grower may be able to supply his own needs or may find it necessary to purchase seed from his neighbors or to secure it at a distance.

Given the variety and the seed, there are at least five methods of seed selection, one or more of which, every grower, good, bad, or indifferent, must follow. These are:

1. Selection at random from the bin.
2. The use of culls.
3. Selection of ideal tubers from the bin.
4. Hill selection.
5. Plant breeding.

By the first method the potatoes are used for seed just as they are shoveled up from the bin, large and small together, with only the rotten and perhaps the scabby tubers removed. It would seem at first thought that under this method the crop would be neither better nor worse than that of the previous year, but as a matter of fact, the stock would in a few years become less vigorous and prolific.

The custom of marketing all the potatoes that can be sold, and planting the remaining culls is all too prevalent and cannot be too strongly condemned. It is true that there are many growers who loudly boast that they have used nothing but culls for a great many years and are now growing larger crops than ever before. It is also true that in almost every instance of this kind, one of two things will be discovered; either the man's methods of culture have improved more than enough to offset the using of poor seed, or every year or two he buys new stock from a neighbor who plants large seed and is taking some pains in the matter of seed selection. Like tends to beget like; whatsoever a man planteth, that shall he also dig, and Nature is no more to be cheated in this way than in any other.

A great many good farmers select their seed in the cellar when the crop is being racked for market, choosing only ideal, smooth, medium-sized tubers for planting. This method is good as far as it goes and to that extent is to be commended. It has, however, its weak points which a simple illustration will bring out.

Two hills of potatoes are growing side by side in the field: one is strong and thrifty, backed by a long line of vigorous ancestry; the other is weak and spindling, and for several generations its parents have been the same. Each hill produces eight tubers; but the good hill contains six shippers and two culls, while the poor hill contains two shippers and six culls. The field is harvested and the two hills are turned into the bin together. Of course, if only culls are planted, three-fourths of the seed will come from the weaker hill; while if large seed is planted, three-fourths will come from the more vigorous hill. But in the latter case, two potatoes from the weaker hill will be planted, and no method of bin selection will be able to keep them out or to tell the ancestry of a single tuber even for a single season. The law of inheritance is just as strong in the potato as in the dairy cow, and to the seed man, is of vital importance. There are too many chances of soil, weather, and market conditions which must be taken in the potato business to permit taking any chances by planting inferior seed.

The above objection also holds true of seed selected at digging time from the row when the potatoes have been dug by a machine.

Doubtless the best method of seed improvement for the busy farmer who lacks time and patience, is that of hill selection. This method requires but little time and, with care and forethought, gives excellent results.

The first thing needful is that the farmer shall establish in his own mind the ideal toward which his efforts are to be aimed. This he must do for himself, no one can do it for him. Suppose he decides to select for seed only those hills which contain six or more tubers which measure up to his ideal, and none which are undersized, overgrown, misshapen, or in any way diseased. Then, from the best section of his field, he digs each hill separately by hand, carefully choosing only those hills which come up to his ideal. In this way, he will secure seed enough to plant, say an acre, the coming season. The acre plot will furnish enough superior seed to plant the whole crop the second year, and from it the hills approaching the ideal should again be selected. The results of hill selection are cumulative, and improvement can be continued indefinitely until the maximum producing power of the variety is reached and maintained.

That hill selection is practical and that it brings results, is proven by the statement of Mr. L. G. Dodge, of the Bureau of Farm Management, United States Department of Agriculture, who says, in reporting the results from the selection of high yielding hills in southern Michigan: "Hills yielding six or more marketable potatoes were saved for planting purposes. The first year, sixteen out of one hundred hills met the requirements. This was continued through two, three and four years. The fifth year, seventy out of one hundred hills reached the required standard." The statement of Mr. Dodge is verified by the experience of practical growers in all parts of the country.

The most scientific method of seed selection and the one which promises the most far reaching results is that of plant breeding. Here, however, time, patience and skill are necessary and we are invading the realm of the trained man of science. The average farmer, because of the pressure of work at planting time and the harvest, will find it difficult to follow up to a definite conclusion any work of this sort.

To recapitulate,—exercise care in digging, handling and storing; keep the cellar at a temperature of from 33 to 34 degrees F.; disinfect for scab, blackleg and other diseases; cut into large, blocky pieces; use gypsum or sulphur as a drier; store cut seed in a dark, cool, dry place, taking special care that it does not heat, and plant as soon as it is dry; use judgment as to depth of covering, and do not allow fertilizer to come in contact with the seed. Study the needs of both market and grower and choose varieties accordingly; secure the best seed possible and improve it by hill selection, planting a special seed plot each year. Be thorough in the work, paying special attention to detail, and *keep it up!*

Ques. Please give the amount of formalin you use for seed potatoes.

Ans. One pint of formalin to 30 gallons of water.

Ques. How about the weeder in ridge cultivation.

Ans. If you use it you are likely to break off sprouts. But if you have witch grass on your piece put the weeder on and go cross ways. It is almost impossible to see the rows and you cannot bury them. If you use a weeder you have lost three weeks of the best portion of the season to kill witch grass.

About how heavy should a piece of seed be? In how many pieces would you cut a potato weighing four ounces?

Ans. From my recollection of the size of such a potato I should say, cut it into four pieces.

Question. How long should potatoes be soaked in formalin?

Ans. By soaking in formalin for two hours or more you will be able to kill all the spores on the outside of the potato. If there is anything on the inside it is very necessary that you reject the tubers. If on cutting into them you find a dark, discolored appearance you should not use them, and should discard your knife. You might get a little blackleg, and I doubt if you could get rid of it the first year.

Mr. Lowell. I could not agree with you on the use of the weeder. I use a Robbins planter and that will make a ridge but before the potatoes spread enough so that there will be danger of breaking off, I go over the piece with a weeder. Then as soon as I can follow the row I use the cultivator and when they get up anywhere from one to two inches—and if there is much witch grass I would not wait until they are two inches high—I cover them. In many cases I would cultivate before I used the weeder, then use the weeder and level it off. Then when the potatoes show, cultivate them. I had a piece of ground on the side of a garden patch that was full of the toughest kind of witch grass, but by covering the potatoes twice and doing less than a day's hand work with the hoe on an acre I disposed of of that witch grass so that it did not trouble very much in the corn the next year. I think the weeder was of some benefit because it leveled the land down where the potatoes were, and when I covered the potatoes the grass that came up was covered deeper than if I had had a ridge there. The Robbins planter makes something of a ridge wherever it is used. We generally put our potatoes about two inches below the level of the ground.

Mr. Day. I think possibly that is a problem for us to decide individually. For my part, I would not want the weeder. While there is a ridge after the potatoes are planted, I would plan on having a small ridge at first and then keep adding a little more earth instead of taking any off. This simply brings out one point,—that we cannot lay down any hard and fast rules in growing potatoes.

Ques. How high a hill would you have when you got through cultivating?

Ans. The last time I hilled up I should want a good-sized hill; I would rather have it too large than too small.

Ques. After you have hilled them up several times with the horse hoe isn't there danger of getting so much dirt on top of them that when you come to run the potato digger there is too much dirt on the potatoes and they fall down into the groove and it bothers in picking them up and keeping them clear?

Ans. You might possibly find trouble that way; but the trouble there would be due as much to the spade not being clean. If the spade is not absolutely clean it will push them out.

Ques. Is it possible to use the horse hoe all the time, not using anything else? The last time we go through the potatoes is it best to leave it as the horse hoe would leave it?

Ans. Yes, I think so.

Mr. Lowell. When you go through with the horse hoe doesn't it leave a hard surface?

Ans. It depends on how the horse hoe is set. It certainly is necessary not to allow a place to be baked down hard and smooth and lie without any dirt on it; but you can prevent this by filling the horse hoe so full that it will overflow or by using a tooth of some kind to stir up the ground after the horse hoe has passed over it.

Ques. What do you use for a harrow?

Ans. I use a disk first and then level off with a spring tooth.

VALUE OF SEED IMPROVEMENT IN MAINE.

By H. S. OSLER, Orono.

There have been great changes in the characteristics of many of the grains and grasses, since their native forms were first observed by man. With the exception of the expert botanist, very few people would be able to recognize any relation whatever between the wild progenitors and the present forms. Almost all of our present numerous varieties of wheat, oats and barley have been introduced from the Old World, chiefly from Europe and Asia, while the sorghums and rices have come from the warmer portions of the Eastern Hemisphere. All of the important standard varieties of forage plants have also been introduced. The potato, maize, and a few other plants recognize the Western Hemisphere as their native home.

In many of the ancient writings, mention is made of the various farm crops, although at that time the knowledge of their growth and culture was largely empirical or was due to casual observation. It was not until many centuries later that science was able to partially expose the mysteries of plant propagation, the phenomena of plant growth, and the advisability of definite and systematic methods of culture.

For many long centuries man has been engaged in the improvement of the different farm crops, in as far as knowledge of the underlying principles would permit.

Darwin states that careful selection of seed was recommended by the Roman writers on agricultural subjects, nearly two thousand years ago. Some of these crops have been cultivated from the remotest antiquity and no doubt the principles of selection have been practiced from the first, and no doubt the limit of perfection so far as selection has been concerned, has long since been reached. It is not strange, therefore, that some of the crops of the present day do not appear any finer than those of ancient Egypt, raised three thousand years ago, although it is possible to find varieties that now produce grains of an improved quality.

While this improvement has, to a certain extent, been progressive, too often the question of crop improvement has been given second place, in comparison with the improvement of live stock. This is too common a fault not only in Maine, but in every section of the country.

It has only been within recent years that we have noted the organization of coöperative seed improvement associations, similar to this one, throughout the country.

The animal breeder has maintained his herd book for many generations, and the term pedigreed stock is quite a common one, but it is only within recent years that the term "pedigree" has been associated with improved seed. There is perhaps no question which so much concerns the present and future of agriculture and which has had so much to do with bringing it up to its present high state of development as that of improved crops, especially along the line of seed selection and improvement. Closely associated with crop improvement, in its relation to the new agriculture, is the development of the live stock industry. Well filled bins of nutritious grains and mows of palatable hay are as essential as long lines of blue-blooded ancestors in producing animals of the highest quality.

The subject of crop improvement is of vital importance to every one engaged in the profession of farming. No one can escape its significance. It falls with equal emphasis upon the eastern and the western producer. While we have been somewhat slow in recognizing its great importance to the industry of agriculture, it is fast coming into its own, and it is to the vision and initiative of such men as those who were the organizers of such associations as this, and others of a similar nature throughout the country, that the new agriculture will be profoundly indebted.

With the present limitations of land areas, in the United States, the day of the migratory soil robbers is fast passing. This, together with the fact that the population is increasing at a more rapid rate than the increase of farm produce, forces the final stages of agricultural development upon us, namely,—the necessity of an increased yield and an improved quality of our farm crops. To this call, Maine must respond, if she intends to maintain her place in the rank of her sister states.

While there is a great possibility of crop improvement in Maine, statistics show that Maine has a record of which she should not be ashamed. Compared with other states, her yields per acre of the various crops for the year's report for 1912 show:

16,000	acres of	corn,	with a yield of	40 bu.	per A., ranking 8th place.
3,000	" "	wheat,	" " " "	23.5 "	" " 8th "
133,000	" "	oats,	" " " "	34.6 "	" " 23d "
105,000	" "	barley,	" " " "	26.2 "	" " 13th "
14,000	" "	buckwheat,	" " " "	29.4 "	" " 3d "
117,000	" "	potatoes,	" " " "	198 "	" " 1st "
1,231,000	" "	hay,	" " " "	1.2 tons	" " 46th "

If we assume for the present that by the use of improved seed there will be an increase in the yield and quality of the crop produced, then there will be a number of questions that will naturally present themselves for consideration.

1st. Is our local production of grain and forage crops equal to our home demands?

2d. Do economic conditions warrant the advisability of adopting improved methods?

3d. Can the present yield and quality of crop be materially improved, and what is their relation to seed improvements?

4th. The relation of seed improvement to the farmer himself.

Are the farmers of Maine satisfied with their present rank? Does not the state afford great opportunities in the development of her diversified farming, especially along the lines of live stock industry, both of beef cattle and dairying, Do we intend to remain idle and allow the shipment of milk from Canada to supply home demands, or to eat beef fattened in Texas and canned in Chicago? We are close to good markets, not only for live stock, but for all kinds of farm produce. Then, if this be true, we must bear in mind that with an increase along these lines, there must necessarily be associated an increase in the production of feeds for home consumption. Today, the state of Maine produces only sixty-seven per cent of the oats, five per cent of the wheat and twenty-six per cent of the corn that is necessary for her own use. In addition to this shortage in feed stuff, she is a heavy importer of mill feeds.

Notwithstanding the teachings and demonstrations of improved methods in management, care, and culture of the various farm crops, by the various educational institutions and agricultural press throughout the country, there has been scarcely an appreciable increase in yields per acre, during the last three or four decades. During these periods of agricultural development, the attractiveness of the fertile lands of the West, their low values, their high state of fertility, their low cost of production, the large yields of superior grades of grain, and the cheapness of transportation, all tended to attract the eastern farmer westward. But now, conditions have changed. The cost of land is rapidly increasing; the great yields have not been generally maintained. This, together with an increased population, has pushed the cost of production upward, so that it seems that the time is at hand when the eastern producer can compete with his western brethren. If there is to be a development of Maine's diversified farming, it becomes necessary then that he himself produce the various farm crops in sufficient quantities, in so far, at least, as stock feed is concerned.

The average annual market value of corn, wheat, oats, barley, buckwheat, potatoes, and hay, produced in the state of Maine, is estimated at about thirty-six millions of dollars. Any improvement, therefore, that can be made in the choice of varieties, by selection of seed, in the methods of cultivation, etc., which would increase the value of these crops ten per cent per annum, would thereby increase the total value of these crops nearly four million dollars for the state. This, divided among the sixty thousand farmers of the state, would increase the revenue of each about sixty-seven dollars. This would be considered a very conservative estimate, as in many cases the value would probably be increased twice this amount.

All this increase would not be the direct result of an increase per acre. It would not only raise the standard of living, but it would also, in a measure, relieve the labor situation. Smaller areas would be made to produce larger yields and a greater profit. The producer would be induced to increase his acreage, and thereby lessen the amount of hand labor by the introduction of improved machinery. With this would naturally be an increased wage, and this would be an extra inducement to labor on the farms.

Can the present yield and quality of the crop be increased? It is perfectly evident to any one who is interested in crop production that there is a wide variation in the yields of the different varieties of grain, or even in the same variety, under different conditions of care and culture. In determining the yields, there must be a consideration of the season, soils, manures, fertilizer, cultivation, and the quality of the seed.

Next to soil and climate, good seed is the most necessary factor to successful crop improvement and successful agriculture. A soil deficient in any of the plant foods may have them supplied in manures and fertilizers. It may have its physical properties so improved as to allow the maximum crop to be raised. An unfavorable climate may have its ill effect mitigated to a great extent by location, drainage, etc. But unless the farmer plants seeds of a good germinating quality and true to name, his efforts will end in failure and disappointment, so far as gaining a livelihood from his occupation is concerned, to say nothing of his chance for profit.

It should be the desire of every farmer to plant good seed, so far as the common judgment can determine by external appearance. The best seeds are those which are large, plump, and heavy, which look bright, and which do not have a musty odor, nor a dry, brittle feeling when stirred with the hand.

Such seeds are likely to be fresh and to germinate promptly. Seeds of cereals will have an additional value if it is definitely known that they are free from spores which cause smuts. Any grower may follow these few suggestions in selecting his seed, and not only improve the yield of his crop but the quality as well. The operation of a properly adjusted fanning mill, a home-made germinator, and the exercise of a little judgment are all that is necessary.

Of course, there are other qualities which are of greater importance in determining plant values than those shown by the external appearance of the seed, such as those involved in heredity and which cannot always be determined by the outward appearance of the seed. Seeds are of but little value, unless they will transmit the valuable qualities of their ancestry to their progeny. This is not always an easy matter to determine, as much depends upon whether valuable qualities of the plants from which the seeds are reared have been fixed or established by one or more years of selection. Unless seed used by farmers was harvested from plants which have grown from carefully selected seed, the chances are that the crop, even if it is adapted to soil and climatic conditions, will not maintain its yields and qualities as it should. If we are to judge by the general complaint of "poor stand," "mixed crop" and "not turning out well,"—we must conclude that there is a general lack of information on the subject.

The chief value of selection, in ordinary farm crops at the present time, is to maintain the high standard reached. The urgent cry of the soil is for the best and we have the evidence of the past to prove that we shall receive the best if we sow the most perfect seed obtainable. Probably very few farmers would care to go to the trouble of crossing and developing new varieties, even if they had the time. That phase of the improvement work naturally belongs to the expert plant breeders. And it is largely to such institutions as the State Experiment Station that we must look for the distribution of pure bred seed, whose desirable characteristics have been fixed.

Having been supplied with an improved variety of seed, it is then essential that its standard be preserved, by careful grading and selection from year to year. This is the work of the members of such organizations as this one and many others of a similar nature, throughout the land. Each member pledges his support to maintain seed of a high standard and promote its distribution as far as it is possible for him to do so. By the distribution of good seed, the quality of the crop will be improved. It is not necessary to tire you with figures, to prove these statements. All I wish to do is to call your attention to the fact that where these practical methods of operation have been used for a period of several years, there has not only been a marked increase in the yield, but also a decided improvement in the quality as well. At first, this improved quality may not bring a higher price, but it may create a demand for products of a better quality, and these will move more rapidly and more easily, and buyers will be willing to pay a premium for them.

While it is essential that new varieties of seed be developed and maintained, it is just as essential that attention be given to the control of some of the undesirable forms which have a tendency to decrease yields and necessitate the expenditure of time and money in their eradication. Maine has a number of very bad weeds. The growing of improved crops, the seeds of which may be used for distribution, will necessitate care, in order that they do not become contaminated by the seeds of noxious weeds. The growing of improved seeds may necessitate decided changes in the system of farming. It will be necessary to plan rotations, not only to aid in controlling the undesirable plants, but to provide the best conditions for maintaining better crops and the producing of greater yields. It will mean better farming.

You will admit that good seed, alone, will not do it all. We have good soil and poor soil. We have rocky places and we have waste places, in Maine. There are many ways of injuring seeds. There are few ways of improving them. Hence, you may select, you may breed, you may clean, you may hand-pick, you may do a multitude of other things and get a sample of seeds, to which nothing could be superior. You might take that extra fine seed and sow it on an average soil and reap a very inferior crop, if that soil has not been properly prepared, has not been made into the right shape for the production of a good crop. The work of this association, the work of any member, can easily be wasted, if that member is not careful to insure such physical conditions in both surface soil and subsoil of his field as will insure the largest production of seed, uniform as to quality and maturity.

The aims of the seed growers are, first, to get large crops. Unless we help increase grain crops, we have no reason for continuing our existence as an organization. Of course it is true that the improvement of quality is important, but the increasing of the returns is the primary consideration. Second, to improve quality. Along with increased returns, we want grain of good quality, uniformly plump grains. Third, uniformity in ripening date. Fourth, freedom from weeds, already mentioned. Fifth, uniform filling of heads. Sixth, early maturity.

All these factors are more or less influenced by the character and preparation of the seed bed. Lastly, we should not forget that this interest in good seed will not only leave a larger and better crop, but will leave the farmer himself a more intelligent and more capable man. For the skilful, intelligent and industrious farmer, prospects were never brighter than they are at present. Land values are increasing and are bound to increase, for the land is the basis of all prosperity. We have one-fourth of the population of the United States within our reach. We have the best markets of the world, because they have the largest purchasing power of any markets of the world; because the purchase price of plant food for growth of a carload of corn or other farm product is less than the transportation cost of a similar carload of products from the West.

The farmer is the citizen who carries on the work directly on the land. Farming is not a sordid occupation; it is not a coarsening one. Men in business take on the quality of their partners, and especially the predominant partners' attributes which find expression through all their minor partners. Perhaps that is why, as you think back and think out, the qualities of reliability, dependability, and conscience are a natural native asset of the New England folk, born and bred in the country. It is true that others have these qualities, but the rural population is the great mother source of them, among the civilized races today.

Farming has this big object before it,—the improvement of crops and through that, the improvement of man. This labor on land is really the culture of the race and not merely the culture of the field. To Maine, comes the challenge of the New Agriculture, "Better Farming," "Better Farms," and "Better Farmers."

ESSAYS

BY STUDENTS IN AGRICULTURAL COURSE IN SECONDARY SCHOOLS, IN COMPETITION FOR PRIZES OFFERED BY MAINE DAIRYMEN'S ASSOCIATION.

WHAT IS GAINED BY WEIGHING AND TESTING YOUR MILK.

By Earl Smith, Bucksport.

(Prize Essay.)

In colonial times and extending up to within one or two generations of the present time, the cow was given but little care. Generally, the cow freshened in the spring, as was the case in her original wild state, gave milk during the summer while there was an abundance of green food, then as soon as the food became poorer her yield would begin to drop off until by mid-winter, few, if any, would give enough to pay for the milking. It cost but little to keep the cow through the summer and the returns from her milk in the form of butter or cheese would generally pay for her feed during the winter. For this reason dairying became simply a side issue, varying in importance according to the location.

Times have changed. Men are now in the business for the returns they can get from it as a specialty. The cow has been bred toward this end until she is a machine for the production of milk from the feed which is given her. All else seems to have been lost sight of in the effort to get the maximum production of the thing which at first thought is the only chance of income. So great has been the change in this direction that in some cases (and their number is on the increase) the cow's usefulness is limited to not more than five or six years. The stamina of the animal has been impaired by forced feeding on the heavy, richer grains. Men who work day in and day out feeding cattle the year through are apt to forget that they are not pushing a bundle of corn through the ensilage cutter or turning grain into the hopper at the grist mill. Care must be taken of the organic machine, as well as of the metallic machine, if they are to serve the purpose for which they were intended. In dairying, we must work for the greatest production, at the smallest cost, for the longest time, and to do this I feel sure that we must weigh and test our milk as it is produced.

Weighing and testing of milk is by no means a new practice. In fact it has been carried on for several years in many different herds all over the country. In other countries it has been in process of development and especially in Denmark where the first association was formed to carry on this work. It helped advance the dairy interests of that country to the present status of the industry and is at the present time working great benefits to the dairyman. Here in America, Michigan has led in the forming of associations through which the testing has been done economically. Other states have followed and our own state is not far behind the others. Even before the testing associations were formed, some men saw the possibilities of the knowledge gained by weighing and testing the milk from their herd, and carrying out the principle thus founded, they have raised the standards of production in their locality and opened the way for the wider operations which have followed.

It has been said that the farmer is the poorest business manager of any who have such a large capital invested. Truly, the farm is the only factory which will allow of such wastes as are practiced in many places and keep out of the hands of the receiver. It is not true that the farmer does not have business ability, for the average farmer has greater ability to manage a business than the average city man. Give the farmer the chance to study the markets and their requirements, which he must meet, and he will out-distance the city man every time. Business must have method and in the testing and weighing of milk we are using one of the methods which will help us to know our exact income and expense. Truly it has been said that the farm is the hardest place in which to keep accounts. The variety of work which is done, together with the irregularity with which much of the work has to be done, makes it increasingly difficult to keep account of the receipts and expenditures. The record obtained by the above method, together with a record of the feed and labor expended, makes this work very simple in the dairy. It lends an interest to the work to take down the book and follow the column showing just what each cow has given you in the past month or year. It is also very profitable as the following statement will show.

In the first place, there is knowledge gained in respect to the individuals of the herd. One cow may look just as strong, just as well built for milk or cream production, as another. We may have some idea of what she produces by the looks of the pail at milking time, but that is a very vague idea when compared with the knowledge which we have at the end of the month's test, when we know the exact amount of cash which she has given us in that time. It is clear cash that counts and what we are looking for, not pleasure, although that may come in the long run. We do not want to keep a cow that is running us in debt, or just paying her keep, when we can have one that will pay a handsome profit.

That "Many cows are poor cows today, who were good cows born," is altogether too true. Feeders of live stock do not realize what their responsibility is. Many times a cow is fed a ration which is far in excess of her needs, or capacity to assimilate and change into milk. It is all too well-known what effect heavy eating has upon the human family. It taxes the system above its strength and the first thing we know, the weakest organ gives way and there must be a rest or the whole system will go to pieces. It is said that "Curiosity is the mother of all knowledge," and we know that "Knowledge is power." Thus, any knowledge which we may obtain in regard to the needs of the dairy cow gives us power to meet those needs. Without the knowledge of production, it is very difficult to feed scientifically. Without a knowledge, to some exent, of the amount of energy consumed in keeping up life and warmth and in producing whatever product we may be seeking, it is impossible to supply that need. One other thing in regard to feeding, we can compare the various feeds in relation to production. If the silage has run short and we have to return to the feeding of hay or root crops, we at once see the loss which we are undergoing from the lack of the higher grade of food. Many farmers have built silos and used them a few years, but failing to see the benefit of that feed, have abandoned them, whereas, if they could have seen the exact gain which they obtained by their use, they would have continued the use of the same. The same thing is true in regard to other feeds, such as mixed grains. If one kind gave better results than the others, it would be used to such an extent that the dealers would keep it in stock at all times and thus we could avoid a change in feed.

The dairy cow is likened to a steam engine or loom, which, when in perfect order, does the work which it is expected to do in the most economical way. When the machine is out of order, it is being operated at a loss. Thus it is with the cow. If she is a little off her feed, as we say, the milk yield will drop from the standard and unless it is noted and the trouble treated, it may cause a great loss in the total products for the year, if not the loss of the cow, as is sometimes the case. By taking the trouble in hand, when it is small, we save time and money. A nut loose on the locomotive may seem a small thing, but when the train is wrecked and the lives of the passengers lost, it is looked upon in a different light. Thus, the careful account of the cow's production gives us an index to her health as well as to our profits.

I have tried to show the various benefits which are to be obtained by testing the product of your dairy herd, both for quantity and quality. We can see that it is essential to know what is produced on our farms and if they are being carried on at a loss, we want to know where the loss is being made. The day is coming when there will be a systematic method of accounting worked out which will fill a need that is deeply felt today. The farmer of today is showing a much greater confidence in the agricultural department and colleges than at any time before and with the help of the secondary schools we hope that the farmer of tomorrow will exceed even the brightest hopes of today. All that educates will bring us toward this end and the advance of rural good.

THE PROBLEM OF CLEAN MILK.

HERBERT L. SEEKINS.

(Prize Essay.)

The problem of producing clean milk is one which every dairyman must solve in order to be successful. Milk in some form is used by practically everyone, and in a pure condition forms a most nutritious and wholesome article of food. But, on the other hand, if it is allowed to become contaminated it may be a menace to the health of the consumer.

Wholesome milk can be obtained only from healthy cows. If the cow is diseased the milk is liable to be infected with the germs of the disease. Of the diseases affecting dairy cows tuberculosis is probably the most common and all cows should be tested for this at least once a year. If any animals are found to be affected they should be removed from the herd at once and their milk should not be used.

The milk from animals in a run down condition may be unfit for use. When animals are not in good physical condition the functions of the body are not always normal and the poisons secreted by the body may not be properly taken care of and may find their way into the milk. The milk from a cow thirty days before and five days after calving should not be used for food.

Milk contains a large number of germs, called bacteria. Some of these are already in the milk when it is drawn from the cow but the larger part enter during or after milking. They produce a variety of effects. Some of the effects caused by bacteria besides disease are the souring of the milk, slimy milk, bitter milk, etc. In order to keep the bacteria out of the milk we must maintain clean conditions.

The stable should be so constructed as to have as smooth a surface as possible, that it may easily be kept clean. The ceiling should be tight to prevent the dust from sifting down on the cows. The stalls should be made according to the size of the animal and iron piping makes a good partition between the stalls. Swing stanchions are the most satisfactory for they give the cows enough movement for comfort and prevent them from stepping too far backward or forward. A cement floor is the easiest to keep clean.

The stable should be well lighted as darkness is the natural breeding place of germs of disease. One window three feet square for every two cows will furnish necessary light for a stable. To be effective they must be kept clean.

The manure should be removed from the stable at least twice a day and this before milking time. A good supply of bedding helps to keep the animal clean. Straw, sawdust or shavings are good materials for this.

If one expects to maintain a healthy herd of cattle he must supply them with plenty of fresh air. The King system of ventilation provides for a continuous change of air without exposing the cows to severe drafts.

Feeds that do not interfere with the health of the animals and do not injure the flavor of the milk are safe to be fed to the dairy cow if they are fed wisely. Feeds such as rape, mouldy hay, sour silage and sour beet pulp cause strong odors in the barn and give milk a bad flavor. Such feeds should be fed after milking. Cottonseed meal and oil meal should be fed in moderate quantities because overfeeding of nitrogenous concentrates interferes with the physical condition of the cow.

The dairy cow needs a good supply of pure water, as impure water interferes with her health and therefore may injure the quality of the milk.

The cows *must* be kept *clean*. If one does not keep his cows clean he cannot expect to produce clean milk. The cows ought to be carded and brushed every day as a great source of contamination is found in the hair and dirt which fall from the cows' flanks. The udders and flanks of the cows should be wiped off carefully with a damp cloth just before milking. The milker should wash his hands before milking and draw the milk with dry hands. The cows should not be milked as soon as they enter the stable and hay or bedding must not be used immediately before or during the milking on account of the dust which contains a large number of germs.

The milk should be drawn in a pail that has a small opening at the top as this will prevent some of the dirt from falling into it. Some milk pails are equipped with strainers, but they are not desirable because the streams of milk will pound to pieces and dissolve any particles of dirt that happen to fall upon the strainer and then carry them through the strainer into the milk.

The milk must not be strained in the barn. As soon as the milk is drawn from the cow it should be removed from the barn to a house reserved for the handling of milk. If a cloth strainer is used it must be thoroughly rinsed with cold water and then boiled at least twenty minutes after each time it is used. The milk room should have plenty of light and ventilation. In addition to the ordinary dairy utensils there should be a small vat or tank of cold water into which cans of milk or cream may be placed to cool them. A table or shelving of convenient height for the tinware may be easily provided.

The utensils that have been in contact with the milk should first be washed with lukewarm water. This removes the casein, which might be cooked on if plunged into hot water. For tinware the addition of alkaline powder is desirable. Brushes are preferred to a cloth because they get into the corners and are much easier to keep clean. After being washed the utensils should be rinsed with clean water and then scalded with boiling water or steam, if available. Allow them to dry without wiping as the use of a towel adds many thousands of germs to the surface of the utensils. Then let them drain and dry in a clean room, or on a rack outdoors where they are not exposed to dust or dirt.

If one expects the milk to reach the consumer in its normal condition, he should cool it as quickly as possible after it is drawn in order to prevent the growth of the bacteria in it. Milk that is cooled to fifty degrees will keep a reasonable length of time. If the milk is peddled from a wagon it is best to bottle it on the farm. The bottles of milk should be placed in iced water until they leave the farm. If ice is available the bottles are best packed in crushed ice in boxes holding from twelve to twenty-four bottles. A clean covered wagon for peddling milk is desirable. For long distances milk should be shipped in refrigerator cars and all cans filled with milk should be sealed and remain sealed until they reach the dealer.

To summarize the conditions necessary for the production of clean milk: Be sure that the cows are healthy to begin with and make their surroundings such that they will remain so. Feed only clean, fresh foods that will not affect the health of the animal or the flavor of the milk. Prevent the entrance of bacteria into the milk as far as possible by keeping the cows and their surroundings perfectly clean and sanitary. Cool the milk quickly to prevent the development of bacteria which have gotten into the milk in spite of the precautions taken.

MY IDEA OF PROFITABLE DAIRYING.

By EARL CLEMENT, Good Will High School, Hinckley.

(Prize Essay.)

Profitable dairying depends upon the man, the cow, the farm. To be a successful dairyman one must first of all be a good business man; he must be a good general, able to command without friction; he must love a cow and know a good one when he sees her.

The cow must be bred for dairy purposes; she must be a glutton for food and have the ability to place the greatest good from it in her udder instead of on her back. She must not only be a good producer of milk, but she must have the power to transmit her own good qualities to her offspring.

The farm should be located near a good market; its soil should not be too heavy and it will always be found more profitable to buy a run down farm than one that is in a high state of cultivation; on account of the price this will usually hold true because then the dairyman will have a good market for his manures and he can plan the buildings to suit himself.

MANAGEMENT.

The Cow. The cow should be pure bred because she not only will be more apt to be a good producer, but her offspring will be so much more valuable. She should belong to one of the four dairy breeds. The breed selected will depend first upon the fancy of the dairyman, for no man can succeed with an animal that he does not like. The breed selected will also depend upon the line of dairying to be followed; if market milk is to be produced, then the cow that will produce milk that will pass the inspector and be produced at the least possible cost, should be the first to be considered. She will probably be the Holstein or the Ayrshire. If cream or butter is the object, then the St. Louis World's Fair test would indicate that the Jersey or Guernsey should have the preference.

The Stable. The stable should be so located as to save as many steps as possible and yet not be a fire menace to the home. It should be so constructed as to be easily kept in a sanitary condition. It should be treated as a kitchen, for such it really is, and not be constructed over a manure cellar. It should have concrete floors throughout; tight gutters to save the liquids which contain from 60% to 65% of the fertility value of the droppings of the animal; a continuous manger, low down and easily kept clean. It must be kept well ventilated and this can be accomplished by a simple piece of thin cloth stretched over an opening in the outside of the stable, preferably the south side. About two square feet per cow of cotton cloth, one grade better than cheese cloth, has proven satisfactory in countries much colder than central Maine. The King system of ventilation is very efficient when properly adapted. Experiments have shown that the dairyman can afford to increase the light in his stable up to four square feet of glass per stall. The tie is a matter of individual taste. In large dairy districts the swinging stanchion is almost universally used and gives perfect satisfaction when fastened with a chain at each end, and has a good fastening device.

The Dairy. The dairy should be conveniently located, away from all sources of contamination; there should be a separate room for the care of the milk and one for the washing of the utensils. The building should be made of concrete; it should be supplied with pure, running water and have a good drainage system. A small steam boiler should furnish hot water for washing, steam for sterilizing and heat for the building and it is important that this boiler be as far away from the milk room as possible, in this arrangement.

Feeding. Most dairymen are paying too much of their profit to the feed dealer. With a good silo, well filled with eared corn; plenty of clover hay and, better still, alfalfa hay, and some soiling crops to supplement the pastures in the hot months, only rich concentrates need be purchased to balance up.

Why should not the dairyman grow also most of his grain feeds on his own farm? They have to be grown on some farm, and when he grows them he does not have to feed either the railroads or the middlemen. Oats and peas make an excellent dairy feed and work well in any good rotation. Some very fine crops of wheat are also grown in Maine.

Branch to be Followed. Whether we sell whole milk, make butter, sell cream or make cheese will depend much upon the market. However, a few things aside from market should be considered. The Kansas Experiment Station tells us that when we sell whole milk we are taking from our farms $6.67 per cow per year, in fertility; when we sell cheese and feed the whey it amounts to $3.32 per year; when we sell cream, $1.11 and butter, $.049. If these are facts, and there is no reason to question them, then we should carefully consider them before deciding what to do with our product. If we are to have profitable cows we will have to raise them. If the other fellow raises them he keeps them, as we do. This is becoming more and more a fact as cow testing associations become more prevalent. If we raise good calves we must have skim-milk as at least a part of their ration. At the present price of butter it would seem to hold out the greatest inducements to the dairy farmer. Whether he should have his home creamery and make up his own product will depend upon the size of his family and the hired help question. If he sells cream to a creamery and gets skim-milk back he is very apt also to bring back bovine tuberculosis with it and had much better have a cream separator and have his milk at home to feed while it is warm; this method much decreases the load to be hauled and the number of times per week that he has to go to the factory.

To summarize, then, my idea of profitable dairying, it will combine the up-to-date man who has selected the best breed for his conditions; treats the cow and not the herd as the unit; studies each cow and her needs, weighs each mess of milk, keeping a record of it, studying it carefully and feeding accordingly, the last possible pound of which food has been produced at home; selling in a retail market where possible, and one who is happy and contented with his lot.

PRESENTATION OF PRIZES.

First prize, gold watch; second, silver watch; third, fountain pen.

Dr. L. S. Merrill.

It has been a very great privilege to listen to the splendid papers prepared and read by these young men. All of us have taken pleasure in offering the inducements to bring out the best thought, the best effort, of the young men in the state who are studying agriculture in secondary schools. While these prizes will have value in themselves to these young men, when they see them they will think of this association, of the membership from which they came, and, boys, to my mind the great value of these rewards will be the result of the effort you have made to win them. You must remember that the World is full of need of straight thinking, swift acting and efficient working men. You are now getting your training, and while Earl Smith in speaking of knowledge made the comment that "Knowledge is power," we must couple with it just a little qualification. That is an old statement, but a man may have knowledge and never be able to use it, so that knowledge and the ability to use knowledge, is power. You are getting your training, and the thing you want along with that training is the ability to use the knowledge you get. In other words, it must be practical, it must be useful. You must know the why of things. You are just beginning to fasten upon your minds this fact, that agriculture is not the sort of hit-or-miss, guesswork proposition that you have sometimes thought it was; that it is built upon exact laws; that science is the tool the farmer has today, if he can apply it.

It is a very great privilege to be selected by this association to present these tokens to you and I shall do so with satisfaction knowing that they are worthily bestowed, that you have earned them. And we present them with the hope that this is just the beginning; that you will understand that these watches mark time and that time is an element that cannot be wasted too much. As young men in the fitting schools of the state, you are spending your time in the school room and you are spending it in the activities of the school which to my mind are important to any young man; for life in its beginning or at any period of time is not made up entirely of work and at the same time you must use it to fit yourself so that you may do things of real value in the world. You know when we are young we are always dreaming of the big things we are going to do; and the young man or young woman who fits himself or herself to do the big things, can and will do them.

Earl Smith, this is not the first time you have won a prize. You began by exhibiting corn, and by invariably taking away a prize, usually a first one; you followed that by taking the first prize at a judging contest. It is with very great pleasure that I present to you this token, not as a reward for what you have done here, but as a stimulus to do better. All of you ought to remember that the better fitted you are to do life's work the better you will be able to do it.

Mr. Seekins, I have not had the pleasure of knowing you very long. I know you have come from a school where they are just beginning to teach agriculture, and the fact that you have the ambition and the will and the power to present a paper that is worth this gift, ought to make you feel proud of this token that is now presented to you. I hope it will be a stimulus to the other boys coming from Somerset. Somerset county is my home and I am delighted to know that a boy from Somerset has won this prize.

Now, Earl Clement, this is just a little different sort of a prize, but I do not think it is worth less because with it you may write another essay another year that will win the first prize. I hope you will do it. I hope you will just let this serve as a token of what you can do if you fit yourself rightly for it.

FRIDAY MORNING, DECEMBER 5.

BUSINESS MEETING OF MAINE DAIRYMEN'S ASSOCIATION.

The following officers were presented by the nominating committee and elected by the association for the ensuing year: President, H. G. Beyer, Jr., Portland; vice president, H. M. Tucker, Canton; secretary, Dr. L. S. Merrill, Orono; treasurer, Rutillus Alden, Winthrop; trustee, E. E. Harris, Skowhegan; delegates to Maine Federation of Agricultural Associations, H. G. Beyer, Jr., A. C. Pope, Manchester; visiting member to the College of Agriculture, L. C. Holston; member of Experiment Station Council, R. Alden.

The committee on resolutions presented the following:

Resolved, That the committee on barns be continued as a legislative committee on barns at the State University; that this association recognizes that new barns at the University are an imperative necessity, for the proper continuation of the work of the University in agriculture; that the provision for new barns should be adequate in amount to secure not only the necessary space, but also modern, up-to-date methods of arrangement and construction, so that the resulting structure may serve as a model showing the present state of knowledge as to the best methods of barn construction and arrangement.

Resolved, That this association give its hearty support to the effort to secure aid from the Federal Government for the support of extension work in each state, under the direction of the College of Agriculture and that therefore we urge the passage by the Congress of the United States of the so-called Lever Bill, hereby reaffirming the position which the association has consistently maintained in the past.

Resolved, That we believe the joint meeting of the Maine Dairymen's Association and the Maine Seed Improvement Association has been a great success, and we favor the continuation of these union gatherings, and that we believe it would be for the best interest of the agricultural organizations of the state if as many as possible of these should unite in these winter meetings.

Resolved, That this association desires to express its hearty approval and appreciation of the county demonstration work which is being carried on under the direction of the College of Agriculture and that we would strongly urge the desirability of extending this work as rapidly as possible to other counties in the state.

Resolved, That especial commendatory mention be made by this association of the splendid exhibition of dairy machinery and supplies shown in connection with this meeting. The value of such a showing of the most up-to-date appliances for carrying on the business of dairying can hardly be over-estimated. We appreciate the efforts of the dealers in agricultural machinery and supplies to make this exhibit of real value, and express the hope that it may be profitable to them as well as to us.

We desire also to commend especially the splendid exhibit of dairy products,—milk, cream, butter and cheese, and the exhibit of seeds, in which many of our leading farmers have co-operated. We believe that these exhibits constitute one of the most important features of the meeting and that every effort should be made to extend this feature at future meetings.

Resolved, That as an association we appreciate the splendid hospitality of the city of Lewiston and the Lewiston Chamber of Commerce in the manner in which they have entertained this convention, and that we desire to express our thanks by these few words, assuring the people of Lewiston that we shall continue to express our appreciation of their hospitality after we have left the city. We look upon Lewiston as our city none the less because the majority of us live in other parts of the state. We appreciate the courtesies extended by the press, and the railroads and the individual courtesies of the people of the city.

ALBERT E. HODGES,
L. C. HOLSTON,
RAYMOND PEARL,

Committee.

On motion of Dr. L. S. Merrill, voted that the report be accepted and the recommendations adopted.

A presentation was made by Hon. John M. Deering of a gold headed cane to Benjamin Tucker, one of the veteran dairymen in the state who has been long connected with the Association. The remarks of Mr. Deering were very appropriate.

On behalf of the ladies Mrs. W. G. Hunton presented to Mrs. Tucker a beautiful cream ladle.

Voted to adjourn.

BUSINESS MEETING OF MAINE SEED IMPROVEMENT ASSOCIATION.

REPORT OF VISITING COMMITTEE TO UNIVERSITY OF MAINE.

Your committee was at Orono many times during the year, and owes much to the heads of the different departments for the courtesy extended to him on all occasions. The citizens of Maine should, as individuals, get in closer touch with the splendid work being done there for the advancement of Maine agriculture. The work in Prof. Simmons' department, in artificial drainage and in increased hay production is of much interest. I deem this branch of agriculture to be the most important factor in the future development of our state.

Another pleasing feature of the work for the past year has been in the Animal Husbandry department. Although the dairy herd is kept for demonstration and class work, it has been more than self supporting. The instruction and efforts of the College to impress on the farmers of Maine the great value of seed selection were not only the prime factors in forming this association but have made its existence possible and will control its future development. With this thought in view let us individually keep in close touch with their efforts and not be satisfied with a report once a year from any member, but keep in mind that the faculty are ready and anxious to receive visitors and recommendations; that in this way more than any other the great diversified interests of Maine can be better understood and benefited.

W. G. HUNTON.

This report was accepted.

A committee for the nomination of officers for the ensuing year was appointed by the Chair, as follows: Dr. L. S. Merrill, C. R. Leland, Dr. C. D. Woods. This committee reported the following: President, L. C. Holston, Cornish; vice president,

R. L. Copeland, Brewer; secretary, C. R. Leland, Augusta; treasurer, C. M. White, Bowdoinham; executive committee, Guy C. Porter, Houlton, R. L. Copeland, Brewer, Frank Lowell, Gardiner; H. M. Wood, Bangor; member Experiment Station Council, W. G. Hunton, Cherryfield; visiting member to College of Agriculture, C. S. McIntire, Waterford; representatives to Maine Federation of Agricultural Associations, L. C. Holston, W. G. Hunton.

Voted, that the secretary be instructed to cast one ballot for all the officers nominated.

The following report was presented by the committee on resolutions:

Resolved; That the joint meetings of the Maine Seed Improvement Association and the Maine Dairymen's Association have been a grand success, and that joint meetings of these associations and such others as may be working along similar lines would be of the greatest value to the agricultural interests of the state.

Resolved; That the Maine Seed Improvement Association endorses the county demonstration work as carried on under the direction of the College of Agriculture, and that we would strongly urge the desirability of extending this work as fast as possible to other counties in the state.

Resolved; That this association give its hearty support to the effort to secure more aid from the Federal Government for the support of extension work in the State, under the direction of the College of Agriculture and that we therefore urge the passage by Congress of the Lever Bill, for extension work, hereby reaffirming the position which the association has consistently maintained in the past.

Resolved; That the association endorse the work of the Federal Government in its study of potato diseases in the state and that the association encourage this work in every way possible.

Resolved; That the association take some action to discourage the sale of potatoes for seed which are infested with "blackleg" or other infectious potato diseases.

Resolved; That the Seed Improvement Association make a more thorough study of varieties and strains, in relation to the localities in which they are grown and their disease resistant qualities; and that the propagation of such varieties, when found, be encouraged.

Resolved; That the executive committee of the Maine Seed Improvement Association make a study of the seed market and its demands, and that plans be drawn up for producing seed which is wanted by the market, in quantities to tempt the buyer.

Resolved; That the association appreciates the efforts of the Lewiston Chamber of Commerce the citizens of Lewiston, the press, the exhibitors, and all others who have assisted in making this meeting such a success.

E. E. PHILBROOK,
H. M. WOODS,
L. C. HOLSTON,
Committee on Resolutions.

Voted, that the report be accepted and the recommendations adopted, and that a vote of thanks be extended to the committee.

C. R. Leland. In regard to the committee on constitution, it is the decision of the committee that no change should be made this year. If the association, or any of the members, desire a change, it can be agitated during this present year and the change made at the next meeting. The members should bear this in mind and be thinking whether any changes in this constitution should be made.

Mr. Porter. I am not entirely satisfied with the report of the committee. It seems to me that it is not progressive. Everything considered, it may be a wise conclusion to come to, but we must remember that we are stewards, in a way. We receive the fund from the state and we are under some obligation. We have had a period of education along these lines. This matter has been agitated in the papers and the press of the state for three or four years, and the people are waking up. Now it seems to me that we ought to make progress. I was really in hopes that some recommendations would come from this committee to govern us in our work. As a member of the executive committee I am sure I want to do what is wise and right, and put this where it would be of the greatest benefit to all. Personally I do not care for the endorsement of the association, as I have been unable to furnish all the seed I could sell. I have had to cancel orders and send back checks; but we are under obligations to the people and we need to move forward: in just what way I do not know, but it has occurred to me that this association in order to be enduring and amount to something must work into the hands of those who propose to be producers of seed. I feel very grateful to those who have instigated this movement and started it. It is a great thing for the state of Maine; but these gentlemen have about all they can attend to and it is now the duty of us farmers to see that it is carried on and perfected. Our opportunity lies along that line.

Mr. White. In relation to the resolution that was offered in regard to the adopting of plans for seed to be sold through the association, most of us realize that it is an almost impossible matter to get out a definite plan in a company of 12 or 15. It seems to me that if we should recommend to our executive committee that they take up that part of the report of our committee on resolutions at an early date and make plans to secure seed so that at our next meeting we will be in a position to offer this seed to our members, it would be a good thing. That seems to me a proper way to get at some definite plan to make this a great success so that it will be on a large enough scale for the members to reap some benefit from it. It would have to be discussed by a smaller body than we have here.

I move that the executive committee go ahead and not only plan but take some means of executing it, during the year.

F. S. Adams. I want to say that we have formulated some plans which I wish to present to this association. During this last year Mr. Leland and myself, with the assistance of Mr. Mitchell of Freedom Academy, have inspected 50 or 60 farms. We took the farms where we knew the men were pretty good seed growers. We had in mind not so much to help the men who are raising seeds, for as a rule those men are able to take care of themselves, but we wanted to help the great majority of farmers who want to buy seed. We found out in our investigations that the potato situation was better taken care of than any other one of the seed propositions. We found quite a few farmers doing good work raising seed potatoes; but when we came to the grains, we did not find so good conditions. We did not find so many men who were making a specialty of raising grains for seed. Mr. Copeland is raising seed oats, but very few others are doing anything in this line. In inspecting these farms we had in view finding out what the men were doing. For instance, if they had been raising one kind of seed for a number of years, what the average yield had been for those years, and also if the seed was absolutely clean from foreign seeds. We found quite a few farms where the farmers had been raising a certain kind of oats for four or five years and were raising some good seed which was absolutely clean of weeds, and we found other farms where this was not so. What we had in mind was getting out a catalogue this coming winter, putting in a list of those farmers who are raising seed that we know to be absolutely clean, from personal inspection. We have been sending out circulars for returns, and have a statement from the men who have been growing these seeds, as to how long they have been raising them, and what the average yield has been for five years if they have been raising them for that length of time. Of course we cannot fix any prices, we can only indicate parties with whom the farmers can correspond and be assured of getting some good seed providing the men are honest, and we believe the most of our seed growers are honest. We thought we would make a small beginning along the line we have indicated, but we do not want to do it without the approval of this association. We would like to have some suggestions in regard to the matter.

Dr. Merrill. I have known something of the work the Department is doing along this line and certainly it is a work that we must all commend. It is a splendid thing to do. I do not know just what sort of a publication they have in mind, whether it is to be published by the Seed Improvement Association or the Department of Agriculture, but I would like to speak just for a moment from the standpoint of the association. An association gets credit, gets standing, gets influence and reputation, through what it does as an association. It seems to me that what this association needs is to carry out the idea that I know the executive committee have in mind, of placing this association on the market, so that its name,—the name Seed Improvement Association or whatever name it bears, will be worth something to its members.

Now the College of Agriculture might get out a Bulletin. We have an association of Maine Agricultural Students, we are growing seed, and we might issue a bulletin that would give the information, but that will not help the Maine Seed Improvement Association. I think it is a splendid thing that the Department of Agriculture and College of Agriculture shall give information broadcast to the farmers of the state, but just what the executive committee must consider is, whether this matter shall not be put into the hands of a committee that shall be empowered to act and place this association on the market so that the association itself shall carry an advertisement of some sort to the people of the state and make an inducement to the farmers to become members. I think Brother Adams will agree with me that this is business and that I am not criticizing his work. I want to see the motion made by our treasurer carried.

Mr. Adams. I was not opposing the motion by any means; I am very much in favor of it. I wanted you to know what we have been trying to do. We will give the association all the information we have and if they want to go ahead we will be very glad to have them.

Dr. Merrill. I would suggest that the executive committee request the representative of the Department engaged in this seed improvement work, who happens to be our secretary, to make a written report of the result of his inspections to the executive committee.

Voted, that the executive committee of the association be empowered and directed to put the Seed Improvement Association upon a business basis.

Dr. Merrill. I would like to move that the executive committee request the members of the Department who make inspections to make to them a written report of the results of their inspections. It is understood that the Department of Agriculture has a fund of $3,000 for the encouragement of this sort of work, together with some other lines, and we have elected as our secretary the man who is engaged in the work. It seems to me the executive committee would have information of tremendous value if they could have a written report of the man who inspects the farms. It is absolutely essential that the executive committee, in order to put this thing where we expect them to, shall have some first hand knowledge.

Mr. Leland. Any information we may have in the office we expect to pass on to the executive committee for the use of the association. I shall be pleased to do whatever I can in helping the executive committee plan the work for next year. I think the motion is not exactly necessary. In regard to this catalogue or list of seed that is to be put out, I think Mr. Adams made it quite clear that we are only doing this until such time as the association is in a position to put out a catalogue under its own name. It was our desire to put out this catalogue to assist in selling this seed, with the assistance of the association, and give it the credit for growing the seed. The association should, as soon as it is in a position and has funds to do it, put out a catalogue of the seed grown by its members. This was merely a beginning, a start in the right direction we hope.

Mr. Adams. Some of the farmers have just got through threshing their grain and it may take a few weeks to get in all the data. Of course this society wants the whole of it, and for that reason it may be late before they get the information.

Dr. Woods. There is one other thing I would like to mention. While this association is represented on the Experiment Station Council and in that way is somewhat in touch with the work the Station is doing in breeding seeds, it seems to me that in some way the executive committee ought to keep in closer touch with us, and if any of this seed that we are breeding is used that they want to distribute among their members they ought to get in touch with us so that they can get this seed. We always do have surplus seed and we shall have some this year. I presume they are interested in the growing of oats, and we have more than 40 plots growing in the season, at Highmoor. It seems to me that if we want to learn something about growing oats Highmoor Farm is about the best place we can visit. We shall be glad to have a Field Meeting at Highmoor Farm in the summer; we can always get railroad rates. Wouldn't that be a good suggestion to pass on to the executive committee?

Mr. Porter. I wish to thank Dr. Woods for this suggestion.

MAINE DEPARTMENT OF AGRICULTURE.

JOHN A. ROBERTS, COMMISSIONER.

STAFF.

EDWARD E. PHILBROOK, Portland,
Field Agent Gypsy Moth Work
FRANK S. ADAMS, Bowdoinham, Dairy Instructor
CLARENCE R. LELAND, Mechanic Falls, Assistant
RUSSELL S. SMITH, Auburn, Dairy Inspector
ALBERT K. GARDNER, Augusta, Horticulturist
HERMAN P. SWEETSER, Cumberland Center,
Assistant
LEVI S. PENNELL, Portland,
Deputy Sealer Weights and Measures
CLARENCE E. EMBREE, Bangor,
Bureau of Marketing and Supplies

CHIEF CLERK

Rena L. Winslow, Augusta

STENOGRAPHERS

Edith B. Wilson, Augusta
Bernice W. White, Augusta
Gladys D. Mathes, Augusta

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	S. P. Emery	Bangor	A. S. Field	Bangor.
Central Maine Fair Co	L. G. Bunker	Waterville	R. M. Gilmore	Waterville	L. G. Whipple	Waterville.
Maine State Pomological	W. H. Conant	Buckfield	E. L. White	Bowdoinham	Thos. E. Chase	Buckfield, R. 2.
Androscoggin County	F. A. Pike	East Livermore	C. D. Dyke	Livermore Falls	H. F. Jones	Fayette Corner.
Androscoggin, Greene Town Fair Association	L. C. Mendall	Greene, R. F. D. 2	W. L. Mower	Greene, R. F. D. 1	B. P. Rackley	Greene, R. F. D. 1
Aroostook, Northern Maine Fair Association	J. Frank Guiou	Presque Isle	Ernest T. McGlauflin	Presque Isle	John E. Bishop	Presque Isle.
Aroostook, Houlton	Nathaniel Tompkins	Houlton	Fred N. Vose	Houlton	Roland E. Clark	Houlton.
Cumberland County	Chas. W. Chaplin	Gorham	C. H. Leighton	Cumberland Mills	Harry C. Palmer	Gorham, R. F. D. 1
Cumberland Farmers' Club	A. W. Stanley	Cumberland Ctr	Willard Wilson	Cumberland Ctr	Willard Wilson	Cumberland Ctr.
Cumberland, New Gloucester and Danville	F. H. Gray	New Gloucester	J. P. Witham	New Gloucester	George C. Jordan	Upper Gloucester.
Cumberland, Freeport Poultry Ass'n	David W. Scribner	Brunswick	George P. Coffin	Freeport	Louis E. Curtis	Freeport.
Cumberland, Little Rigby Park	Sumner O. Hancock	Casco	Ernest U. Archibald	West Poland	Leland H. Poore	Webb's Mills.
Franklin County	B. F. Weathern	Farmington, R. F. D.	Geo. D. Clark	Farmington	Geo. M. Currier	Farmington.
Franklin, North	E. Dill	Phillips	J. I. Harnden	Phillips	A. W. Davenport	Phillips.
Hancock County	F. P. Merrill	Bluehill	G. F. Candage	Bluehill Falls	M. R. Hinckley	Bluehill.
Hancock, Eden	Charles L. Shand	Bar Harbor	Leon L. Smith	Salisbury Cove	Charles F. King	Eden.
Hancock, North Ellsworth	John McNamara	Ellsworth, R.F.D. 3.	H. Fremont Maddocks	Ellsworth, R. F.D. 3.	Asa C. Flood	Ellsworth Falls.
Kennebec, South	L. H. Ford	Whitefield	Arthur N. Douglas	Gardiner	Jasper S. Gray	Windsorville.
Knox, North	E. E. Thurston	Union	H. L. Grinnell	Union	Geo. C. Hawes	Union.
Lincoln County	Leslie Boynton	Jefferson	J. A. Perkins	Nobleboro	Harvey E. Winslow.	Damariscotta.
Lincoln, Bristol	Emery P. Richards	Round Pond	J. Wilber Hunter	Damariscotta	C. B. Woodward	Damariscotta.
Oxford County	W. J. Wheeler	So. Paris	W. O. Frothingham	So. Paris.	W. O. Frothingham	So. Paris.
Oxford, West	A. R. Hill	E. Brownfield	B. Walker McKeen	Fryeburg	A. D. Merrill	Fryeburg.
Oxford, Androscoggin Valley	W. W. Rose	Canton	O. M. Richardson	Canton	W. S. Marble	Dixfield.
Oxford, North	Charles T. Poor	Andover	John F. Talbot	Andover	R. A. Grover	Andover.

Oxford, Western Maine Poultry Association	A. E. Shurtleff	South Paris	E. P. Crockett	South Paris	D. H. Bean	South Paris.
Penobscot, West	E. M. Atkins	Dexter, R. F. D. 3	E. E. Colbath	Exeter	F. C. Barker	Exeter.
Penobscot, North	H. B. Lewis	Springfield	I. R. Averill	Prentiss	O. A. McKenney	Springfield.
Penobscot, Orrington	C. H. Chapman	So. Brewer, R. F. D. 1	F. Elmer King	So. Brewer, R. F. D. 1.	F. Elmer King	So. Brewer, R. F. D. 1.
Penobscot, Bangor Poultry Ass'n	F. G. Bishop	Bangor, R. F. D. 8	Cyrus S. Winch	Bangor, 144 Exc. St.	Cyrus S. Winch	Bangor, 144 Exc. St.
Piscataquis County	C. W. Brown	Dover	E. C. McKechnie	Foxcroft	A. J. McNaughton	Foxcroft.
Sagadahoc County	Daniel Brown	Gardiner, R. F. D. 13	Edwin C. Patten	Topsham	Lyman E. Smith	Brunswick.
Sagadahoc, Richmond Farmers' and Mechanics' Club	Henry F. Smith	Richmond	N. H. Skelton	Richmond	Wm. R. Fairclough	Richmond.
Somerset County	B. F. Burns	Madison	J. F. Withee	Madison	J. F. Withee	Madison.
Somerset, East	A. W. Miller	Hartland	H. H. Coston	Pittsfield, R.F.D. 2	A. K. Libby	Hartland.
Somerset, Central	C. W. Day	Skowhegan	S. H. Bradbury	Skowhegan	J. W. Folger	Skowhegan.
Somerset, Embden	G. G. Palmer	North Anson	Chester K. Williams	North Anson	D. S. Witham	Solon.
Waldo and Penobscot	Frank A. Littlefield	Brooks	F. H. Putnam	Monroe	C. M. Moore	Winterport.
Waldo, Unity Park Association	J. H. Campbell	Plymouth	E. T. Reynolds	Unity	E. T. Reynolds	Unity.
Washington, West	A. H. Chandler	Columbia Falls	Wm. N. Dyer	Harrington	E. V. Coffin	Harrington.
Washington, Calais Fair Ass'n	W. L. Eaton	Calais	Thos. J. Doyle	Calais	E. C. Short	Calais.
Washington, Princeton	John B. Mercier	Princeton	Irvin R. Sprague	Princeton	Eugene M. Richards	Princeton.
York, Shapleigh and Acton	Clarence A. Butler	Acton	Fred K. Bodwell	Acton	Geo. T. Crediford	Shapleigh.
York, Cornish Agricultural Ass'n	O. W. Adams	Cornish	Wm. R. Copp	Cornish	Sam'l G. Sawyer	Cornish.
York, Berwick Poultry Ass'n	W. W. Brooks	Berwick	A. C. Brooks	Berwick	A. C. Brooks	Berwick.

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	130	60	220	38	240	36	30	624	260	76	600
Eastern Maine Fair Association	67	30	87	5	–	–	117	239	30	44	236
Central Maine Fair Co	174	149	243	12	381	67	220	503	249	149	460
Maine State Pomological	–	–	–	–	–	–	–	–	–	–	–
Androscoggin County	8	2	10	36	32	2	10	92	11	1	62
Androscoggin, Greene Town Fair Association	48	4	36	19	18	–	25	102	–	–	3
Aroostook, Northern Maine Fair Association	207	78	132	36	6	–	102	252	76	32	336
Aroostook, Houlton	101	57	105	36	4	13	74	289	19	20	532
Cumberland County	99	14	37	36	139	4	30	260	26	11	132
Cumberland Farmers' Club	7	8	17	13	32	8	8	86	8	5	–
Cumberland, New Gloucester and Danville	42	7	22	40	18	–	22	68	2	31	73
Cumberland, Freeport Poultry Association	–	–	–	–	–	–	–	–	–	–	670
Cumberland, Little Rigby Park	8	–	–	9	42	6	–	57	–	3	6
Franklin County	90	59	189	206	298	44	129	796	168	30	70
Franklin, North	76	9	24	95	164	9	70	371	81	15	17
Hancock County	29	2	–	46	56	4	27	104	18	–	20
Hancock, Eden	6	2	7	3	–	–	–	12	8	–	25
Hancock, North Ellsworth	–	5	14	7	–	–	7	26	–	–	1
Kennebec, South	35	5	6	18	74	4	10	117	–	4	–
Knox, North	32	12	20	31	96	7	12	178	13	6	42
Lincoln County	34	4	10	20	52	9	25	120	–	–	18
Lincoln, Bristol	19	–	–	17	30	2	–	49	–	–	17
Oxford County	89	52	122	112	116	6	108	516	51	27	229
Oxford, West	75	15	75	70	220	23	44	400	25	10	50

Oxford, Androscoggin Valley	47	16	62	30	92	5	15	220	2	10	75
Oxford, North	30	4	8	12	20	8	12	64	28	20	12
Oxford, Western Maine Poultry Association	-	-	-	-	-	-	-	-	-	-	645
Penobscot, West	46	24	64	49	36	1	54	174	50	25	150
Penobscot, North	19	4	28	-	-	-	5	37	-	-	-
Penobscot, Orrington	7	1	-	4	2	-	4	11	-	2	12
Penobscot, Bangor Poultry Association	-	-	-	-	-	-	-	-	-	-	-
Piscataquis County	37	7	22	35	6	-	30	100	6	15	19
Sagadahoc County	78	45	268	73	124	26	-	536	124	60	495
Sagadahoc, Richmond Farmers' and Mechanics' Club	21	1	5	26	4	-	18	54	3	-	10
Somerset County	29	7	16	35	32	20	7	117	78	-	31
Somerset, East	22	2	8	8	6	-	5	29	7	11	59
Somerset, Central	35	8	28	35	32	4	-	107	93	18	250
Somerset, Embden	11	4	12	-	2	-	7	25	-	-	-
Waldo and Penobscot	58	19	87	42	78	21	40	287	62	5	49
Waldo, Unity Park Association	87	10	46	45	20	10	36	167	25	15	100
Washington, West	23	10	24	23	36	-	6	99	61	25	41
Washington, Calais Fair Association	24	11	14	24	-	-	10	59	-	6	200
Washington, Princeton	4	1	2	17	-	1	-	21	12	-	5
York, Shapleigh and Acton	5	-	-	12	80	14	-	106	3	1	18
York, Cornish Agricultural Association	30	13	37	31	90	8	5	184	28	20	75
York, Berwick Poultry Association	-	-	-	-	-	-	-	-	-	-	438
	1,989	761	2,107	1,406	2,678	362	1,324	7,658	1,627	697	6,283

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	$80 00	$25 00	$85 00	$18 00	-	$40 00	$30 00	$42 00	$125 00
Eastern Maine Fair Association	84 00	15 00	31 00	10 00	$14 00	18 00	10 00	44 00	16 00
Central Maine Fair Co.	69 00	25 00	133 00	55 00	-	58 00	-	-	206 00
Maine State Pomological	-	-	-	-	-	-	-	-	-
Androscoggin County	3 00	-	-	7 00	-	-	-	14 00	18 00
Androscoggin, Greene Town Fair Association	-	-	-	-	-	-	-	2 00	20 00
Aroostook, Northern Maine Fair Association	55 00	25 00	132 00	79 00	42 00	6 00	-	334 00	90 00
Aroostook, Houlton	90 00	40 00	105 00	87 00	-	4 00	7 00	167 00	28 00
Cumberland County	20 00	20 00	11 00	7 00	-	25 00	15 00	16 00	47 00
Cumberland Farmers' Club	-	-	4 00	2 00	-	-	-	6 00	5 00
Cumberland, New Gloucester and Danville	2 00	2 00	-	2 00	2 00	5 00	2 00	13 00	13 00
Cumberland, Freeport Poultry Association	-	-	-	-	-	-	-	-	-
Cumberland, Little Rigby Park	-	-	-	-	-	-	-	6 00	16 00
Franklin County	24 00	7 00	13 00	9 00	10 00	20 00	10 00	42 00	49 00
Franklin, North	-	7 75	1 00	4 50	5 50	6 00	6 00	12 10	20 00
Hancock County	8 00	-	5 00	5 00	-	3 00	2 00	25 00	18 00
Hancock, Eden	-	-	-	-	-	-	-	13 00	-
Hancock, North Ellsworth	-	-	-	-	-	-	-	-	-
Kennebec, South	2 50	2 00	6 75	3 00	-	4 00	-	15 00	38 00
Knox, North	3 00	-	-	3 00	3 00	2 50	-	20 50	52 00
Lincoln County	14 00	5 00	-	-	3 00	10 00	-	9 00	-
Lincoln, Bristol	-	-	-	-	-	-	-	1 50	-
Oxford County	38 00	27 00	6 00	12 00	57 00	31 00	-	64 00	171 00
Oxford, West	20 00	9 00	33 00	7 00	-	-	12 00	-	12 00

Oxford, Androscoggin Valley	11 00	10 00	5 00	3 00	6 00	10 00	8 00	29 00	79 00
Oxford, North	-	3 00	6 00	5 75	-	-	-	10 75	64 00
Oxford, Western Maine Poultry Association	-	-	-	-	-	-	-	-	-
Penobscot, West	7 00	14 00	6 00	6 00	-	5 00	-	32 00	109 00
Penobscot, North	-	-	-	3 50	-	-	-	11 50	-
Penobscot, Orrington	-	-	-	2 50	-	4 50	-	2 00	3 00
Penobscot, Bangor Poultry Association	-	-	-	-	-	-	-	-	-
Piscataquis County	5 00	5 00	5 00	6 00	3 00	6 00	-	11 50	45 00
Sagadahoc County	13 00	10 00	20 00	14 00	-	-	-	36 00	115 00
Sagadahoc, Richmond Farmers' and Mechanics' Club	1 00	1 00	1 00	2 00	-	-	-	5 35	7 25
Somerset County	5 00	3 50	5 50	5 50	6 00	6 00	-	12 00	20 00
Somerset, East	13 00	9 00	16 00	5 00	-	9 00	-	19 00	100 00
Somerset Central	5 00	4 00	9 00	9 00	-	20 00	12 00	20 50	62 00
Somerset, Embden	-	-	3 00	-	-	-	-	6 00	10 00
Waldo and Penobscot	23 00	12 00	18 00	12 00	12 00	12 00	8 00	24 00	141 00
Waldo, Unity Park Association	15 50	6 00	16 50	6 00	6 00	8 00	16 00	21 50	30 00
Washington, West	-	-	-	-	-	125 00	-	9 00	113 00
Washington, Calais Fair Association	18 00	5 00	16 00	7 00	-	-	-	43 00	-
Washington, Princeton	-	-	-	-	-	-	-	5 00	3 00
York, Shapleigh and Acton	-	-	-	-	3 50	3 00	-	-	-
York, Cornish Agricultural Association	-	4 00	-	-	4 00	7 00	-	24 00	50 00
York, Berwick Poultry Association	-	-	-	-	-	-	-	-	-
	$629 00	$296 25	$692 75	$397 75	$177 00	$448 00	$138 00	$1,168 20	$1,895 25

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	$296 00	$480 00	$260 00	$284 00	$32 00	$58 00	$32 00	$72 00	$180 00	$338 00
Eastern Maine Fair Association	135 00	305 00	86 00	106 00	-	-	-	-	-	-
Central Maine Fair Co	272 25	555 50	34 00	261 50	95 50	114 00	-	173 00	112 00	242 00
Maine State Pomological	-	-	-	-	-	-	-	-	-	-
Androscoggin County	6 00	22 00	69 50	4 00	-	-	-	4 00	10 00	61 00
Androscoggin, Greene Town Fair Association	2 50	3 50	4 50	-	10 00	-	-	-	-	-
Aroostook, Northern Maine Fair Association	446 00	849 00	65 00	162 00	-	14 00	-	-	-	-
Aroostook, Houlton	308 00	719 00	85 00	139 00	-	6 00	8 00	41 00	-	-
Cumberland County	49 00	52 00	40 00	35 00	42 00	24 00	13 00	22 00	32 00	175 00
Cumberland Farmers' Club	11 00	15 00	13 00	5 00	14 00	22 00	-	11 00	34 50	45 00
Cumberland, New Gloucester and Danville	11 00	33 50	34 75	10 00	14 00	5 50	2 00	-	-	-
Cumberland, Freeport Poultry Association	-	-	-	-	-	-	-	-	-	-
Cumberland, Little Rigby Park	-	-	18 00	-	17 00	-	-	6 00	13 00	-
Franklin County	113 50	189 00	108 50	122 00	100 00	57 00	12 00	27 00	174 00	59 00
Franklin, North	9 25	16 90	24 85	41 00	4 50	10 15	2 75	5 50	32 80	30 00
Hancock County	10 00	-	62 75	10 00	17 00	7 50	-	7 50	10 00	16 00
Hancock, Eden	4 50	15 25	3 00	-	-	-	-	-	-	-
Hancock, North Ellsworth	15 50	14 50	14 00	-	-	-	-	-	-	-
Kennebec, South	14 50	8 25	20 50	11 50	22 25	-	3 00	7 00	50 00	77 75
Knox, North	30 00	27 00	38 50	12 00	28 25	13 00	3 00	5 00	31 00	26 00
Lincoln County	9 25	13 75	20 00	16 00	7 50	17 50	-	9 00	32 00	26 00
Lincoln, Bristol	-	-	6 00	-	5 50	-	-	1 00	-	5 00
Oxford County	207 00	240 00	223 00	121 00	129 00	58 00	-	22 00	100 00	246 00
Oxford, West	48 00	120 50	130 50	96 00	40 00	45 00	5 00	20 00	156 00	145 00

Oxford, Androscoggin Valley	36 00	89 00	53 00	15 00	17 00	38 00	6 00	7 00	34 00	33 00
Oxford, North	14 00	25 00	13 25	13 00	45 75	13 00	3 00	7 00	5 00	-
Oxford, Western Maine Poultry Association	-	-	-	-	-	-	-	-	-	-
Penobscot, West	54 50	126 50	73 25	60 00	63 00	-	-	2 00	-	-
Penobscot, North	3 50	30 00	-	5 00	-	-	-	-	-	-
Penobscot, Orrington	1 00	-	5 00	4 00	2 00	-	-	-	-	-
Penobscot, Bangor Poultry Association	-	-	-	-	-	-	-	-	-	-
Piscataquis County	15 00	22 50	34 50	30 00	5 50	-	-	-	-	-
Sagadahoc County	163 00	600 75	125 85	135 00	36 00	30 00	4 00	63 00	46 00	230 00
Sagadahoc, Richmond Farmers' and Mechanics' Club	30	2 75	5 80	3 00	1 30	-	-	-	-	-
Somerset County	8 25	8 25	26 75	3 00	7 00	7 75	-	12 00	24 00	28 00
Somerset, East	7 00	10 00	23 00	6 00	13 00	-	-	-	-	-
Somerset, Central	28 00	89 00	67 00	-	20 00	19 00	-	11 00	23 20	80 00
Somerset, Embden	3 00	5 00	-	3 00	-	2 00	-	-	-	-
Waldo and Penobscot	64 00	111 00	45 50	150 00	18 00	50 00	9 00	16 00	61 00	100 00
Waldo, Unity Park Association	25 50	58 50	32 50	45 00	12 00	10 00	6 00	11 00	12 00	20 00
Washington, West	56 00	58 00	63 00	10 00	53 00	-	-	-	-	40 00
Washington, Calais Fair Association	156 00	78 00	39 00	25 00	-	-	-	-	-	-
Washington, Princeton	3 00	6 00	21 25	-	-	-	-	2 00	-	-
York, Shapleigh and Acton	-	-	6 50	-	6 00	31 50	-	41 00	35 00	11 00
York, Cornish Agricultural Association	50 00	170 00	75 00	8 00	121 00	49 00	7 00	20 00	60 00	75 00
York, Berwick Poultry Association	-	-	-	-	-	-	-	-	-	-
	$2,686 30	$5,169 90	$2,071 50	$1,951 00	$999 05	$701 90	$115 75	$625 00	$1,267 50	$2,108 75

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 manufacturers and needle-work.	Amount of premiums awarded objects not named above.	Total amount of premiums and gratuities awarded.
Maine State Agricultural	$654 00	$214 00	$422 00	$278 50	$176 75	$264 50	-	-	$198 25	$150 00	$4,835 00
Eastern Maine Fair Association	190 00	36 00	216 25	143 25	290 75	61 00	-	-	230 90	196 25	2,238 40
Central Maine Fair Co.	736 00	258 00	941 50	102 00	215 00	339 75	65 25	-	377 15	731 00	6,171 40
Maine State Pomological	-	-	-	-	436 50	-	-	-	-	-	436 50
Androscoggin	7 00	2 00	46 50	5 50	3 30	3 00	-	-	11 50	76 00	373 30
Androscoggin, Greene Town Fair Association	-	-	1 50	4 00	4 00	1 50	-	-	2 50	4 00	60 00
Aroostook, Northern Maine Fair Association	235 00	74 00	243 00	130 20	148 65	74 75	32 00	-	262 95	490 30	3,989 85
Aroostook, Houlton	71 00	62 50	235 05	65 80	62 55	18 00	-	-	216 85	114 00	2,679 75
Cumberland County	20 00	9 00	209 00	28 00	61 00	9 50	17 00	3 00	60 70	83 00	1,145 20
Cumberland Farmers' Club	12 00	8 50	96 00	33 25	17 75	11 50	-	-	60 10	14 00	440 60
Cumberland, New Gloucester and Danville	1 00	14 00	25 50	10 75	17 90	9 50	-	-	43 35	51 75	325 50
Cumberland, Freeport Poultry Association	-	-	428 00	-	-	-	-	-	-	4 50	432 50
Cumberland, Little Rigby Park	-	3 00	2 50	-	-	-	-	-	-	40 50	122 00
Franklin County	108 85	10 00	77 00	30 85	34 45	41 50	1 00	-	76 10	142 45	1,668 20
Franklin, North	20 75	3 00	7 40	10 00	10 20	4 65	1 25	-	33 35	10 25	341 40
Hancock County	9 50	-	15 75	86 40	34 60	11 30	1 00	-	50 50	25 50	441 30
Hancock, Eden	5 00	-	16 50	126 95	30 80	22 00	-	-	15 00	12 00	264 00
Hancock, North Ellsworth	-	-	-	29 75	23 75	2 00	75	-	14 95	-	115 20
Kennebec, South	-	5 00	-	21 95	13 95	5 00	50	-	30 25	-	362 65

Knox, North	8 00	11 00	28 75	41 65	43 50	6 75	8 45	-	24 60	66 45	536 90
Lincoln County	-	-	11 00	21 00	22 20	1 50	3 75	-	45 10	20 00	316 55
Lincoln, Bristol	-	-	10 00	23 20	7 40	4 00	1 00	-	26 40	31 20	122 20
Oxford County	52 00	66 00	195 50	91 50	373 25	31 45	11 75	15 00	113 65	340 00	3,042 10
Oxford, West	25 00	10 00	27 50	30 75	25 60	14 00	10 40	-	24 00	194 50	1,260 75
Oxford, Androscoggin Valley	3 00	8 00	41 50	11 75	20 25	11 00	2 50	-	39 75	101 50	728 25
Oxford, North	19 00	16 00	8 00	7 00	12 00	6 00	8 00	5 00	21 35	-	330 85
Oxford, Western Maine Poultry Association	-	-	675 20	-	-	-	-	-	-	-	675 20
Penobscot, West	47 00	47 00	128 50	62 05	61 70	16 40	16 80	-	104 45	97 56	1,139 71
Penobscot, North	-	-	-	5 00	36 00	3 00	50	-	33 00	5 00	136 00
Penobscot, Orrington	-	4 50	4 75	12 50	15 40	-	1 00	-	41 25	11 25	114 65
Penobscot, Bangor Poultry Association	-	-	530 00	-	-	-	-	-	-	-	530 00
Piscataquis County	-	4 00	10 75	10 25	16 25	7 50	-	-	26 00	30 00	298 75
Sagadahoc County	185 50	81 75	190 15	165 00	165 75	75 55	10 00	-	114 80	350 76	2,980 86
Sagadahoc, Richmond Farmers' and Mechanics' Club	1 10	-	2 45	14 10	10 95	3 75	25	-	8 15	1 70	73 20
Somerset County	34 25	-	13 25	11 10	3 75	1 25	50	-	26 65	9 40	288 65
Somerset, East	6 00	16 00	46 75	58 00	20 00	40 00	2 50	-	15 90	127 25	562 40
Somerset, Central	164 00	10 00	219 00	32 25	107 25	28 25	3 00	-	-	1 85	1,044 30
Somerset, Embden	-	-	-	9 00	-	-	-	-	-	-	41 00
Waldo and Penobscot	110 00	26 00	34 25	64 25	45 50	18 00	1 50	-	116 75	10 00	1,312 75
Waldo, Unity Park Association	12 00	8 50	70 50	32 50	11 25	10 50	18 50	6 00	60 25	58 25	646 25
Washington, West	96 00	39 00	20 50	61 50	68 00	10 25	2 50	-	157 60	4 00	986 35
Washington, Calais Fair Ass'n	-	16 00	154 25	103 00	36 75	20 00	-	-	209 25	16 00	942 25
Washington, Princeton	15 00	-	1 50	29 50	31 77	6 00	-	-	42 65	-	166 67
York, Shapleigh and Acton	2 25	1 50	15 00	65 00	40 00	18 00	15 00	-	45 00	58 25	397 50
York, Cornish Agricultural Association	20 00	18 00	105 00	6 00	27 75	3 75	16 50	-	47 45	-	968 45
York, Berwick Poultry Association	-	-	167 00	-	-	-	-	-	-	-	167 00
	$2,870 20	$1,082 25	$5,694 50	$2,075 00	$2,784 17	$1,216 35	$253 15	$29 00	$3,028 40	$3,680 42	$46,252 29

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	$2,500 00	$60 00	$1,500 00	$2,390 00	$19,884 08	$26,334 08
Eastern Maine Fair Association	1,364 50	-	868 00	1,120 00	12,415 00	15,767 50
Central Maine Fair Co.	2,500 00	-	3,300 00	1,816 60	11,943 79	19,560 39
Maine State Pomological	1,816 18	193 00	-	-	332 00	2,341 18
Androscoggin County	114 73	29 00	-	-	653 59	797 32
Androscoggin, Greene Town Fair Association	14 41	43 00	25 97	-	49 30	132 68
Aroostook, Northern Maine Fair Association	1,641 04	45 00	3,000 00	1,555 00	12,103 30	18,344 34
Aroostook, Houlton	1,117 17	-	3,000 00	663 00	6,614 20	11,394 37
Cumberland County	480 51	20 00	-	335 00	5,659 96	6,495 47
Cumberland Farmers' Club	194 91	65 50	-	412 50	1,747 07	2,419 98
Cumberland, New Gloucester and Danville	99 08	10 00	-	108 75	731 24	949 07
Cumberland, Freeport Poultry Association	222 08	18 50	150 00	-	390 46	781 04
Cumberland, Little Rigby Park	58 75	-	300 00	270 00	1,184 45	1,813 20
Franklin County	675 08	737 00	800 00	660 00	2,452 34	5,324 42
Franklin, North	145 42	313 00	490 93	52 50	465 27	1,467 12
Hancock County	165 81	-	-	159 50	1,888 43	2,213 74
Hancock, Eden	85 87	-	-	125 00	1,240 63	1,451 50
Hancock, North Ellsworth	-	-	-	-	177 00	177 00
Kennebec, South	184 09	-	250 00	30 00	941 42	1,405 51
Knox, North	209 89	2 00	300 00	50 00	2,019 00	2,580 89
Lincoln County	184 14	-	550 00	60 00	1,221 20	2,015 34
Lincoln, Bristol	62 47	1 25	-	-	330 55	394 27
Oxford County	1,191 28	35 00	-	780 00	6,242 77	8,249 05

Oxford, West	446 56	30 00	-	160 00	4,230 76	4,867 32
Oxford, Androscoggin Valley	306 10	-	-	449 50	1,686 60	2,442 20
Oxford, North	185 40	5 00	-	75 00	582 72	848 12
Oxford, Western Maine Poultry Association	211 44	37 00	-	-	947 55	1,195 99
Penobscot, West	429 60	51 00	-	288 75	2,214 68	2,984 03
Penobscot, North	83 27	2 00	-	200 00	1,450 00	1,735 27
Penobscot, Orrington	58 09	-	-	92 00	779 70	929 79
Penobscot, Bangor Poultry Association	-	-	-	-	-	-
Piscataquis County	131 65	-	-	70 00	1,079 71	1,281 36
Sagadahoc County	1,246 01	25 00	6,500 00	330 00	4,703 74	12,804 75
Sagadahoc, Richmond Farmers' and Mechanics' Club	33 04	1 00	-	-	111 00	145 04
Somerset County	137 27	-	75 00	10 00	787 35	1,009 62
Somerset, East	126 44	50 00	-	442 50	905 13	1,524 07
Somerset Central	328 32	20 00	-	405 50	2,415 00	3,168 82
Somerset, Embden	25 12	-	4 97	1 50	44 25	75 84
Waldo and Penobscot	545 11	-	1,075 00	400 00	1,262 30	3,282 41
Waldo, Unity Park Association	251 91	-	-	118 00	1,083 00	1,452 91
Washington, West	517 82	4 00	-	225 00	3,890 40	4,637 22
Washington, Calais Fair Association	259 04	-	-	215 00	6,072 04	6,546 08
Washington, Princeton	-	-	-	320 00	1,172 45	1,492 45
York, Shapleigh and Acton	164 00	181 00	60 00	-	58 58	463 58
York, Cornish Agricultural Association	388 73	-	255 00	530 00	2,442 78	3,616 51
York, Berwick Poultry Association	-	-	-	-	402 26	402 26
	$20,902 33	$1,978 25	$22,504 87	$14,920 60	$129,009 05	$189,315 10

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	$2,270 72	$5,550 00	$5,355 29	$7,903 83	$25,914 84	$62,000 00	$13,000 00
Eastern Maine Fair Association	-	3,065 00	5,000 00	4,099 60	14,403 00	45,000 00	868 00
Central Maine Fair Co	-	3,260 00	10,147 87	969 47	20,548 74	-	4,098 98
Maine State Pomological	-	-	1,642 58	-	2,079 08	-	-
Androscoggin County	-	400 00	276 37	146 45	1,196 12	2,000 00	-
Androscoggin, Greene Town Fair Association	-	-	38 00	-	98 00	-	-
Aroostook Northern Maine Fair Association	2,500 00	3,275 00	5,742 05	2,727 34	18,234 24	40,000 00	9,400 00
Aroostook, Houlton	2,059 02	2,089 75	2,489 76	343 15	9,661 43	-	-
Cumberland County	800 00	1,245 00	1,955 00	-	5,145 20	7,000 00	800 00
Cumberland Farmers' Club	151 83	900 00	563 40	162 52	2,218 35	2,600 00	300 00
Cumberland, New Gloucester and Danville	-	355 75	117 25	-	798 50	3,000 00	-
Cumberland, Freeport Poultry Association	-	-	128 63	-	561 13	300 00	150 00
Cumberland, Little Rigby Park	198 05	1,100 00	418 90	-	1,838 95	1,900 00	325 75
Franklin County	525 00	1,650 00	800 00	-	4,643 20	20,000 00	1,046 79
Franklin, North	35 00	298 85	225 09	917 18	1,817 52	2,500 00	2,143 00
Hancock County	161 48	790 00	902 22	-	2,295 00	3,500 00	-
Hancock, Eden	150 00	320 00	525 14	-	1,259 14	2,950 00	650 00
Hancock, North Ellsworth	-	-	-	65 00	180 20	1,000 00	200 00
Kennebec, South	46 15	230 00	193 58	489 92	1,322 30	1,000 00	700 00
Knox, North	600 00	510 75	633 11	267 00	2,547 76	2,000 00	750 00
Lincoln County	-	330 00	450 00	918 79	2,015 34	2,000 00	625 61
Lincoln, Bristol	112 46	-	152 27	5 00	391 93	1,000 00	-
Oxford County	773 33	1,900 00	1,722 03	844 56	8,282 02	12,000 00	450 00

Oxford, West	600 00	1,200 00	700 25	146 50	3,907 50	12,000 00	1,000 00
Oxford, Androscoggin Valley	155 00	1,000 00	506 73	-	2,389 98	-	1,705 00
Oxford, North	25 00	150 00	145 23	91 10	742 18	1,500 00	-
Oxford, Western Maine Poultry Association	48 00	-	215 50	133 26	1,071 96	350 00	-
Penobscot, West	456 35	773 75	408 50	420 75	3,199 06	4,500 00	4,950 00
Penobscot, North	200 00	750 00	450 00	150 00	1,686 00	3,000 00	-
Penobscot, Orrington	60 00	303 50	237 71	105 37	821 23	1,800 00	1,200 00
Penobscot, Bangor Poultry Association	100 00	-	107 00	-	737 00	400 00	-
Piscataquis County	240 00	700 00	-	8 00	1,246 75	3,500 00	2,700 00
Sagadahoc County	1,500 00	900 00	1,523 82	650 00	7,554 68	10,000 00	5,150 01
Sagadahoc, Richmond Farmers' and Mechanics' Club	-	-	70 50	-	143 70	-	-
Somerset County	50 00	321 25	160 00	190 25	1,010 15	1,000 00	525 00
Somerset, East	193 38	800 00	468 25	108 50	2,132 53	2,200 00	1,939 21
Somerset, Central	-	950 00	1,057 00	111 45	3,162 75	-	-
Somerset, Embden	11 00	5 00	1 53	3 25	61 78	10 00	-
Waldo and Penobscot	-	965 00	314 22	665 98	3,257 95	10,000 00	2,435 00
Waldo, Unity Park Association	275 00	600 00	250 00	-	1,771 25	-	300 34
Washington, West	140 87	825 00	2,310 65	550 00	4,812 87	1,926 00	1,500 00
Washington, Calais Fair Association	400 00	1,900 00	2,728 40	211 35	6,182 00	12,000 00	4,456 91
Washington, Princeton	-	800 00	85 00	440 00	1,491 67	5,000 00	2,500 00
York, Shapleigh and Acton	-	-	42 00	-	439 50	2,000 00	-
York, Cornish Agricultural Association	133 68	1,180 00	1,123 47	195 00	3,600 60	4,500 00	380 00
York, Berwick Poultry Association	193 20	-	252 29	-	612 49	282 00	125 20
	$15,164 52	$41,393 60	$52,636 59	$24,040 57	$179,487 57	$287,718 00	$66,374 80

Special Report

OF THE

College of Agriculture of the University of Maine

FOR THE

Commissioner of Agriculture

FOR THE YEAR 1913.

THE WORK OF THE COLLEGE OF AGRICULTURE OF THE UNIVERSITY OF MAINE IN 1913.

It is now generally recognized that Colleges of Agriculture have a two-fold function,—the teaching of resident students and extension service.

This report of the work of the College for the year 1913 will therefore include a more or less detailed statement concerning both its teaching and extension service.

The Registration of Students.

The College is experiencing a steady growth in the number of students registered in the various courses, as will be shown by the following statistics, comparing the registration in 1913 with that of 1911.

Courses.	1911.	1913.	Gain.	Percentage gain or loss.
Four years courses	139	252	113	81.2
Two years courses	61	46	*15	*24.5
	200	298	98	49

*Loss.

CLASSIFICATION BY RESIDENCE

Maine by counties:

Androscoggin	21
Aroostook	6
Cumberland	34
Franklin	9
Hancock	11
Kennebec	18
Knox	7
Lincoln	6
Oxford	16
Penobscot	61

Piscataquis	9	
Sagadahoc	4	
Somerset	6	
Waldo	6	
Washington	9	
York	12	
		235
Other States		63
Total		298

Percentage of distribution of graduates from the four years and the two years courses, according to present vocation:

Farming	62.7	
County Demonstrating Agents	2	
Agricultural Teaching and Experimentation	14.6	
State and United States Departments of Agriculture	4.7	
Agricultural Editors	2	
Dairy Manufactures	2	
Total in Agricultural Lines		88
Business		6.6
Profession		4.7
Unknown		.7
Total		100

It is interesting to note from the above data that a very large percentage, (eigthy-eight) of the graduates of the College of Agriculture are engaged in some form of agricultural pursuit. This information is given since it will unquestionably be a source of gratification to the people of Maine to know that the young men who are being trained in the science of farming are actually using the education they have gained, either in farming or in furthering that industry.

College Curricula.

The courses of study offered by the College were described quite fully in "Agriculture of Maine" for 1911 and it is not necessary, therefore, to enlarge upon this particular feature, but it may be well to note that a revision of some of the four years courses was made during the year.

In every instance the revision has been made for the purpose of increasing teaching efficiency and to offer major students the opportunity of taking such a program of study as shall offer them the best training for the particular line of work they propose to follow as a vocation.

Departments of Instruction.

For convenience of administration and efficiency of teaching, the College is subdivided into departments. At the present time, it comprises the departments of Agronomy, Animal Industry, Bacteriology and Veterinary Science, Biological and Agricultural Chemistry, Biology, Forestry, Home Economics, Horticulture, and Extension Service. As the College has grown, so have these departments grown in their requirements of teachers, equipment, and laboratory space.

In order to properly set forth the work of the College as performed by the several departments, it has been found advisable to present a portion of the subjects in tabular form, and the balance under departmental headings.

Name of Department.	Number of Teachers.		Number of courses given.	College credit hours.	Total teaching	*Total number of students registered in all courses.
	Whole time.	Part time.				
Agronomy	3	-	29	75	116	494
Animal Industry	4	-	41	74	99	815
Bacteriology and Veterinary Science	1	1	11	26	54	199
Biological and Agricultural Chemistry	1	1	7	32	42	177
Biology	5	-	19	78	116	600
Forestry	2	-	21	40	55	76
Home Economics	4	-	27	-	169	319
Horticulture	2	1	18	61	83	218
	22	3	173	386	734	2898

*Students may be registered in more than one course given by a department.

AGRONOMY.

The Agronomy Department comprises three divisions:—Crops, Soils, and Farm Management. On account of the enlarged duties devolving upon the Department, it was found necessary at the beginning of the College year to employ an additional instructor, who was placed in charge of the soils division.

The old soils laboratory was outgrown several years ago but by combining several rooms in the basement of Winslow Hall, a new and very much enlarged laboratory has been provided. The outdoor laboratory used by the crop section was moved to a more convenient location and considerably enlarged, and is used for plot work, and for growing material for class use. The farm management section is in great need of suitable laboratories for teaching farm mechanics and farm machinery. The farm crops laboratory has been remodelled to some extent and made more efficient. It needs to be enlarged but this does not appear possible at the present time, since all the available space in Winslow (Agricultural) Hall is now being used for other and equally important purposes.

The equipment of the department has been materially increased, especially in the crops and soils sections. A new departure was made the present year, by requiring of all major students in soils, practical field experience in making a soil survey. The survey was begun in Somerset county last summer, prior to the beginning of the fall semester and will be continued next year. It is believed that this plan will result to the material advantage of the students and also to the farming industry in the section surveyed.

ANIMAL INDUSTRY.

Th animal industry department comprises the divisions of Animal Husbandry, Dairy Husbandry, and Poultry Husbandry. A major course of study is offered by each of these divisions.

At the beginning of the College year, the dairy manufactures section of the department was separated from the dairy production section and an instructor placed in charge. One of the important events of the year in connection with this department was the establishment of coöperative arrangements with the Experiment Station, whereby breeding experiments for the purpose of determining the inheritance of milk production, were begun with the college herd. As an aid to these experiments as well as for teaching purposes, a foundation herd of beef cattle, the Aberdeen Angus, consisting of three pure bred cows and one bull, was secured from the famous Escher herd of Iowa. This addition made necessary the remodelling of a portion of the sheep barn to provide housing room, and while this arrangement is inconvenient, and therefore unsatisfactory, it is the best that can be done under the circumstances. At the present time, a number of grade animals are in the college herd, and it is the opinion of the Department that provision should be made for replacing these with pure bred animals. In order that an economical use of labor be made, the poultry plant should be enlarged and equipped more completely.

BACTERIOLOGY AND VETERINARY SCIENCE.

The teaching facilities of the department have been increased by the enlargement of the bacteriological laboratory and by the part time services of an additional instructor. Another year, the entire services of an additional instructor will be needed. A new course in soil bacteriology is now offered students taking major work in agronomy.

BIOLOGICAL AND AGRICULTURAL CHEMISTRY.

It has been found necessary to enlarge the laboratory used by this department, to accommodate the students taking work with it. The services of an additional instructor have been shared with the department of bacteriology, during the past year, but with the beginning of the next college year, the entire time of two teachers in the department will be required. A portion of the time of the head of this department has for many years been given to the teaching of geology. It is hoped, however, that this arrangement may be made unnecessary in the near future, by the establishment of a department of geology in the University, thus leaving the department free for the teaching of the important subjects of biological and agricultural chemistry. If, however, the department is to continue giving the courses in geology, then a geological laboratory will constitute one of its early needs.

BIOLOGY.

During the past two years, the number of students taking work in this department has increased fully seventy-five per cent. An extra instructor was added to the teaching force at the beginning of the year, to enable the department to carry forward the work devolving upon it.

The greatest need of this department at the present time, is increased class room and laboratory space. Some solution of this problem will have to be found very soon or the work of the department will be severely crippled. Since approximately one-sixth of all the college hours required of agricultural and forestry students is taken in the department of biology, adequate accommodations for the department are matters of great importance to the College of Agriculture.

FORESTRY.

During the last two years, the number of students taking major work in forestry increased from forty-four to sixty-three. This increase has made necessary the employment of an additional instructor. A revision of the forestry curriculum was made during the year, seven new courses being added, and the program now offered compares favorably with that given by the best of forestry schools.

Forest Nursery.—A special act of the Legislature made possible the establishing of a State Forest Nursery in connection with this department. The site has been chosen and a substantial wire fence now encloses it. Within the enclosure, a storage and packing house has been built and the heavy grading necessary has already been done. A start on the planting proper was made in a small way last spring, but permanent arrangements were not made in time to permit extensive planting. In the spring of 1914, however, the planting will be begun just as soon as the frost is out of the ground. It is the purpose to grow forest tree seedlings for planting on waste and cut-over lands in Maine, and to supply them to prospective planters at the cost of production. In addition to thus furnishing planting stock, at a minimum cost for reforestation, the students taking the course in Silviculture will have the very valuable experience gained by practical work in the forest nursery.

HOME ECONOMICS.

The department of Home Economics has experienced a very rapid growth since its establishment at the University. Beginning in 1909 with only a few students, and one instructor, it has grown in four years to a department offering twenty-seven courses, having forty major students and four teachers. The home economics curriculum was revised in 1912 and is now of recognized standard grade, among the colleges, offering a major course in the subject.

It was found necessary to provide the department with larger quarters than previously occupied in Winslow Hall and to meet this necessity, a large portion—three floors of the main house—of the Maples, a dwelling house owned by the University and located in close proximity to Winslow Hall, was assigned for this purpose. In the new quarters are located the model housekeeping apartments, the art and the cookery laboratories, while in Winslow Hall remain the sewing room and the laundry. The increased floor space provides the department with satisfactory quarters for the present, but if the department continues to grow, as every indication seems to promise, a new building devoted exclusively to home economics will soon be needed.

HORTICULTURE.

A new course, Floriculture, was given during the fall semester, and other courses will undoubtedly be added in the near future to provide adequate training for students taking major work in the department. The outdoor laboratories devoted to floriculture, landscape and vegetable gardening, small fruits and orcharding, have been enlarged in size and re-located for convenience, nearer the greenhouse and Winslow Hall.

As time passes, each of the subdivisions making up the department will be strengthened and the equipment increased. It will be necessary to add an extra instructor to the teaching force of the department, beginning with the college year in 1914.

The department is very much in need of adequate laboratory facilities and these ought to be supplied at once, in order to meet the demands now being made upon it by both the agricultural and the forestry students.

Equipment.

The equipment of the College is constantly being improved by the addition of new and up-to-date apparatus, and the purchase of first class breeding stock. The additions made during the year may be summarized as follows:—

Agronomy.—The new soils laboratory has been equipped in a very satisfactory manner; the farm crops laboratory provided with grain testers, balances, storage, and exhibition cases, and the farm management section with some much needed apparatus.

Animal Industry.—Four pure bred beef cattle have been secured and additional poultry and swine breeding stock purchased. For greater economy of space in the Dairy Building, a rearrangement of the dairy machinery has been made and considerable new machinery added.

Bacteriology and Veterinary Science.—In this department many additions to the equipment have been made, including microscopes, an incubator, a refrigerator and a life-sized model of a horse. It is planned to secure skeletons of domestic animals for the use of the veterinary science division as soon as possible.

Biological and Agricultural Chemistry.—The principal additions in this department are apparatus to fully equip the enlarged biological chemistry laboratory provided the department last year.

Biology.—An extra supply of microscopes was found necessary to provide for the largely increased number of students taking biology.

Home Economics.—The provision of enlarged laboratories made necessary the purchase of considerable extra equipment, but the items are too numerous to recount in a brief report.

Short Winter Courses.

Short winter courses of four weeks' duration in Dairying and General Agriculture were held during January. These were immediately followed by three weeks courses in Horticulture and Poultry Management. All the courses were well attended. It is planned to hold the Short Courses at a season of the year when it shall be most convenient for farmers to attend,—hence, they are held annually during the months of January and February.

Extension Service.

Extension service at the University of Maine is not a new movement. As early as 1902, several lines of extension work were established, to which others have since been added. Lack of funds, not the demand for such work on the part of the farmers of the state, has resulted in a comparatively slow development of the service.

FUNCTION.

The function of the College Extension Service is something more than the promotion of agriculture; it is the organization and development of the industry. It aims not only to spread agricultural truths, but to set agricultural truths at work. It believes in the "business" of farming and therefore deals with agriculture from the economic standpoint. Its slogan is,—"Greater profits in farming."

ORGANIZATION.

For the first seven years the extension service was carried on coöperatively by the various departments in the College. In 1909, a separate department, known as the Extension Department, was established with a director in charge. All extension service continued to be done, however, almost exclusively, by the regular teaching faculty until the latter part of 1912, when the coöperation of the General Education Board made possible the establishment of "Farm Demonstrations," a line of work the College had long desired to undertake. By means of this arrangement, four men were employed as county agents and set at work with the beginning of 1913. Later in the year, a fifth county agent was employed and also a state leader, in charge of the organization of boys' and girls' agricultural clubs. Beginning with the fiscal year, July 1st, 1913, the University authorized the employment of a state-wide extension worker and Prof. Ralph W. Redman was engaged to fill this position, and he was made Assistant Director of Agricultural Extension Service. The regular extension service force consists therefore of eight men. In addition, the service is actively participated in by the entire faculty of the College of Agriculture and several members of the faculty in other colleges of the University.

CORRESPONDENCE COURSES.

The interest in the Correspondence Courses is steadily maintained. The letters of appreciation received from those who have completed one or more courses, confirm the opinion of the Extension Department that correspondence courses in Agriculture have a real value, especially for those who find it impossible to pursue regular courses of study at the College. The courses offered at the present time are:

Course I, Farm Crops and Crop Production.
Course II, Farm Management.
Course III, Feeding and Breeding of Farm Animals.
Course IV, Poultry.
Course V, Fruit Growing.
Course VII, Home Economics.
Course VIII, Elementary Agriculture.
Course IX, Domestic Science.
Course X, Vegetable Gardening and Small Fruits.
Course XI, Dairy Farming.

Correspondence course students are required to purchase the text-books recommended, varying in cost from seventy-five cents to two dollars each. Every effort is made to connect the correspondence courses with actual farming operations and thus make the course of as much practical benefit as possible.

LECTURES.

Lectures given by the Agricultural faculty have constituted an important part of the Extension Service from the very beginning. At first, they were only given during the summer vacation, but as the demand grew more insistent, the service was extended to include the entire year. At the present time, this particular line of extension service is participated in not only by the members of the Extension Department staff, but also by the entire faculty of the College of Agriculture. During nineteen hundred and thirteen, two hundred and forty-three lectures were given, before audiences numbering 23,911 people. As an aid in answering inquiries concerning lectures, the College issues a bulletin, once each year, giving the names of the lecturers available and the special subjects on which they are prepared to speak.

LECTURE COURSES.

For the purpose of determining their value as a regular form of extension service, complete lecture courses of five lectures given by members of the University faculty, were arranged for and given in four towns during the year with such satisfactory results that they will be offered again the coming year to a limited number of towns. These courses were given under the auspices of granges, clubs and societies. Aid is always given where desired, in planning the courses.

FIELD MEETINGS AT THE UNIVERSITY.

Two Pomona Grange Field Meetings were held at the University in 1913, on the invitation of the College of Agriculture. The first meeting was held August 2nd by West Penobscot Pomona Grange. The lecture program was given in the forenoon, the principal speakers being Hon. C. S. Stetson, State Master, and Mr. E. H. Libby, State Secretary.

The second meeting was held under the auspices of Penobscot Pomona Grange. At this meeting the speakers were Hon. C. S. Stetson, State Master, Hon. C. M. Freeman, Secretary of the National Grange, and Hon. B. W. McKeen, State Lecturer. In each instance, the attendance was large. Dinner was served in the gymnasium and the afternoon devoted to sight-seeing about the University farm and campus.

AGRICULTURAL ORGANIZATIONS.

The extension department works in the closest coöperation with agricultural associations and organizations of all kinds. It believes in the organizations of agricultural interests and uses its influence to encourage them. On request, one hundred and forty-six lectures were given before farmers' organizations during the year.

ASSOCIATION MEETINGS AT THE UNIVERSITY.

In November, the Maine Live Stock Breeders' Association, the Maine Jersey Breeders' Association, the Maine Shorthorn Breeders' Association and the Maine Guernsey Breeders' Association held their annual meetings at Orono, as the guests of the College of Agriculture. During the convention, state associations of Holstein breeders and of Ayrshire breeders were formed. These meetings were well attended and a live interest in stock breeding manifested. It was estimated that the largest number of genuine breeders of pure bred stock ever assembled in the state at one time were in attendance. These associations will meet at Orono again in November, 1914.

PUBLICATIONS.

A monthly bulletin known as "Timely Helps for Farmers" is issued by the Extension Department and mailed regularly to all persons in the state desiring the same. During the year, the bulletins have been devoted to the following topics:

Lice and Mites on Fowl, W. F. Schoppe, July, 1912.
Insects Damaging Spruce Trees, J. M. Briscoe, August, 1912.
Lecture Courses, L. S. Merrill, September, 1912.
Suggestions on Alfalfa in Maine, W. L. Slate, Jr., October, 1912.
Practical Dairy Bacteriology, H. W. Smith, November, 1912.
Farmers' Week, L. S. Merrill, December, 1912.
Bovine Tuberculosis, F. L. Russell, January, 1913.
Bibliography on Home Economics, Comstock & Palmer, February, 1913.
Dairy Products in the Home, R. W. Redman, March, 1913.
Strawberry Culture, E. F. Hitchings, April, 1913.
Legumes as a Source of Nitrogen, H. W. Smith, May, 1913.
Cane Fruits, W. H. Darrow, June, 1913.

ADVICE GIVEN BY MAIL.

"Advice by mail" furnishes an opportunity for the College to serve many thousands of Maine farmers each year. This form of Extension Service has developed very rapidly, and deservedly so, since opportunity is given the College to be of direct personal assistance to the man on the farm in solving the problems he is constantly facing. When letters of inquiry are received, they are distributed for reply to those persons in the institution best qualified to give the desired information. It is believed that this service is an important and valuable one to render to the people of the state and all inquiries are promptly and cheerfully answered.

IDENTIFICATION OF PLANTS, DISEASES, AND INSECTS.

Many times farmers are troubled by unknown weeds, plant diseases, and injurious insects, identification of which and advice as to the best methods of combatting same would be of great benefit. Such samples can be sent to the College of Agriculture where identification will be made and the farmer advised what steps should be taken for their control. The sending of such samples to the College renders a service not only to the farmer, but also to the University, since it gives information as to the distribution of noxious weeds, insect pests, and plant diseases, throughout the state.

SUMMER CAMP.

The summer camp course was inaugurated this year under the auspices of the State Department of Forestry, and full equipment was provided for twelve men. This equipment was of the very best, and consisted of tents, cots, blankets, and full commissary outfit. The site chosen for this year's work was on Indian Township, in Washington County. The permanent camp was located on a neck of well-wooded land on the north side of Big Musquash Lake, just east of Big Musquash Stream, about six miles either by water or by road from Princeton, Maine. Here an abandoned logging camp was furnished through the kindness of Mr. Charles F. Eaton. This camp was used as a cook-shack and mess-quarters. Two men were assigned to each tent for living quarters. These tents were 9 1-2 by 9 1-2 feet, and were made of 10 ounce Army duck, with fly. A tent in a small clearing on a point overlooking the lake served as a base for the lecture work and for the storage of books, charts, maps and other equipment; though most of the lectures were given in the open in front of this tent, the men being seated in a semi-circle about the instructor. This lecture work occupied most of the mornings. A whole township was available for field-work, to which the afternoons and some entire days were devoted. The work given was very elementary in character, consisting of general descriptions and discussions of various phases of forestry, and explanations and demonstrations as well as practical training in the use of instruments used by foresters. As a general rule, the following program was adhered to, with the exception of the all day "hikes" and Field exercises:

Monday	8:00 to 9:00 A. M.	Silviculture
Wednesday	9:15 to 10:15 A. M.	Mensuration
Friday	10:30 to 11:30 A. M.	Seminar
	1:00 to 5:00 P. M.	Mensuration Field Work
Tuesday	8:00 to 9:00 A. M.	Economics of Forestry
Thursday	9:15 to 10:15 A. M.	Forest Botany
	10:30 to 11:30 A. M.	Seminar
	1:00 to 5:00 P. M.	Silviculture Field Work
Saturday	8:00 to 9:00 A. M.	Forest Protection
	9:15 to 10:15 A. M.	Lumbering
	10:30 to 11:30 A. M.	Seminar

For this course there are no entrance examinations or requirements of any kind, excepting that the student be in good health and not less than eighteen years of age. No tuition is charged. The living expenses while in camp are distributed pro rata amongst the students, and this is the only necessary expense. The instructor in charge reserves the right to eject any applicant and to dismiss any one from the camp at his discretion.

The time selected for the course this year was August 6th to 20th and so admirable was the weather during the whole of this period that not a single day's work was interfered with on that account. The course will in all probability be given in August hereafter, at a date set early in the spring, and all applications must be filed with the director together with a deposit of ten dollars on account of board, on or before July 1st, 1914. The place of the camp for the summer of 1914 will also be determined later.

This course also provides an opportunity for young men who are just finishing at high or preparatory schools, and are yet uncertain as to whether or not they wish to make forestry their profession and life work, to find out very definitely what the work is like. This course is entirely separate and apart from the regular four-year curriculum of the Forestry Department at the University of Maine. If enough applications for the course are received previous to July 1st, 1914, the summer Camping Course will be offered regularly as a branch of extension work in Forestry.

Applications and requests for information about the Forestry Camping Course should be addressed to John M. Briscoe, Professor of Forestry, Orono, Maine.

FARMERS' WEEK.

Farmers' Week has come to be a recognized institution in Maine. Already seven of these short courses have been held. The course is divided into three sections.

1. Farm Crops and Horticulture
2. Animal Industry
3. Home Economics

In each of these sections, lectures are held continuously throughout the day and in the evening meetings are held jointly by all sections. Farmers' Week in 1913 comprised one hundred lectures and demonstrations. These were given by forty-six different persons,—members of the Agricultural faculty, Arts College faculty, Experiment Station staff, and successful farmers.

Each year, in connection with Farmers' Week, the annual meetings of the Maine Federation of Agricultural Associations and Maine Association of Agricultural Students are held. Farmers' Week is not only an agricultural and home makers' short course but one of the largest and most important "get together" meetings for rural people held in the state.

FARMERS' COÖPERATIVE EXPERIMENTS.

Following the custom established several years ago, coöperative experiments were carried on with farmers in various sections of the state, although not in such numbers as formerly. The experiments were confined to tests with the following crops: Alfalfa, potatoes, and oats.

Alfalfa.—Alfalfa seed from the Bureau of Plant Industry, United States Department of Agriculture, was furnished ten farmers. In most instances the crop developed satisfactorily and went into the winter in good condition. Previous years' tests, however, have not given very promising results.

Potatoes.—Potato seed, Lowell Green Mountain variety, was distributed in limited quantities to several farmers in Washington County, the object being to furnish the farmer with seed of known quality to use in a comparative test with the ordinary seed grown on the farm. The results of the tests were satisfactory to all concerned.

Oats.—Oat seed, grown at "Highmoor," the State Experimental farm, of the Banner and Kherson varieties, was supplied thirty farmers in Washington County. Quite generally, the coöperators report that the results were satisfactory and that the seed will be used again in 1914.

BOYS' AND GIRLS' AGRICULTURAL CLUBS.

The organization of boys' and girls' agricultural clubs was begun as a definite line of Exension Service in August of the present year, and a State Leader appointed to superintend the movement. Profiting from the experience of other states, it was planned to organize the boys and girls into different clubs, the boys' clubs to be known as Boys' Potato Clubs and the girls' clubs as Girls' Canning Clubs. The project of potato growing was assigned to the boys, since it was desirable for the first year at least that,—1st, they should engage in growing a uniform product; 2d, that the product should be one that could be grown successfully in all parts of the state; 3d, that it should have a universal market.

The project of growing string beans was selected for the girls, since this crop may be marketed, not only in cans, but also as green beans for table use.

The clubs are all organized under local leadership, and since the most effective work appears to exist where clubs are connected more or less intimately with the schools or other organizations, local leaders were sought among school superintendents, teachers and persons engaged in community service of some kind. State-wide interest is being manifested in the movement and already fifteen clubs have been formed and others are in process of organization. A circular entitled "Agricultural Contests for Boys and Girls" has been issued by the Extension Department and is now available for distribution. This circular gives full information for organizing and conducting clubs and should be in the possession of every person interested in the movement.

Extension Schools.

To meet the demand for instruction in Agricultural subjects, by people who cannot attend regular sessions at the University of Maine, the College of Agriculture offered a limited number of short courses of three days' duration, to be given in communities upon the application of twenty-five or more adults who agree to regularly attend the sessions and defray local expenses.

HOW SCHOOLS WERE SECURED.

Whenever the residents of a town desired a school, a satisfactory method of organization was found to be as follows: The people interested appointed an Executive Committee of two or three members with Chairman and Secretary. This committee first got in touch with the Extension Department at the College of Agriculture, to find out plans for the desired school, apparatus required, minimum number of students allowable, etc.; second, they found how many people would agree to support the school by regular attendance and proportionate contribution towards paying necessary local expenses; third, where a sufficient number of people were interested, they completed arrangements with the Extension Department for the school.

SCHOOLS HELD.

Fourteen schools have been held as follows:—Four in Apple Packing, at Newburg, West Paris, Winthrop and Wilton; three in Animal Feeding, at Belfast, Buckfield, and Islesboro; four in Soil Fertility, at East Vassalboro, Fairfield Center, Warren and Windsor; three where Dairying and Potato Culture were the subjects, at Columbia Falls, Perry, and Lubec.

LOCAL EXPENSES.

The highest local expense for any school this year was met by an assessment of ten cents per session for each member of the school.

RESULTS.

The effects of Extension Schools on the community are difficult to measure, but the fact that already requests for schools for next year have been received from towns where schools were held this year indicate that the people believe they are of definite value.

Farm Demonstration Work.

Farm Demonstration Work, the first movement of the kind in this section of the United States, was begun early in the year in four counties in the state, under the direction of county representatives of the Extension Service.

This service was made possible by the coöperation of the General Education Board. A complete statement of the farm demonstration work in 1913 would be too extended for the present report, hence very little more than a summary of the service will be given at this time.

Table.—Showing Demonstration Counties and Addresses of Representatives in Charge.

Counties.	Name of Directors.	P. O. Address.
Cumberland	Ernest M. Straight	Portland
Kennebec	Arthur L. Deering	Augusta
Oxford	George A. Yeaton	Norway
Washington	Clarence A. Day	Machias

It was decided at the outset that for the first year at least, the demonstrations should be: Market Gardening in Cumberland County; General Farming in Kennebec County; Orcharding in Oxford County; and Grain and Potato Growing in Washington County.

Table.—Showing number and kinds of demonstrations in each county.

Kinds of Demonstrations.	Number by Counties				
	Cumberland	Kennebec.	Oxford	Washington	Totals.
Flint corn	–	1	–	–	1
Sweet corn	6	6	–	–	12
Oats	–	5	–	6	11
Buckwheat	–	–	–	1	1
Potatoes	3	2	–	14	19
Beets	1	–	–	–	1
Cabbages	1	–	–	–	1
Squash	1	–	–	–	1
Tomatoes	1	–	–	–	1
Orcharding	–	4	26	4	34
Strawberries	2	1	–	–	3
Dairying	–	4	–	–	4
Grass	–	–	–	1	1
	15	23	26	26	90

The demonstrations were successful to a remarkable degree and already their influence is spreading to other farms. Early in the summer the financial assistance given by the General Education Board was increased, and it was decided to establish demonstrations in Penobscot County. Mr. Maurice D. Jones of Orono was secured as director and in August he began an agricultural survey of the county, preparatory to the next season's work.

During the summer successful field meetings were held in all demonstration towns in Kennebec and Washington Counties. Several meetings were also held in Cumberland and Oxford Counties. The meetings were all largely attended and served to acquaint the people of these counties more intimately with the purpose, the scope, and the results of farm demonstrations. In 1914, at least two hundred farms in the five counties will be carrying demonstrations in farming in coöperation with the Extension Service.

It is hoped eventually to establish "farm demonstration work" in every county in Maine, since it appears to be one of the most practical and resultful plans thus far found, to spread and actually set at work fundamental truths in successful farming.

Employment Bureau.

The College is frequently requested to recommend trained men for positions as butter makers, farm managers, poultrymen, orchardists, teachers, and agricultural experts. In order that these inquiries might receive the most careful attention, an employment bureau was organized last year by the Extension Department, in coöperation with the Maine Associaion of Agricultural Students. It is the aim of this bureau to keep in close touch with the work of the graduates of the College of Agriculture, and thus be able to make recommendations to those who may require the services of trained and experienced men.

Needs of the College.

If all the needs of the College were to be enumerated, they would present a formidable list, but it is intended in this report only to set forth those needs which appear most pressing and at the same time most important.

Dairy Barns.—In a report made by the President of the University eight years ago, the need for new dairy barns was clearly set forth and the need of the College in this respect has since then been growing more apparent each year. The present barns are neither sanitary, convenient nor of suitable size for carrying on the work of the College, educationally or commercially, to the greatest advantage to the students or profit to the state. They should be supplanted by modern barns, well adapted to all the purposes of the institution.

Horse Barns.—The horse barns are in a dilapidated condition and new ones should be provided for in the near future. It has been suggested that one of the present dairy barns might be remodelled for the housing of horses and it is possible that this plan could be worked out satisfactorily.

Dairy Building.—The present dairy building is now outgrown, and it will be impossible for all students of whom dairy work is required, to take the subject the coming year. This is a very unfortunate situation, one which will need to be remedied very soon. A new and modern dairy manufactures building is one of the pressing needs of the College.

Machinery Building.—A good sized but not necessarily expensive machinery building, including a repair shop, is needed for two purposes:—First, to house machines and provide a repair shop for classes in farm machinery and farm mechanics; second, to house machinery as a permanent exhibit of up-to-date farm machinery for the benefit of the farmers of the state who visit the University in thousands each year.

Greenhouses.—The present greenhouses are too small for the uses of the students taking work in horticulture, farm crops, and soil bacteriology. They are also old and will soon need a large amount of money expended in repairs. They should be replaced with larger and more conveniently arranged buildings.

General.

The entrance requirements for the four years courses in agriculture, forestry, and domestic science are set forth in detail in the annual catalog of the University.

For the two years courses in agriculture no entrance examinations are required. Students fifteen years of age or over who are prepared for advanced grammar or high school work are eligible for registration.

For admission to the two years course in domestic science it is required that students shall be graduates of a recognized High school or its equivalent, and have in addition some practical knowledge of house work.

Information concerning entrance requirements, college expenses, and student employment will be forwarded on application to the Dean of the College of Agriculture, Orono, Maine.

SPECIAL REPORT

OF THE

Maine Agricultural Experiment Station

FOR THE

COMMISSIONER OF AGRICULTURE

For the Year 1913

MAINE
AGRICULTURAL EXPERIMENT STATION
ORONO, MAINE

Organization July to December, 1913.

THE STATION COUNCIL.

PRESIDENT ROBERT J. ALEY,	*President*
DIRECTOR CHARLES D. WOODS,	*Secretary*
CHARLES L. JONES, Corinna,	*Committee of Board of Trustees*
FREELAND JONES, Bangor,	*Committee of Board of Trustees*
WILLIAM A. MARTIN, Houlton,	*Committee of Board of Trustees*
JOHN A. ROBERTS, Norway,	*Commissioner of Agriculture*
EUGENE H. LIBBY, Auburn,	*State Grange*
ROBERT H. GARIDNER, Gardiner,	*State Pomological Society*
RUTILLUS ALDEN, Winthrop,	*State Dairymen's Association*
LEONARD C. HOLSTON, Cornish,	*Maine Live Stock Breeders' Association*
WILLIAM G. HUNTON, Readfield,	*Maine Seed Improvement Association*

And the Heads and Associates of Station Departments, and the Dean of the College of Agriculture.

THE STATION STAFF.

ADMINISTRATION	CHARLES D. WOODS, Sc. D.,	*Director*
	BLANCHE F. POOLER,	*Clerk*
	GEM M. COOMBS,	*Stenographer*
	JANIE LOGIE FAYLE,	*Stenographer*
BIOLOGY	RAYMOND PEARL, Ph. D.,	*Biologist*
	FRANK M. SURFACE, Ph. D.,	*Biologist*
	MAYNIE R. CURTIS, Ph. D.,	*Assistant*
	CLARENCE W. BARBER, B. S.,	*Assistant*
	JOHN RICE MINER, B. A.,	*Computer*
	HAZEL F. MARINER, B. A.,	*Clerk*
	FRANK TENNEY,	*Poultryman*
CHEMISTRY	JAMES M. BARTLETT, M. S.,	*Chemist*
	HERMAN H. HANSON, M. S.,	*Associate*
	EDWARD E. SAWYER, B. S.,	*Assistant*
	ELMER R. TOBEY, B. S.,	*Assistant*
	HARRY C. ALEXANDER,	*Laboratory Assistant*
ENTOMOLOGY	ALICE W. AVERILL,	*Laboratory Assistant*
	EDITH M. PATCH, Ph. D.,	*Entomologist*
PLANT PATHOLOGY	WARNER J. MORSE, Ph. D.,	*Pathologist*
	MICHAEL SHAPOVALOV, M. S.,	*Assistant*
	VERNON FOLSOM,	*Laboratory Assistant*
HIGHMOOR FARM	WELLINGTON SINCLAIR,	*Superintendent*
	HAROLD C. GULLIVER, B. A.,	*Scientific Aid*
	ROYDEN L. HAMMOND,	*Seed Analyst and Photographer*
	CHARLES S. INMAN,	*Assistant*

THE WORK OF THE MAINE AGRICULTURAL EXPERIMENT STATION IN 1913

DIRECTOR CHAS. D. WOODS.

The year 1913 was the twenty-ninth year of the Maine Agricultural Experiment Station. It began its work April 1, 1885. In the following pages is given a brief outline of some of the more important lines of investigation that have been taken up during the year, and particularly matters which have an immediate practical agricultural significance. The full report of the operations of the Experiment Station will be found in its bulletins and annual report for the year 1913.

GOVERNMENT OF THE STATION.

The development and management of the Station is in charge of a Station Council made up of the President of the College, the Director of the Station, the heads of the various departments of the Station, the Dean of the College of Agriculture, three members of the Board of Trustees, and a representative from each of the state-wide agricultural organizations.

The Station Council meets once a year. At this meeting the Director and other members of the Station staff outline the work which has been undertaken in the past year and make recommendations for the following year. Such of these as commend themselves to the Station Council as well as suggestions from that body are approved and the Director is instructed to carry them out in detail. The appointment of members of the staff is made by the Trustees, and the recommendations of the Council are subject to their approval.

The Director is the executive officer of the Station and passes upon all matters of business. The members of the staff have charge of the lines of work which naturally come under their departments.

Income of the Station.

For the year which ended December 31, 1913, the income of the Station in round figures was: From the United States Government, Hatch Fund, $15,000; Adams Fund, $15,000; from the State of Maine, investigations in animal husbandry $5,000; printing bulletins and reports $4,500. In addition to this there were about $20,000 in appropriation and fees from the State for carrying out the work of inspection and about $11,000 from the sale of farm and poultry products.

Relation of the Station to the University of Maine.

The Station is by act of legislature a department of the University of Maine and in the organization of the University is co-ordinate with the different colleges. The function of the colleges is to teach. It is by the Act of Congress establishing the Station "The object and duty of said experiment stations to conduct original researches or verify experiments .... bearing directly on the agricultural industry of the United States as may in each case be deemed advisable, having due regard to the varying conditions and needs of the respective States or Territories." None of the funds received by the Station can lawfully be used for teaching, for demonstration, for exhibition purposes or for any purpose whatever outside of research into agricultural problems.

Organization of the Station.

The Maine Agricultural Experiment Station was first established as a fertilizer control, but in 1888, when the Hatch Act became effective, the purpose of the Station was changed by that Act so that its work is that of the investigation of agricultural problems. However, the fertilizer control was left in the hands of the Director of the Maine Agricultural Experiment Station, and as various other inspection laws regulating the sale of commercial feeding stuffs, agricultural seeds, drugs, foods, fungicides, insecticides, and other materials, were enacted they were also placed in the hands of the Director of the Experiment Station. The execution of the laws which had to do directly with the agricultural products were not particularly taxing, but with the large duties which were required particularly under the food and drug law, it came about that the time of the Director of the Experiment Station and much of the office force was diverted from the strict purpose of investigation to that of police duties. Recognizing that it was the function of an experiment station to conduct original experiments and investigations in agriculture, and that the function of the State Department of Agriculture is executive, the Legislature of 1913 so changed the laws regulating the sale of agricultural seeds, commercial fertilizers, commercial feeding stuffs, drugs, foods, fungicides and insecticides, that the purely executive part of the work is, beginning with January 1, 1914, in the hands of the Commissioner of Agriculture. The analytical work, including the publication of the results of the examinations, will be conducted at the Experiment Station, as in the past. This probably is the most important legislation, from the standpoint of the integrity and concentration of the work of the Experiment Station, that has recently occurred.

Dissemination of Information.

It is not the function of the Station to disseminate general agricultural or other information. That is for the College through its extension department. It is, however, the distinct duty of the Station to publish the results of its investigations. Although the correspondence that bears upon general agriculture is referred as far as practicable to the correspondence department of the University, the Station receives and answers many thousand letters each year.

The Station publishes: (a) Bulletins which contain the results of investigation; (b) Official Inspections which give the results of the work of inspection; (c) Miscellaneous Publications; and (d) a series of publicity letters that are issued Wednesdays of each week and sent to a limited number of papers to be released for publication on the following Wednesday. The bulletins, the Official Inspections and the chief miscellaneous publications are bound together at the close of the year and make up the Annual Report of the Station. During 1913 there were issued 14 bulletins containing about 350 pages; 10 Official Inspections containing about 350 pages; 28 miscellaneous publications and 53 publicity letters.

Some of the investigations of the Experiment Station which are necessary for the solution of the problems which the Station is investigating are of a technical nature, and so far as possible these are printed in other places, such as scientific magazines published in this country and in Europe, and the bulletins of the United States Department of Agriculture. Something more than 200 printed pages were thus published in 1913.

The following are the principal publications, although there were numerous circulars not here listed as well as more pretentious papers that were printed in scientific periodicals, both American and foreign.

LIST OF PRINCAPAL PUBLICATIONS IN 1913.

Work of Investigation (Bulletins).

209 New Mineral Fertilizer.
210 Spruce Bud Worm and Spruce Leaf Miners.
211 Potato Flea Beetle.
212 Orchard Spraying Experiments in 1912.
213 Aphid Pests of Maine. II. Willow Family.
214 The Biology of Poultry Keeping.
215 The Measurement of the Intensity of Inbreeding.
216 Poultry Notes, 1911-13.
217 Woolly Aphid of the Apple.
218 Tables for Calculating Coefficients of Inbreeding.
219 Comparative Studies of Certain Diseases Producing Species of Fusarium.
220 Woolly Aphids of the Elm.
221 Variations of Fat in Milk. Pedigree System Applied to Guinea Pigs. Aluminum in Chick Feeds.
222 Meteorology, Finances and Index.

Work of Inspection (Official Inspections).

46 Seed Inspection.
47 Fungicide and Insecticide Inspection.
48 Drugs.
49 Protection of Food Offered for Sale.
50 Feeding Stuff Inspection.
51 Weight of Butter.
52 Seed Inspection.
53 Fertilizer Inspection.
54 Insecticide and Fungicide Inspection.
55 Clams, Oysters and Scallops.

Among the more important miscellaneous publications are:

467 The Potato Flea Beetle.

468 Preparation and Use of Lime-Sulphur in Orchard Spraying.
471 Methods of Poultry Management at the Maine Agricultural Experiment Station.
485 Special Report of the Maine Agricultural Experiment Station for the Commissioner of Agriculture for the Year 1912.
488 Summaries of Station Work. I. Apple Studies.

A complete list of the Station publications for 1913 is given in Bulletin 222.

All publications of the Station are distributed free to residents of Maine. The demand for the Station bulletins outside of the State has made such inroads upon the printing fund that a price is put upon them to non-residents with the exception of exchanges, scientific investigators and libraries.

Equipment of the Station.

The Station is well equipped in laboratories and apparatus, particularly in the lines of chemistry, entomology, horticulture, pomology, plant pathology and poultry investigations. Its poultry plant is probably the most complete for the purpose of investigation of that of any experiment station in the country. While the Station carries on some coöperative work such as orcharding, and field experiments with farmers in different parts of the State, most of the work is conducted in its own laboratories and poultry plant at Orono, and upon Highmoor Farm, situated in the town of Monmouth.

Its offices and laboratories are chiefly located in Holmes Hall (named in honor of Dr. Ezekiel Holmes, the first Secretary of the Board of Agriculture) on the University of Maine campus, Orono. It is a two story brick building, 81x48 feet. The poultry plant is also situated on the University of Maine campus.

Aroostook Farm.

More than 70 years ago, Dr. Ezekiel Holmes, the first secretary of the Board of Agriculture, and who was in many ways a pioneer in Maine in the application of science to agriculture, urged the necessity for an experimental farm in Aroostook County. This idea conceived so long ago came to partial fulfillment by the act of Legislature of 1913 providing an appropriation for the purchase of a farm for experimental purposes in agriculture in Aroostook County. The appropriation for the purchase of this farm was $10,000. To the committee this seemed inadequate to obtain such a farm as was needed for the purpose of an experimental and seed farm. In order that a better farm than could be obtained for $10,000 might be purchased, they sought the coöperation of Aroostook citizens. As a result, a farm was purchased in Presque Isle for which the State has paid $10,000 and the citizens of Presque Isle have provided for the payment of the other $10,000 to complete the original cost of the farm and $3,000 for putting up a suitable house.

The farm is well situated two miles south of Presque Isle village. The Bangor and Aroostook Railroad crosses the farm. There was a siding at the point where the direct road from Presque Isle to Houlton crosses the Bangor and Aroostook Railroad, and a flag station has been established there under the name of "Aroostook Farm."

The house and barn upon the farm were destroyed several years ago. One of the best barns in Aroostook County was erected, to replace the one burned, by the last owner. It has a high cement constructed basement, part of which is fitted for admirable potato storage. The farm contains about 275 acres, about one-half of which is cleared. It has several types of soil characteristic of Aroostook County, and it is believed to be in every way suited to experimental work. The house for a farm superintendent will be constructed in the early spring from funds provided by citizens of Presque Isle.

The State made no appropriation for the carrying out of experimental work on this farm in 1913 and 1914. Through the liberality of the management of the Bangor and Aroostook Railroad in contributing $2,500 to the carrying out of investigations in the year 1914 there is made possible the beginnings of experimental work on this farm in 1914. The Directors have given this support clearly recognizing that the railroad will obtain no direct returns therefrom, but believing that the road in common with the County will receive so much indirect benefit that the beginnings of the studies should not be postponed until the meeting of the legislature in 1915. This gift is made with the distinct understanding that it will not be duplcated and is to tide over the existing lack of funds.

As Aroostook Farm was turned over to the Experiment Station there were about 55 acres plowed, ready for the potato crop for 1914. There were about 25 acres in potatoes in 1913, that it was planned by the former owner to seed to oats in 1914.

Among the experiments which it is hoped to begin at Aroostook Farm in 1914, the following may be cited:

Experiment with Oats.

Experiment to test the profitable amount of oat seed per acre for a maximum crop. There is a great diversity of opinion in the county and in the state as to the amount of oat seed that is best used per acre. While this would naturally vary with the different varieties, it is believed that many people in Aroostook County are not merely wasting seed but are decreasing the crop by over-seeding. This will be given as thorough a try-out as is possible in a single season on ten acres, using the Prosperity oats which have been cleanly grown at Highmoor Farm for three years. Fifteen or more varieties of the most promising of the oats which have been grown at Highmoor Farm for the past three years will be tested out in acre plots at Aroostook Farm in 1914.

Experiments with Potatoes.

The hill selection Cobblers which have been made during the past three years at Highmoor Farm will be taken to Aroostook Farm and the testing out continued. Experiments upon the different methods of applying fertilizer to the potato crop will also be as thoroughly tested as is practicable in a single season.

The United States Department of Agriculture will use 12 acres in continuing the testing out of the seedlings and other single tuber tests which they are carrying out at four different sections in the country. For the two preceding years these were conducted on the John Watson farm at Houlton. The study of the chemical effects of potato diseases will be continued by the Department of Agriculture in 1914. A few other minor experiments are planned by the Experiment Station which are not here given.

HIGHMOOR FARM.

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

The farm consists of 225 acres, about 200 of which are in orchards, fields and pastures. There are in the neighborhood of 3,000 apple trees upon the place which at time of purchase had been set from 15 to 25 years. The fields that are not in orchards are well adapted to experiments with corn, potatoes, and similar general farm crops. The house is two story with a large wing, and contains about 15 rooms, well arranged for the Experiment Station offices and for the home of the farm superintendent. The barn is large, affording storage for hay and grain. The basements of the building afford a moderate amount of storage for apples, potatoes and roots.

Highmoor farm is used as a laboratory by the different departments of the Station and part of the work in progress there is described in other parts of this report. Anyone interested can obtain a full list of the field experiments at Highmoor Farm in 1913 on request to the Director of the Station. A similar list for 1914 will be published.

Work of Inspection.

The inspections entrusted to the Maine Agricultural Experiment Station include agricultural seeds, commercial feeding stuffs, commercial fertilizers, creamery glassware, drugs, foods, fungicides and insecticides. In the course of the year this work leads the deputies to visit practically every town of importance in the State at least once and many of them several times.

The work of inspection comprises much more than the actual collection of the samples. The deputy has constantly to be on the watch for goods which are not registered in the case of fertilizers, feeding stuffs, fungicides and insecticides; labels and tags have to be constantly examined in order to see that the statements thereon are apparently in accord with truth. Weighings are often made in order to see that the net weight actually contained in the package does not fall below the guaranteed weight; and there must be constant watch for old, shop-worn and damaged goods.

The fertilizer inspection must of necessity be carried on almost entirely during the early spring months just before that commodity is used by the farmers. While a large amount of fertilizer comes into the state during the fall and winter and is stored in large warehouses, more and more is being shipped into the state by rail and directly to the points of consumption so that the collection of samples of the various brands becomes more and more difficult and involves a larger expenditure of time and money each year.

The feeding stuffs inspection comes naturally during the fall and winter months when commercial feeding stuffs are most in use. This work also increases year by year as the consumption of commercial cattle feeds increases. The importance of this inspection becomes more and more apparent as the number of compounded feeding stuffs on sale increases. The tendency to use waste and inferior materials, screenings, chaff, oat clippings, hulls, cob meal, and other low grade materials, is ever increasing and the importance of having such compounds marked plainly so that the consumer may know exactly what he is getting is, of course, apparent.

The inspection of agricultural seeds also comes during the spring months just before the seed is placed in the ground. A comparatively few samples of seeds are actually analyzed, because the seed analyst himself does the actual work of inspection and no samples are taken unless the appearance of the goods indicates that the guarantees accompanying it may be too high, or for some other reason there is cause for suspicion.

The insecticides and fungicides inspected include all classes of materials which are used to destroy, repel, or mitigate in any way insect and fungus pests. The requirements of the insecticide and fungicide law are more recent than the other inspection laws of the State, but the importance of the work is already evident.

The inspection of foods and drugs goes on constantly throughout the year, and the number of samples collected does not represent in the least either the importance of the work or the scope of the ground covered by the deputies.

The importance of manufacturing, storing and dispensing food materials under sanitary conditions is just being realized by the public. Just how much disease is spread because flies carry with them and deposit upon exposed foods the germs of dangerous diseases, or the dust of the streets containing dangerous disease germs is scattered upon food materials, or the spray from human mouths contaminate food products, can never be ascertained. That diseases are spread by these means, however, is indisputable. In like manner it can never be ascertained of just what value various inspection laws are to the commonwealth, but by comparing the reports of many other states with our own we can feel certain that at the present time the old statement that Maine is the dumping ground for inferior materials can no longer hold true. The character of the various materials offered for sale in the State, which come under the requirements of the various inspection laws, is constantly improving.

The actual work of inspection in the field is accomplished by means of several deputies. The collection of samples of fertilizers, feeding stuffs and seeds is done, as noted above, at certain short definite periods of the year and is usually done by special deputies who search for these particular materials only. The remainder of the inspection work is at the present time done principally by local inspectors appointed to look after some limited locality in which they reside.

By this means the larger towns and cities are at present being constantly inspected and the sanitary conditions of food displays are being constantly improved.

As stated above, with the close of the present year the Director of the Experiment Station is relieved from the executive work under these various laws, which will be enforced by the Commissioner of Agriculture. There will be no radical changes in the enforcement of these various acts. The chemical analyses will be made at the Maine Agricultural Experiment Stations and the results of the examination published by the Station, as in the past.

Biology.

The Department of Biology is chiefly engaged in the study of plant and animal breeding. The final goal of this work is to find out how the common farm crops and live stock may be improved in quality and productivity by breeding. On the animal side the work is largely with poultry and cattle, while on the plant side corn, oats and beans have been the crops chiefly studied.

WORK WITH POULTRY.

During nearly the whole existence of the Maine Agricultural Experiment Station it has carried on work with poultry along one line or another. Two phases of the poultry work of this Station have attracted wide attention, namely its experiments in breeding for increased egg production, on the one hand, and in poultry management on the other hand. In recent years an increasing amount of attention has been paid to the former line of work. This is warranted by the great practical importance to agriculture of the subject of breeding for performance in general. Not only is a working out of the fundamental principles upon which successful breeding for egg production depends proving useful and valuable to the poultryman, but also to the breeder of any kind of live stock who is seeking to improve utility qualities. Poultry probably furnishes more favorable material for working out the laws of inheritance and breeding than any other of the domestic animals.

Another line of work has to do with the physiology of egg production. In this connection a study has been published during the past year of the mode of formation of the white of the egg.

How the White of the Egg Is Made.

The oviduct or egg tube of a laying hen is divided into five main parts, readily distinguishable by gross observation. Beginning at the anterior end of the organ these parts, in order, are: (a) the infundibulum, or funnel, (b) the albumen secreting portion, (c) the isthmus, (d) the uterus or "shell gland" and (e) the vagina.

Each of these parts is generally supposed to play a particular and exclusive role in the formation of the protective and nutritive envelopes which surround the yolk in the complete egg as laid. Thus the funnel grasps the ovule at the time of ovulation; the glands of the albumen region secrete the different sorts of albumen or "white" (thick and thin) found in the egg; the shell membranes are secreted in the isthmus; and finally the glands of the uterine wall secrete the calcareous shell. This is in brief, the classical picture of the physiology of the oviduct.

For some years past experiments and observations have been systematically carried on in the Biological Laboratory of the Maine Station with the object of acquiring a more extended and precise knowledge of the physiology of the hen's oviduct than is to be gained from the literature.

Putting all the evidence together, the following account of the processes by which the hen's egg acquires its white and shell summarizes the results of this study.

1. After entering the funnel the yolk remains in the so-called albumen portion of the egg tube about three hours and in this time acquires only about 40-50 per cent by weight of its total "white", and not all of it as has hitherto been supposed.

2. During its sojourn in the funnel and albumen portions of the duct the egg acquires its chalazæ and chalaziferous layer, and the "thick" albumen layer.

3. Upon entering the isthmus, in passing through which portion of the duct something under an hour's time is occupied instead of three hours as has been previously maintained, the egg receives its shell membrane by a process of discrete deposition.

4. At the same time, and during the sojourn of the egg in the uterus or shell gland it receives its outer layer of fluid, or "thin" albumen which is by weight 50-60 per cent of the total "white."

5. This "thin" albumen is taken in as a dilute fluid by osmosis through the shell membranes already formed. The fluid albumen added in this way diffuses into the dense albumen already present, dissolves some of the latter and so brings about its dilution in some degree. At the same time the fluid albumen is made more dense in this process of diffusion, and comes to have the consistency of the thin layer of the normal laid egg. The fluid albumen taken into the egg by osmosis is a definite secretion of glands of the isthmus and uterus.

6. The addition of albumen to the egg is completed only after it has been in the uterus from 5 to 7 hours.

7. Before the acquisition of albumen by the egg is completed a fairly considerable amount of shell substance has been deposited on the shell membrane.

8. For the completion of the shell and the laying of the egg from 12 to 16, or exceptionally even more, hours are required.

Poultry Management.

At all times efforts are being made to improve the methods of management of poultry on the Station plant. During the past year the Station has issued Circular 471 entitled "Methods of Poultry Management at the Maine Agricultural Experiment Station." This is a revision, with much additional matter, of Farmers' Bulletin 357; it brings the account of the Station methods up to date.

"Dead in Shell."

Careful analysis of the matter leads to the conclusion that there can be but two general classes of causes concerned in the death of chicks in the shell during incubation. The first of these classes of causes must be those which are inherent in the egg which one has attempted to hatch. The other class of causes must include those which are involved in the method of incubation practiced in hatching the eggs. The causes of mortality during incubation which are inherent in the egg itself may be considered first. The developing chick embryo derives the nourishment which it needs for its proper development from the yolk and white of the egg. All the time that it is growing and developing it feeds on these substances. It is, of course, obvious from general experience that if a young growing animal does not get the right kind of food for its proper nourishment it does not make good growth or develop in strength. Improper nourishment means that the young animal will weaken and may finally die. The same reasoning applies exactly to the development of the chick in the egg. It cannot make a proper growth unless it has nourishment of the right kind. Now the yolk and white of the egg are formed in the body of the mother hen which laid the egg. Experience has demonstrated that if this hen is not in good, strong, vigorous physical condition and is not fed the proper sort of food while she is laying eggs, then in turn the yolk and albumen within these eggs which is to serve as food for the embryo during incubation will not be of the sort which will produce strong healthy chicks.

Here then is the clue to the primary factor in the control of death of chicks in the shell during incubation. The first step to take towards preventing mortality in the shell is to see that the breeding birds from which the eggs come are in a strong, healthy, vigorous condition, and that they are fed a proper ration for breeding birds. In the experience of the Maine Agricultural Experiment Station the most important factor in feeding breeding birds is to see first of all that they get a minimum amount of animal food of any kind in their ration. By animal food is meant any food substance of animal origin, such as beef scrap, blood meal, fish scrap, milk, green cut bone, etc. Furthermore it is necessary that the breeding birds have an abundance of fresh succulent green food. During the season of the year when hatching is done the climatic conditions in Maine are such that green food from out of doors cannot be obtained. Under these conditions the most satisfactory source of green food which has been found at the Station is green sprouted oats. These should be fed to the breeding birds in liberal quantities. To give good results the oats should be quickly grown and should be about 6 inches tall above the root at the time when they are fed. This material may furthermore be supplemented to great advantage by feeding cut clover or cut alfalfa which has been steamed. The birds relish this and it has a valuable influence on the quality of the hatching eggs. Attention to these points in the feeding of breeding birds will go a long way in the reduction of mortality in the shell during incubation.

Turning now to the second class of causes, those having to do with the operation of the incubator itself, it is probable that the greatest single factor in incubation causing mortality in the shell is a lack of sufficient moisture. In making this statement it is of course assumed that the operator of the machine is skilled in that work and that he understands how to run the incubator at an even temperature. By improper temperatures chicks may be killed in the shell very easily, but there should be no difficulty in this direction with any good standard incubator, provided the directions furnished by the manufacturers are carefully followed. The need for a continuous and copious supply of added moisture during incubation however is very often overlooked. This necessary added moisture may be supplied in various ways. Some incubators on the market are made with automatic arrangements to supply this water. On the other hand most of the hot air incubators, which are very widely used, lack any such arrangement. In these cases the most satisfactory way of supplying added moisture is by sprinkling the eggs each time they are taken out of the machine for turning, with water warmed to a temperature of from 108-110 degrees. This water may be sprinkled on the eggs by hand as in sprinkling clothes for ironing, or a hand spray-pump may be used for the purpose. The eggs should be put back into the machine when wet. There should be no sprinkling of the eggs after the 18th day of incubation. From this time on the eggs should be left undisturbed until the chicks hatch.

The Value, Method of Preservation, and Economical Use of Hen Manure.

One of the most valuable by-products of any live-stock industry is the manure. Its proper care and use is one of the distinguishing features of a successful stock farm. The high nitrogen content of poultry droppings makes them in certain respects the most valuable of farm manures. At the same time this quality necessitates special treatment to preserve the nitrogen and utilize it economically.

According to experiments carried on at this Station some years ago the night droppings average 30 pounds per hen per year. They contain .8 pound of organic nitrogen, .5 pound of phosphoric acid and .25 pound of potash. At the present price of fertilizers this material would be worth 20 cents. No data are available on the amount of day-voided dung. Since the hens spend less than one-half of their time on the roosts, and since more dung is voided while the birds are exercising than when at roost, it is estimated that during a year probably 45 pounds of dung are voided by each bird while off the roost. Allowing that more than one-half of the fertilizing elements of the day dung are necessarily lost, the value of the total droppings, if properly cared for, should be at least 30 cents per bird per year.

The poultryman or farmer who properly cares for the droppings can add a neat further profit to his business. For example the droppings from 1000 birds, if preserved without needless loss, will be worth at least $300.

Poultry manure contains more nitrogen than other farm manure, because in birds the excretion of the kidneys is voided in solid form (uric acid), with undigested portions of the food. This form of nitrogen is easily available to plants. Unfortunately, however, it is not stable. Putrefactive processes easily change it to ammonia compounds, and unless special care is taken of the droppings one-third to one-half of the nitrogen passes off as ammonia gas.

The mechanical condition of poultry manure is poor. It is apt to be sticky when fresh and lumpy when dry. On this account, if used untreated, it can only be successfully applied to the land by hand, as it does not work well in drills or spreaders. Hen manure used alone is very wasteful of nitrogen as it carries this element in too large a proportion to its phosphorus and potassium.

In the experiments referred to above the attempt was made to find a method of treatment of hen manure which would first prevent the loss of nitrogen, second, add sufficient phosphorus and potassium in forms available for plant food to make a balanced fertilizer; and, third, so improve the mechanical condition of the dung that it can be applied to the land with a manure spreader. Seven different methods of treatment were tested. Summarized the results were as follows: By itself, hen dung is a one-sided nitrogenous fertilizer. As usually managed, one-half or more of its nitrogen is lost, so that as ordinarily used it does not carry so great an excess of nitrogen. Because of its excess of nitrogen it will be much more economically used in connection with manures carrying prosphoric acid and potash. As both acid phosphate and kainit prevent the loss of nitrogen, it is possible to use them in connection with sawdust or some other dry material as an absorbent (good dry loam or peat will answer nicely) so as to make a well balanced fertilizer. For example, a mixture of 30 pounds of hen manure, 10 pounds of sawdust, 16 pounds of acid phosphate, and 8 pounds of kainit would carry about .25 per cent nitrogen, 4.5 per cent phosphoric acid, and 2 per cent potash, which, used at the rate of 2 tons per acre, would furnish 50 pounds nitrogen, 185 pounds phosphoric acid and 80 pounds potash.

At the present price of fertilizing ingredients this mixture is worth about $10.00 per ton. It is a well balanced, stable fertilizer which, while still not fine enough to work well in drills, can be successfully applied with a manure spreader.

The kind of absorbent used should be the one which can be obtained at least cost, since the amount of plant food added by any one of those suggested is negligible, and since they are about equally effective as dryers (the slight acidity of peat gives it some advantage as it helps a little to preserve the nitrogen). It is probable that one of the three can be obtained by any poultryman or farmer at little or no expense.

The absorbent and the acid phosphate and kainit should be kept conveniently at hand and each day when the droppings are collected they should be treated. It may be best to weigh the ingredients a few times, after which it will be possible to make sufficiently close estimates by measure.

The treated droppings should be well sheltered until time to apply them to the land, i. e., shortly before plowing. Any form of shelter may be used. For a temporary plant, or for a small farm, a small wooden building or a bin in a larger building will probably be the best place practicable; but for a large, permanent poultry plant a cement manure shed or tank is advisable. A general farmer also will find such an equipment for the storage of all farm manure a paying investment. A portion of this shed can be partitioned off for hen manure.

A properly constructed cement building will not have to be constantly repaired and frequently replaced like a wooden structure, which rots out quickly when used for the storage of manure. The cement building is water tight, preventing the entrance of water from without and the escape of any unabsorbed liquid manure. It is, in fact, a perfect permanent shelter.

WORK WITH DAIRY CATTLE.

At the last session of the legislature an act was passed providing for the conducting by the Station of investigations in animal husbandry. An annual appropriation was made for this purpose. Work on this line has been well started during the past year. The main lines of study involved are:

(1) The study of existing records of milk production for the different pure breeds of dairy cattle.

(2) The carrying out of definite and controlled matings, both within the pure breeds and in crosses of high and low producing breeds, in order to discover whether this character milk production is inherited in a similar way to the character egg production, which has been studied in fowls.

It is of course obvious that experimental work in this line will take a considerable number of years to produce results. The dairy cow is a slow growing animal and the character milk production is one which does not come into expression until full adult life is reached. However, the milk records now in existence will make it possible to make some beginning at once on an analysis of the inheritance of this character before the results of experimental investigation come into hand.

Collateral lines of investigation in connection with the cattle breeding project include the study of sex determination, of inbreeding and other topics.

Influencing the Sex Ratio in Cattle.

To control the sex of offspring is a thing which the breeder of live stock would very much like to be able to do. Sex control, however, can never be hoped for until the laws of sex determination are known. The search for these laws has engaged the attention of students for centuries past. Many theories regarding the matter have been propounded, but only within comparatively recent years have careful experimental and statistical investigations on sex-determination been made.

Some years ago the Maine Agricultural Experiment Station undertook the collection of statistics in regard to cattle breeding operations in order to find out whether the time of service in relation to the period of heat had any relation to the sex of the resulting calf. About 1860 it was suggested by a European investigator named Thury that if cows were served at the very beginning of heat there would be a tendency towards a preponderance of heifer calves in the resulting offspring. On the other hand if the cows were served relatively late in heat there would tend to be more male calves born. Thury produced practically no concrete evidence in support of his theory and after a few experimental tests of it on a small scale the matter dropped out of notice and has been practically forgotten. Within the last few years, however, experimental studies on sex determination in lower animals like the frog and the toad have tended to show that in its essentials Thury's idea was probably right. In these lower animals it has in some cases been possible to control sex absolutely, that is, to produce all the offspring of one sex.

The statistics regarding sex determination in cattle collected at the Maine Agricultural Experiment Station are the most extensive which have yet been available to test this matter. Putting together all the authentic evidence which has been collected at the Maine Station and at several experiment stations in Germany the relations are as shown in the following table:

Time of Service.	Sex of Calf.		Number of Male Calves to every 100 Female Calves.
Early in heat	134 male	178 female	75.3
Middle of heat	67 male	58 female	115.5
Late in heat	77 male	44 female	175.0
Totals	278	280	

These figures comprise 558 distinct breeding operations to test the matter. They show that when the service was early in the heat there were 133 heifers to every 100 bull calves (or put the other way about there were 75 bull calves to every 100 heifers). When the service was late in the heat this relation was reversed. There were then 175 bulls born to every 100 heifers. These figures have been subjected to the most refined mathematical tests, applied to determine whether they are to be regarded as accidental or as representing a real and definite law of sex determination. The results point with a high degree of probability to the latter conclusion.

The position of the Experiment Station in regard to the results set forth above should be clearly understood. It is not contended or supposed that the time of service in relation to the period of heat absolutely controls the sex of the subsequent offspring. It is believed, however, that the facts show, with a considerable degree of probability, that the sex ratio in cattle can be to some extent modified by controlling the time of service. But the amount of such observed modification is not so great that the matter can be tested with a few individuals.

There is every reason to believe that any effect would only appear in fairly comprehensive statistics. The matter is one of much practical consequence to the stock breeder. Because this is so we would caution the reader against misinterpreting these results. A trial of a half dozen individuals will not in any sense whatever adequately test the accuracy of the results set forth above.

The probability that the sex ratio can be changed by careful attention to this matter of time of service is sufficiently great, in our judgment, to warrant any man in modifying his breeding practice in accordance with it, particularly since in so doing he will be incurring no added risk of any kind. In the every day affairs of life in regard to business, investment of funds, and the like, practical men every day undertake courses of action on the basis of probabilities much smaller than that in favor of getting an increased number of males if cows are served late in heat. The practical cattle breeder in most cases would like, if he could get it, an excess of female calves. All the evidence at hand warrants the belief that by taking care that cows are served as soon as possible after the onset of heat there will be some reduction in the proportion of male calves born. In short, the facts warrant the breeder in paying attention to the time of service in his cattle breeding operations, but he must not suppose that by so doing he can absolutely control the sex of the offspring, or even approach measurably close to absolute control. He can at best merely modify, over a period of years, the sex ratios in greater or less degree, in the direction which he desires.

The Fear of Inbreeding.

A careful study of the history of the best improved strains of live stock of all sorts leaves no room for doubt that the attainment of the highest degree of excellence has always been associated with the practice of a very considerable amount of inbreeding, of rather close degree. It is a curious paradox of animal husbandry in general that while, as a matter of fact, every successful breeder of high grade stock practices inbreeding to a greater or lesser extent, a great many of these men are violent, even fanatical, opponents to inbreeding in theory. Most of them will deny stoutly that they ever practice inbreeding. They contend that they practice "line breeding," but never "inbreeding."

The distinction here is obviously verbal and not biological. The essential and important biological point is that what is actually done is to *purify* the stock in respect to all characters to as great a degree as possible. What the successful breeder aims to do is to get his stock into such condition that he has only one kind of "blood" in it. Expressed more precisely, though unfortunately more technically, it may be said that the breeder endeavors to get his stock homozygous with reference to all important characters or qualities. The quickest way, indeed the only way, practically to obtain this result is by the practice of some degree of inbreeding. Sometimes a great stride towards the desired end may be made by mating brother and sister or parent and offspring together.

That a mating of such close relatives will surely result in disaster is one of the carefully nursed superstitions of breeding, which has often been exploded, but will doubtless always be with us. It may be said that all the evidence which may be gleaned from the experience of stock breeders indicates that the results which follow inbreeding depend entirely upon the nature of the individuals inbred. If one inbreeds weak animals, lacking in constitutional vigor, and carrying the determinants of undesirable qualities in their germ cells, the offspring resulting from such a mating will undoubtedly be more nearly worthless than were their parents. If, on the other hand, one inbreeds in the same way strong and vigorous animals, high in vitality, and carrying the germinal determiners of desirable qualities there may be expected a corresponding intensification of these qualities in the offspring. The time has come when a vigorous protest should be made against the indiscriminating condemnation of inbreeding. It should be clearly recognized that if the experience of stock breeders extending throughout the world, and as far back as trustworthy data are available, means anything at all it plainly indicates that some degree of inbreeding* is an *essential* to the attainment of the highest degree of success in the breeding of animals.

This contention receives full support from the results of modern exact studies in genetics. Such studies show that the

* Of course if the term "inbreeding" makes too violent a strain upon anyone's prejudices, there is no objection to his using for the practice the term "line-breeding," or some other even milder designation.

personal bodily characters of the parents have no causal relation to the personal characters of the progeny. What the progeny shall be like is determined by the constitution of the germ cells of the parents. When by a proper system of selective breeding the point is reached where these germ cells are pure with reference to a particular character, or degree of a character, then that character will unfailingly appear in the offspring, in the degree of perfection in which it is represented in the germ cells. This is the highest goal of the practical breeder. But in a sexually reproducing organism, like the domestic fowl or cattle, purity of the germ cells with respect to the determiners of any character is only to be obtained, in the hands of a practical breeder without special scientific training, by the practice of inbreeding.

It should not be understood that indiscriminate inbreeding without definite purpose or reason is advised, or advocated as a panacea for all the difficulties which beset the breeder's path. All successful breeding is the working out of carefully made plans. In those plans inbreeding has a place.

WORK WITH PLANTS.

Beans.

The experience of the past two years has shown that it is impossible to grow several varieties of beans in adjoining plots without the varieties mixing. The general impression has prevailed that the bean flower was so constructed as practically to ensure self-fertilization and to prevent cross fertilization by insects. The pistil and stamens are entirely enveloped in a sheath or tube-like structure. Generally the pollen will have ripened and the ovule will have been fertilized before the bud fully opens. Without the intervention of insects, self-fertilization would always take place in the bean blossoms.

Last year humble bees were observed working among the blossoms of the bean plants in the Station's variety tests. Humble bees were seen to light on the lower petals of blossoms, which were borne down by the weight of the bee, and served as levers, throwing the stigma and antlers out of the sheath into full view. The bee brushed its body against the exposed stigma and antlers and then flew to other blossoms, again alighting on the lower petals and repeating the operation described above. Hence, it seems justifiable to conclude that the humble bee may be an agent in the crossing of beans.

The crop of beans harvested in the fall of 1912 presented marked differences in size, color, shape and type within the same variety. Even the descendants of single plants supposedly self-fertilized also showed a wide variation in color and shape. Some exhibited an entire lack of uniformity. This was conclusive evidence that the beans propagated in the variety tests of 1911 had been crossed and observations of the bees lead one to believe that the beans were again crossed in 1912. In view of this hybridization it became necessary to devise ways and means of protecting bean plants to prevent crossing by humble bees, especially if one desires to study the inheritance of characters in beans and to originate new pure strains. To accomplish this a screened cage was planned wherein it would be possible to propagate 500 to 600 plants to form the basis of pure lines.

From the experience reported above growers of seed beans will realize that it is advisable to cultivate only one variety of beans at a time. If more than one variety is grown there is bound to result a mixture of types through the agency of humble bees in crossing.

While the Station's work with beans to date has not progressed far enough to enable one to draw many conclusions, some promising types have been separated out which are spreading habit of growth, white blossoms and many pods enveloping all white beans. The seed of this plant has been planted separately during the past two years and each season has produced a high yield of white beans.

Another interesting pure line is one of the Old Fashioned Yellow Eye beans. A plant of this type,—short, erect growing, with white blossoms bearing many pods and yielding beans white in all parts except around the eye, was selected in 1911. This plant also has bred true to type each season. The Old Fashioned Yellow Eye bean is familiar to all in Maine. However, of the three varieties sold in the state by dealers for seed, none is pure. Each will produce many widely varying types. The fixation of the color pattern and shape of bean, and also yield, seems to have been accomplished in the line developed from the one plant just mentioned. The color present in the Old Fashioned Yellow Eye bean is generally a hue of yellow. However, we have found this same pattern also carrying red, black or brown pigment. In what way each of these is produced is another interesting phase of the work yet to be studied.

In addition to these strains of beans there are many others that have been propagated from single plants. Some produce black beans, others all yellow, brown or mottled beans. Some of these may prove to be superior strains for snap beans if not for marketing as dried beans. All in all the bean breeding work at Highmoor is developing many interesting types of beans, some of which promise to be of superior value as a crop.

Oats.

Two lines of work with oats have been carried on at Highmoor for several years. These are (a) variety tests and (b) breeding work.

(a) *Variety Tests.*

The object of the variety tests of oats is first to find out which varieties already on the market are best suited to Maine conditions and second to furnish material for the breeding work. These variety tests were begun at Highmoor in 1910 and have been carried on for four seasons. In all from 20 to 30 varieties have been tested each year. The more promising varieties have been continued in the test from year to year. Those varieties which failed to do as well as expected have been discarded and new varieties substituted in their place.

Seed for these tests was obtained from dealers and growers in the United States and from members of the Canadian Seed Growers Association in Canada. These varieties represented the most productive strains grown in the regions from which they were obtained. All varieties were sown in drills 6 inches apart and at the rate of two bushels by weight of seed per acre. In the earlier tests each variety was grown in a 1-10 acre plot. During the past season a new method has been adopted which is very satisfactory. Instead of having one 1-10 acre plot there were four 1-40 acre plots for each variety. These four plots were scattered over the field so that each variety was tested in a wide range of soil conditions. In calculating the yield per acre the average yield of the four 1-40 acre plots was used as a basis. This is much more satisfactory than the use of a single large plot.

During the past season 21 varieties of oats were tested at Highmoor. Of these, 11 varieties have been tested for four seasons, 8 for two seasons, one for three seasons and one for one season. The average yield both of grain and straw for the four seasons for the 11 varieties tested is given in the following table.

Yield of the Most Promising Varieties of Oats on the Basis of an Average of Four Successive Years Test.

Name of Variety.	Average Yield for Four Years.	
	Bushels of grain per acre.	Pounds of straw per acre.
Irish Victor	63.7	2794
Lincoln	63.0	2879
Imported Scotch	63.0	2793
Prosperity	62.2	2766
Banner	60.5	2820
President	59.3	2722
Silver Mine	59.0	2710
Reg. Swedish Select	57.6	2684
Victor (a black oat)	57.6	2614
Kherson (an early oat)	57.6	2471
Senator (Horse mane oat)	49.25	2985

Among the varieties tested four seasons there are some very interesting types. First among the early varieties of oats is the Kherson. With short, fine, stiff straw supporting a small open head, characterized by short delicate drooping branches, the Kherson often surprises one in its cropping ability. The grain is long, slender, yellow in color and not particularly attractive to the average farmer because of its small size. Nevertheless, this oat is one worthy of attention. Seeded May 1 to 5 it is generally thoroughly ripe by August 1. At Highmoor this variety yielded from 48 to 69 bushels per acre during the past four seasons, giving an average yield of 57 1-2 bushels per acre. The average yield of straw during the same period was 2,466 pounds per acre. In the season of 1913 this oat yielded 61 bushels per acre.

Among the medium late varieties are the Imported Scotch and Irish Victor. These mature generally about a week later than the Kherson. These varieties have a taller straw and larger, more plump, white grains. The Imported Scotch has yielded from 60 to 71 bushels of grain per acre during the past four seasons, the average yield for the four seasons being 63 bushels per acre. The yield of straw averaged 2,793 pounds per acre. The straw of each of these varieties is a little weak. In 1913 the yield of these varieties was as follows:

Imported Scotch,	grain	68	bu.	per	acre,	straw	2,635 lbs.
Irish Victor	"	67	"	"	"	"	3,003 "

Of the late varieties of oats which mature 10 days to three weeks later than the Kherson there were several types in these tests. Only a few of these will be mentioned owing to the lack of space.

An oat which always attracts attention by its long head of the "Horse Mane" type, and tall stiff stout straw bearing very broad leaves, is the Senator. However, this oat has never yielded very satisfactorily. The heads carry many spikelets but the percentage of barren grains is very high so that this promising variety always fails to yield as high as one would estimate from its appearance. The grain is very large, the kernel being enclosed in a thick hull. Often the kernel of a mother oat does not develop, in which case the pin oat is generally enclosed within the hull of the mother oat. The yield of grain ranged from 38 to 63 bushels per acre, giving an average yield of 52 bushels per acre in the four years test. The yield of straw amounted to 3,000 pounds.

The Banner Oat with a yield of 46 to 71 bushels per acre is one of the best late oats tried out in these tests. The plants are tall, leafy, possessing stiff straw, and carrying open heads with stiff upright branches. This oat produced on the average 61 bushels of grain per acre and 2820 pounds of straw during the past four seasons. The grain is medium to large in size, plump and white. It does best on strong moist soil. The President oat is late like the Banner and similar in appearance excepting that the branches of its open head are longer and droop more. Yield of grain 50 to 68 bushels per acre. Straw (4 year average) 2,722 pounds. The grain of this variety is large, plump and white.

The Prosperity oat is also a late variety producing tall leafy plants having stiff straw. The heads are open, spreading with long branches, the grain is white, short and plump. During the four years test the yield of grain ranged from 53 to 73 bushels per acre, averaging 62.5 bushels. Average amount of straw produced was 2,768 pounds.

A black oat, the Victor, is an interesting type. The straw is coarse, tall, stiff, and bears an open head with very long branches. This variety yielded 55 to 60 bushels of grain per acre.

The Lincoln oat resembles the President in general appearance except that it does not grow as tall. The grain is short, very plump and white. During the past four seasons this variety has yielded from 48 to 70 bushels of grain per acre and an average of 2,900 lbs. of straw.

Of varieties introduced since 1910 the Early Pearl, a medium to late variety, is very promising, judging from its performance in these tests. This oat has been grown for several years by Mr. R. L. Copeland of Brewer, Maine. It seems that this variety originated from a single plant found on the roadside and later propagated by Mr. Copeland. It has a uniform appearance and is very productive on fertile soils. In 1912 this variety produced 64 bushels of grain per acre and in 1913 70 bushels per acre. These figures are the means of yields from two plots in 1912 and four plots in 1913. The straw of this variety is tall, stiff, medium size, the heads open, erect. The grain is white, long, medium size, and well filled.

Other late varieties, the Siberian, Abundance and Silver Mine, resemble in general the Banner and President varieties in appearance. The yield has not been as great as that of these two varieties.

These tests will be continued in following seasons in order that each variety may be tested more than two years at least and preferably during five years. In such a period it may be possible to judge of the effects of certain seasonal changes on the cropping ability of these different varieties.

(b) *Breeding Work.*

The work of producing new varieties of oats which would be better suited to Maine conditions was started in 1910. Two lines of work have been carried on. One of these has been the attempt to cross varieties which possess desirable characters and then to isolate from the progeny strains which will possess the good qualities of both parents. Last year about 300 hybrid oat plants were grown. It is too early to make any statement regarding new varieties secured in this way. It will be several years before we can be certain that any new varieties secured in this way are breeding true or that they are better than varieties already existing.

The second line of work has been the selection of individual plants and the propagation of new strains from these. Each year we have gone through the plots and selected out individual plants which appeared to be better than their neighbors. The seed of each plant was kept separate and sown in a single row by itself. Hence all plants in a row were the descendants of one plant. Throughout the growing season notes were made as to the characters and general behavior of the plants in these rows. The plants of each row were weighed and threshed together so the progeny of the original selections were kept free from admixtures. Being self pollinated the oat plant generally breeds true from season to season. To those self-fertilized plants which breed true Johannsen of the University of Copenhagen has given the name "pure line." The culture of the progeny of single oat plants in rows affords a good basis for the study of the characters of the plants and also forms a basis of measuring the value of the selections in respect to the yield of grain and straw. Individual plants, all the progeny of which the test of two years showed to be uniform in type and possessing the ability to transmit the character of high yield, were propagated the following season in plots of two-thousandth acre in area. These small plots were necessary because of the small amount of seed available. The test in plots of this area showed some of the pure lines to be worthy of further trial. These promising lines were propagated the following year in fortieth acre plots. During the past season at Highmoor there were 49 of these plots representing the descendants of 33 plants selected in the season of 1910. Some of these appear very promising. These 33 pure lines represent all the plants, out of 300 originally selected, that were deemed worthy of further propagation. Some of these 33 lines will be taken out of the test this year because they are no better than strains already on the market.

One of the most productive pure lines is worthy of mention here. This new variety, Maine 357, represents an oat characterized by tall stiff straw averaging four feet in height, carrying open spreading heads. The grain is white, fairly long, plump and well filled. On two fortieth acre plots during the past season this oat yielded at the rate of 81 1-2 bushels per acre.

Besides this new variety known as Maine 357 there are six varieties of equal importance whose yields in 1913 ranged from 71 to 75 bushels per acre. All of these varieties originated by the Station are characterized by stiff straw, spreading heads and white plump grain. In 1913 these seven new varieties produced an average yield of 74 bushels of grain per acre. Twenty-one commercial varieties representing the best oats obtainable in the seed markets of this country were also tested at Highmoor last season. These yielded an average of 62 bushels of grain per acre as compared with 74 bushels produced by the seven varieties originated by the Station. This represents an average increase of nearly 20 per cent. in yield as a result of the breeding work over the *best* commercial seed.

Before a final decision is made in regard to these lines it will be necessary to continue the test during another season. At present, suffice it to say, there is a great deal worthy of confidence in the strains of oats that have been developed from single plants at Highmoor.

Corn.

The work with sweet corn and with field corn (yellow dent) has been continued. The field corn of the Cornforth strain has been bred up to a point where it appears to be a desirable sort for the Maine farmer. The past season was an extremely hard one for corn on account of the cold weather during June. However, a fair proportion of this corn matured in good season and was ready for harvest in the latter part of September.

The work with sweet corn suffered more severely from the cold spring. This was chiefly owing to the fact that the plots were on a cold piece of ground.

The new variety of sweet corn originated by the Station was given a further extended test this year. This variety promises to be superior to any corn now grown in the state for canning purposes. It is believed that the work of the past season has brought about a still further improvement in this corn. Owing to the unsatisfactory season this year it is desired to test this corn another year before it is put in the hands of the farmers.

Winter Wheat.

The possibility of winter wheat becoming a grain crop in Maine has often been discussed, and a few records of experiments with this cereal in this state have been found. Another winter grain, namely winter rye, is used much more extensively now than a few years ago as a green food for stock and also as a crop for plowing under to increase the humus content of the soil. In order to determine the behavior of winter wheat under the climatic conditions of this region a small amount of each of two varieties, one the World's Champion, the other Garton's Selected Turkey Red, were tested. These are said to be among the best winter wheats grown in the West.

On September 5, 1912, these two varieties were sown at Highmoor on separate plots. The seed was dropped in drills at the rate of 1 1-2 bushels per acre, and fertilizer, 4-8-7 grade, was broadcasted at the rate of 500 lbs. per acre. The growth of winter wheat is similar to that of winter rye. The leaves spread out upon the ground forming a thick covering before snow falls. By September 27 the plants of the World's Champion and the Selected Turkey Red varieties had developed leaves about 6 inches long. Throughout the winter the plants remained green. The plots on which these varieties grew were situated on a slope where very little snow collected. During the greater part of the winter these plants were unprotected and laid fully exposed to the frequent changes from freezing to thawing temperatures. All in all the environmental factors formed a severe test of the hardiness of these varieties. In the spring growth started at an early date and the plants grew rapidly, attaining maturity by the last of July. On August 1 the crop of each variety was harvested. The grain was well developed, red in color and hard, the straw was stiff, free from rust and of bright appearance. The yield of the two varieties tried out was as follows: The World's Champion yielded at the rate of 30 1-2 bushels of grain and 2,745 lbs. of straw; the

Selected Turkey Red produced 27 1-2 bushels of grain and 2,385 lbs. of straw per acre.

Considering these yields of grain in pounds per acre it is seen that 30 1-2 bushels of wheat are equivalent in pounds to a yield of 57 bushels of oats per acre; 27 1-2 bushels of wheat to 51 1-2 bushels of oats. It should be said that more experiments should be conducted to determine the time of planting in its relation to yield of grain and straw. However, in our judgment the time of sowing winter wheat should not be later than September 5 to get the best results.

Yield of Apples from Individual Trees.

It has been felt for some time that in one respect the records of the individual apple trees at Highmoor were not complete. The yield of apples from each tree has in the past been estimated and not accurately determined. Since in different years such estimates are made by various people they are not suitable for comparative purposes. After all it is the yield of apples that is the important thing to know about a tree. This fact was fully appreciated at the beginning of the experiments. The reason for not attempting to measure the yield has been that it was thought likely to involve too great a loss of labor at a very busy season. With a good crop of apples there are twenty to twenty-five pickers employed at Highmoor. If each man should lose five minutes on each bag of apples it would mean a great loss of time for the season.

However, the necessity of having some accurate measure of the yield of fruit from each tree has been becoming more urgent each year. It was decided that this year we should try out some methods for doing this. With a relatively light crop of apples this year it was possible to work out the details without causing much loss of time.

The method finally adopted was as follows: Large tripods were constructed with the legs about twelve feet long. From the center of such a tripod there was suspended a rod upon which a pair of 60-pound spring balances hung. Such a tripod was placed between the rows of trees to be picked. The pickers all use bags which fasten over the shoulder. Each picker brought his bag of apples to the tripod, hung it on the scales and taking another bag returned to the tree. A man at the tripod recorded the weight of the apples to the proper tree and emptied the bag.

By such methods there is practically no loss of time by the pickers. It is, of course, necessary to have an extra man for weighing and emptying the bags. One man can weigh, record and empty the apples from nine or ten pickers.

Such records continued for several years will give the Station a very valuable set of data. In the first place it furnishes the best measure of the success or failure of most experiments. Thus a fertilizer or cultivation experiment must, if it is successful, show an increased yield of fruit over that given by the control trees. Estimates are not reliable especially in years where the differences are small. Besides such estimates may be unconsciously biased by the observer.

Aside from this the data will furnish many interesting biological facts. Thus it will be of interest to know whether certain trees which yield well in a poor year will also yield well in a good year. Are there trees which are uniformly better yielders than other trees of the same age, size, etc.? If so, is it possible to propagate this high yielding quality by grafting or budding? It is hoped that in the course of time these and other questions may be solved from these data.

Chemistry.

The work of this department for the past year has been devoted almost entirely to inspections and may be considered under the following heads:

Fertilizer Inspection,
Feeding Stuff Inspection,
Food and Drug Inspection,
Fungicide and Insecticide Inspection,
Creamery Glassware Inspection.

The work of the department has been interrupted somewhat by quite extensive repairs on the laboratories. However, the addition of two new rooms and considerable new chemical apparatus will greatly facilitate the work in the future.

FERTILIZER INSPECTION.

Four hundred and eighty-seven samples of fertilizing materials were received and analyzed in the last inspection. Nearly all of these were mixed fertilizer, only 19 samples of chemicals being received. These consisted of 6 samples of nitrate of soda, 5 samples of acid phosphate, and 7 samples of muriate and sulphate of potash.

In addition to the regular determinations of nitrogen, phosphoric acid and potash the quality of the nitrogen in the mixed fertilizers was determined. This work involved four extra determinations of nitrogen and increased the work of analyzing a fertilizer about one-third. It is of value, however, in detecting low grade forms of nitrogen which are often used in low grade fertilizers.

The mineral nitrogen, particularly that in the form of nitrate, is very important to Maine farmers, especially those growing potatoes, and the nitrate content should be considered as much as the total nitrogen.

Manufacturers are still in some instances using very different sources of nitrogen in the same brand of fertilizer. It certainly does not seem to be unreasonable to insist that a high priced and high grade brand of fertilizer be as uniform in the forms of nitrogen that it carries as in its total nitrogen. For instance, it is believed to be necessary in this climate for the best results that a potato fertilizer contain about one-third of its nitrogen as nitrate. If much more is present it is liable to loss from leaching. If much less is present the plant will not have enough immediately available nitrogen. Most of the manufacturers do not appear to attach sufficient importance to this feature. They frequently substitute ammonium sulphate or organic nitrogen for nitrate nitrogen, seeming to have only the total nitrogen in mind.

Even a cursory examination of the tables in Official Inspections 53 will show figures that bear out the above statement. This is as true of the high as of the low priced brands of fertilizers sold in the state. And also it seems to apply to a large number of the makers. It would seem that one should have the right to expect that the goods would be uniformly made and mixed. The variations in character of the nitrogen content seem to indicate that too little importance is attached by the manufacturer to the forms of nitrogen in a definite brand.

It is believed that quite heavy losses in crops in this state have occurred in some seasons from lack of sufficient nitrate nitrogen to give the crop an early start. Every farmer who buys fertilizer for potato growing should know whether it contains the required amount of nitrogen in this form and the manufacturers should be required to furnish such guaranty.

As a rule the results of the analyses show that all the fertilizers sold in the state correspond reasonably close to their guarantee in total fertilizing elements.

FEEDING STUFF INSPECTION.

The feeding stuff inspection is made during the months when the most feeds are used and consequently covers a part of two calendar years. The results of the last completed inspection were published in May as Official Inspections 50. Five hundred and ninety-three samples were collected and analyzed, complete analyses being made of one sample of each brand and protein on all samples. At the present time less than half the inspection samples have been collected. Many samples of cottonseed meals, however, have been sent in by dealers and early in the season many samples were found to be below guaranty in protein,—so much so that several were reported for prosecution. This inferiority did not seem to be confined to any particular brand but even those brands which can nearly always be relied upon to be up to guaranty fell below. The manufacturers claimed that the inferiority was due to bad weather conditions in the cotton growing states when the seed was harvested, which always impairs the quality of the meal it makes. The samples which have been received recently are of better quality and are well up to their guarantees.

Other classes of feeds which have been examined correspond well with the guarantees, and very few adulterated feeds have been received.

FOOD AND DRUG INSPECTION.

A smaller number (726) of food and drug samples have been handled the past season than usual, owing to quite extensive repairs to the laboratories going on, and a smaller chemical force than usual for the last five months of the year. The principal materials examined have been oysters and clams, tested for water content and preservatives; ice creams, tested for butter fat content; rice, tested for glucose and talc coatings; pickles, tested for alum and preservatives; sweet spirits of nitre, which deteriorates quite rapidly, tested for percentage of ethyl nitrite; butter tested for fat, water, salt and casein; molasses tested for sucrose, invert sugar, glucose and water.

FUNGICIDE AND INSECTICIDE INSPECTION.

One hundred and sixty samples of fungicides and insecticides were collected and examined. They comprised almost all kinds of materials used as disinfectants or insect repellents or destroyers. Many of these were examined only sufficiently to determine if their labels were in conformity with the law. All materials suspected of carrying arsenic were tested and those with printed guarantees were analyzed. This included 13 samples of Paris green, 10 of lead arsenate, 9 of poison fly paper, 5 of arsenite of soda, 3 of bordeaux mixture and lead arsenate, 1 prepared bordeaux, one of zinc arsenite, one Rough on Rats, and 4 lime-sulphur solutions.

CREAMERY GLASSWARE.

Under the state law requiring that the glassware used by creameries for testing milk and cream by the Babcock test shall be tested for accuracy, about the usual number (1,500 to 2,000) of pieces have been received.

ENTOMOLOGY.

The work of the Department of Entomology has been confined chiefly to five lines of investigation during 1913. These are ecological and life history studies of aphids; a survey of Maine to ascertain the distribution of leaf hoppers, with special attention to those species which give promise of most economic significance; morphological, ecological and life history studies of the larvæ of the sawflies; a study of seasonal distribution and ecology of Maine crane flies; and field studies of our blueberry insects.

APHID INVESTIGATIONS.

In the report for 1912 a general statement of the purpose and significance was given of our aphid investigations which have been under way for several years. The discovery there recorded of the annual migration of the woolly aphid of the apple from the elm leaf to apple and the resulting knowledge that the elm generations are an essential part of the life cycle of this insect put a new significance upon the economic status of the elm aphids and incited the entomologist of the Station to concentrate attention during the past season chiefly upon the woolly aphids of the elm and two bulletins just issued (No. 217 and No. 220) give the results of this investigation. As a brief summary of the case it may be stated that in New England there are five distinct though closely allied species on the elm. Of these, the most important to us as an orchard state is the species previously discussed which migrates to the apple from the leaves of the American elm. A second species common on the English elm in Maine, and probably introduced into this country with the tree, is a leaf curling aphid which migrates to the roots of currant and gooseberry where it is a serious pest. We do not yet know the full life cycle of the third species, which deserts the curled leaf of the American elm in the spring to pass its summer in some place still remaining to be discovered. The fourth species forms a large gall something the size and shape of a fig on the elm twig in the spring, but we do not know its summer haunts. The fifth species apparently confines itself to the elm alone where it is common, especially on young trees, in woolly clusters on the bark.

A key is given here to aid in distinguishing the woolly aphid of the apple from the other elm species with which it may easily be confused in the spring of the year.

A. Conspicuous woolly colonies on bark of *Ulmus americana.* Throughout the summer on young elms. No alternate host known. Widely distributed in America .... *S. rileyi*

AA. Spring generations in elm leaves, causing various types of deformation.

B. Large baggy gall on *Ulmus campestris.* Alternate host unknown. European species. Taken in Connecticut in 1913 ....*S. lanuginosa*

BB. Terminal leaf cluster or rosette on *Ulmus americana*. Spring migration to apple, mountain ash, and hawthorn. Maine to Colorado ....*S. lanigera* (*americana* in part, of authors)

BBB. Leaf curl or roll type of deformation.

C. Leaf roll. Wax glands of apterous generations and antennæ of winged generations apparently the same as those of the rosette dweller. Spring migration to apple. Recorded as yet only from the south ......*S. lanigera* (*americana* in part, of authors)

CC. Leaf roll of *Ulmus scabra* and *U. campestris*. Antenna of winged generations with V and VI without annulations. Spring migration to gooseberry and currant. European species. In America found in California, Oregon and Maine (1913) ....*S. ulmi* (*fodiens*)

CCC. Leaf roll of *Ulmus americana*. Second apterous spring generation with wax glands distinctly unlike those of *lanigera*. Spring migrant with antenna typically with III not longer than IV+V+VI. Alternate host unknown. Maine to California...........*S. americana* in part, of authors

LEAF HOPPER INVESTIGATIONS.

The insects known as leaf hoppers belong to the same order of insects as the aphids or plant-lice and like them feed by piercing the plant tissue with a sharp beak and sucking the sap. As their name implies, however, they are not stationary like the aphids but hop actively from place to place so that often the damage done by them is hard to trace to its source. Especially is this the case when as often happens fungous troubles find entrance into the plant tissue at the wounds caused by the insects.

Closely allied to the leaf hoppers and included with them to a certain extent in this account are the "frog hoppers" or "spittle insects" known by the blobs of froth, common in meadows and on trees in which the young live.

Most of the species are very inconspicuous both on account of their small size and their close color resemblance to the objects around them. They jump so quickly when disturbed that they are caught with difficulty except by sweeping with a net, and when on the wing they are easily mistaken for other insects except by a person especially trained to recognize them. For these reasons the leaf hoppers themselves though abounding nearly everywhere are almost unknown to the ordinary observer, though their cast skins are frequently found in the wake of their injuries and are more familiar objects than the live insects which discarded them.

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

No comprehensive study of the Maine species of this group having previously been made and the situation in regard to them evidently needing the attention of a specialist, the Maine Agricultural Experiment Station invited Prof. Herbert Osborn, head of the Department of Zoölogy and Entomology at the Ohio State University, to undertake this important work for us. As Professor Osborn is the best American authority on these insects and has studied them in various parts of the United States as special agent of the Bureau of Entomology, it need not be stated that he was prepared to give us the most valuable information as a result of his summer's investigations in this state.

Reporting very briefly some of the results of the season's work on the leaf hoppers of Maine it may be said that Professor Osborn's collections show in general the species to be found in the state and for many of them a considerable amount of data as to distribution over the state and through the season.

At Highmoor Farm some of the species were found to be doing very apparent damage on oats, one species was found working on beans and two or three particularly on the potatoes. The *Cicadula 6-notata* was abundant on oats and grasses at Orono, North Harpswell, Portland, Highmoor, Houlton, Fort Fairfield and Fort Kent. *Empoasca mali* was found on apple and was also plentiful on beans and potatoes at Highmoor and Houlton. Several of the grass feeding species were abundant in the meadows and pastures and a few notably numerous in the salt marsh grasses near Portland. In 1908 *Aphrophora parallela* attacked the new growth pine shoots in the southern part of the State to such an extent that the sap dripped down from the wounded tips like rain-drops from branches after a shower.

The leaf hoppers affecting the cereal and forage crops constitute a very constant factor and the extent of the drain on such crops is doubtless very much greater than is generally appreciated. In some estimates made by Professor Osborn in other parts of the country these insects were taken in grass land at the rate of one and a half to two millions to the acre and in many instances grain fields have been very badly injured (see Bulletin 108, Bur. Ent. U. S. Dept. Agr.). It may be stated that no such serious devastations were found this season in Maine, but meadows and grass lands have shown the presence in large numbers of certain species which are injurious to an extent that makes them an economic factor of importance.

In all approximately 150 Maine species were studied by Professor Osborn which will be discussed in a forthcoming report on the investigations for the season with especial attention to such as are most important from the economic standpoint.

SAWFLY INVESTIGATIONS.

A sawfly belongs to the same order of insects as the bees and wasps but instead of having a sting for an ovipositor, its egg laying apparatus is equipped with a little saw with which it cuts a slit in the tissue of the leaf and deposits an egg in the opening. The adult or winged sawfly does practically no harm, but the young which hatch from her eggs, are as greedy as caterpillars and as completely demolish the foliage they feed upon. The larvæ resemble hairless caterpillars somewhat in their appearance as well as in their feeding habits and are frequently mistaken for them.

Certain species like the currant and gooseberry "worm" the pear and rose "slugs" and the larch sawfly are familiar pests to all who are interested in these plants, and it frequently happens that pine and spruce growths over large areas are devastated by sawfly larvæ.

But in spite of their destructiveness, the larvæ of sawflies have not been given very much attention, only about 150 species for the whole United States having been previously reared and studied.

In order that our Maine species might be adequately handled, this Station invited Dr. A. D. MacGillivray of the University of Illinois to work on the group in this state this summer. As Doctor MacGillivray has made a special study of adult sawflies, his systematic knowledge of the family put him in a position to work up the earlier stages of these insects as only a specialist could.

The task is not a simple one as these larvæ present certain difficulties. Some species for instance are powdery white during one stage and after molting become yellow with black spots. As several molts occur during the growth of the larvæ and as closely related species resemble each other, the precautions necessary in rearing large collections of these insects are evident.

However, about 150 species of larvæ have been taken and recorded, between 40 and 50 species have been reared to the adult stage and others are in their cocoons to emerge next spring. These 150 species have been collected from and reared on the leaves of 36 kinds of trees, shrubs, and plants of economic value either for their products or as ornamental vegetation or because they are so closely related to plants of economic value that their pests should be known.

As a result of this season's work the Maine Agricultural Experiment Station is in possession of an exceedingly fine reference collection of sawfly larvæ and their respective records.

From time to time it is proposed to publish bulletins on such species as are of most significance in the state. On account of their prevalence and the constant inquiries concerning them, the first to be treated will be the sawfly infesting conifers. The spruces, pines and larches in Maine have suffered severely over large areas from the depredations of these insects.

CRANEFLY INVESTIGATIONS.

This family of insects had been almost entirely neglected in Maine, nor had they anywhere received the economic attention which seems their due. There was reason to think that Maine possesses a very extensive fauna in this family and as the larvæ of many species feed upon the roots of grasses their status in relation to corn, oats, wheat, and other grains as well as the native meadow grasses is a matter that could well bear investigation.

Mr. Chas. P. Alexander, of Cornell University, world authority on *Tipulidæ,* undertook for this Station a study of seasonal distribution and ecology of Maine craneflies during the summer of 1913. The outcome of this work was most gratifying, for of the 150 or more species studied none were found which would indicate that these numerous and common insects are a present menace to plants of economic value in Maine, our species being mostly confined to swamplands.

BLUEBERRY INSECT INVESTIGATIONS.

The field observations as to the insect status of the blueberry were supplemented by rearings under control conditions. Among the most common pests bred from the fruit were a fly, a weevil, and two moths. Parasites of the moths were abundant. The results of one season's observations indicate that the situation is well worth following up and this work is to be continued through another season. It might be said that the practice of burning over the blueberry barrens as is the custom is highly to be commended as a means of keeping certain very serious pests in check.

PLANT PATHOLOGY.

The work in this department has been carried on during 1913 upon much the same lines as in the past. While the diseases of other economic plants have been by no means ignored the attention of the plant pathologists has been largely centered upon those which attack the apple and the potato. In addition to the regular lines of investigation much valuable data is accumulated each year relative to the prevalence and distribution of plant diseases within the State. This work is greatly facilitated by the hearty coöperation of the office of the State horticulturist and the directors of extension work in the College of Agriculture. It is also made much more effective through coöperation with the United States Department of Agriculture in connection with the plant disease survey carried on by the Bureau of Plant Industry. The Station pathologist is supplied with printing shipping tags which will carry packages of diseased plants without prepayment of postage and which can be furnished to those who will send specimens.

OCCURRENCE OF PLANT DISEASES IN 1913 WITH RECOMMENDATIONS FOR THEIR CONTROL.

An accurate record is kept of all specimens received giving date and place of the collection, and the name of the collector. The following discussion is based upon the observations made by the pathologists during the season, and upon specimens received from various sources. No attempt is made, however, to include all plant diseases recorded during the season, but simply to mention certain of those which for a particular reason are considered worthy of special consideration.

Diseases of orchard trees and fruits.

Apple scab on the fruit and leaves while quite prevalent was not so common nor so destructive as in 1912. This was without doubt due to differences in seasonal climatic conditions. Mention was made in the previous report of the occurrence of scab on the limbs of some varieties of apples which resulted in more or less killing back of the twigs of the current year's growth. Many more specimens of this form of the disease were collected or received from correspondents during the winter and spring months of 1913. The results of certain studies on this and of spraying experiments on apples are given under a separate heading.

Fewer specimens of crown-gall upon nursery stock were received than for the past two or three years. So far this has all come from trees shipped in from outside the State, no specimens having been received which were reported as coming from Maine nurseries. Apple trees affected by crown-gall should not be set.

Apple rust, which is common and destructive in some states was sent in for the second time since the present record was started some 7 years ago. Both specimens have come from the southwestern part of the state, as apple rust is only found in the vicinity of the red cedar. It is one of the diseases which require the presence of two different or alternate hosts for the development of the fungus which produces it. This fact is the key to the situation with respect to the method of control. If red cedars are removed it is easily eliminated as it is absolutely essential that the fungus pass one stage of its life history upon this tree to be able to re-infect the apple. Recently it has been found, particularly in Wisconsin and West Virginia that lime-sulphur is quite effective in controlling apple rust if applied at the proper time in the spring. However, unless it is impossible to eradicate the red cedar trees in the vicinity of the orchard lime-sulphur should not be relied on wholly in controlling the disease. Also from what has already been said it is evident that apple rust need not be feared in those sections of Maine where the red cedar does not occur.

The quince is also attacked with the same disease, and in Maine appears to be far more susceptible to it than the apple. In fact quince rust is a disease which appears to occur in Maine with a frequency which is far out of proportion to the extent that its host plant is cultivated in the state. Several specimens were sent in during the past season. It attacks the leaves, the limbs, and the fruit of the quince, but it is on the last two that it does the most damage. The affected limbs show swollen or enlarged sections an inch or more in length, not unlike the black knot of plums in shape, but quite different in color. These enlarged portions of the small limbs and twigs are covered with small pustules, and the latter often show feathery projections around the openings. They are quite noticeable when the spores begin to form as the liberation of the latter gives the surface a bright salmon color. Most of the specimens of diseased fruits which have been received by this Station were quite severely attacked by the fungus. They were frequently distorted in shape, and usually covered with the fruiting pustules which showed many of the feathery cylindrical projections which when broken have a fimbriate margin. On account of the liberation of millions of bright colored spores upon the surface of such fruit the diseased portion is of a salmon or even orange color.

Early in the spring, almost before the growing season has begun, the other stage of the quince or apple rust occurs on the red cedar in the form of little swellings of the limbs known as "cedar apples." After the first warm rains come these swell up and become gelatinous and also somewhat orange tinted. It is then that the spores are formed and matured which infect the quince and apple. These spores are not able to re-infect the red cedar. To produce the disease of the latter the other form of the spores must come back from the quince or apple or some closely related fruit.

Where spraying is attempted the quince or apple trees should be sprayed with a bordeaux mixture or lime-sulphur just before the cedar apples on the red cedar become gelatinous, repeating this twice at the intervals of a week or ten days.

Much injury from russeting of apple fruits was observed during the past season which was directly traceable to weather conditions which existed during the earlier part of the season, although this was in some instances incorrectly attributed to spraying. When the fruit was setting, and shortly thereafter, weather conditions were very unfavorable, with late frosts and heavy rains associated with strong, cold winds. Warm weather previous to this, or late in April, forced the flower buds to early opening. These circumstances combined, resulted in almost a total failure of the apple crop. Such fruit as did set was more or less injured. Nearly 32 per cent of the crop of the unsprayed trees at Highmoor Farm were russeted at harvest time, and this could only be accounted for as the result of the conditions mentioned above. Early in the season frost injury was plainly evident on apple leaves in many instances. It is possible that some form of orchard heating such as is practiced in the far West might be effective in preventing disasters of this kind, although unfavorable weather conditions in the spring of 1913 were so prolonged as to make the expense for heating prohibitive.

The usual amount of brown rot and black knot on plums as well as Plum Pockets was received. The recommendations for control are given on pages 295 and 296 of the Report of the Commissioner for 1912, and need not be repeated here. One specimen of peach leaf curl was received in 1913. While this is a very serious disease in some localities it is of little economic importance in Maine since here the peach is grown in a very limited area. An application of strong lime-sulphur just before the buds open, the same as is used for scale insects, will control it. Bordeaux mixture or even a solution of 2 pounds of copper sulphate dissolved in 50 gallons of water, and used as a spray at the same time will also act as a preventive.

Diseases of Field and Garden Crops.

Certain diseases of field and garden crops observed last year are worthy of special mention. The leaf spot of the beet seems to be very common and widespread in the State, and no doubt does much damage. One case was noted at Orono where the same disease was quite injurious to Swiss chard, although it is claimed by those who have studied the subject that this plant is seldom affected to a serious extent.

On beet leaves the spots are at first very small brown specks with reddish purple borders. When the spots reach a diameter of one-eighth inch or more they turn ashen gray at the center but the border remains purple as long as the blade continues green. After a time the leaves blacken and dry up gradually from tip to base. These leaves stand more nearly upright than the healthy ones and are somewhat curled or rolled. The older and more mature leaves are attacked and killed first.

Leaf-spot of the beet can be controlled by bordeaux mixture, but to do so it is important to begin spraying early.

Late blight of celery is a relatively new disease in the United States, and has very recently made its appearance in Maine. It has not been considered a serious malady in Europe, but judging from an outbreak in an Orono market garden in the summer of 1913 it may prove serious here, for it ruined the crop in this instance.

The attacked plants are covered by irregular rusty brown spots more or less in the center of which, after the spots begin to turn brown, may be seen little dark colored bodies imbedded in the diseased tissues. These are the fruiting organs of the fungus. No experiments have been tried at this Station for the control of this disease, but it is claimed that in the field early spraying with bordeaux mixture or ammoniacal copper carbonate is the most effective means of combatting it. There is much danger in placing an affected crop in storage, and where this is done the cellar must be well ventilated and not too moist.

Two diseases of the pea which have been reported in Wisconsin as doing much damage to the crop in those sections where peas are largely grown for canning purposes have been found to a certain extent in Maine. One of these produces spots on the stems and leaves, and these spots have ashen white centers with dark borders. In severe cases the lesions on the stems run together and girdle the stalk. The other disease attacks the base of the stem causing a wilt and early death of the plant.

For control measures it is recommended to use clean seed,—that is from a field where the disease does not occur, and practice a crop rotation of several years before growing peas on the same land again. Thorough drainage and avoiding the use of manure on the surface of soil around the base of the plants is also helpful. In severe cases it is best to gather and burn all vines after harvesting the crop.

Partly on account of the failure of late blight of the potato to appear in 1912, and partly on account of the scarcity of potato bugs, not making it necessary to spray for them, many potato growers neglected last season to spray sufficiently to control late blight and rot. Consequently more loss resulted from this disease in 1913 than was necessary. Otherwise about the usual amount of the common potato diseases were observed.

Several new types of potato diseases are beginning to manifest themselves in this country, and Maine potato growers should be on the alert to prevent their getting a foothold here. Powdery Scab has been found to be quite abundant in certain restricted, neighboring portions of Canada. As yet there have been but three reports of the occurrence of this disease in the United States, and these are not serious outbreaks.

A new disease known as silvery scurf has recently been introduced into this country from Europe, and apparently is by no means uncommon in Maine. In our cool storage cellars it apparently does not develop sufficiently to attract attention, but when sent South into a warmer climate quite characteristic spots may develop on the surface of tubers. These are dark areas on the skin of the tuber which when carefully examined seem to be covered with fine black spots. The disease only attacks the skin, and does not produce a decay, but the tubers on which it occurs are apt to dry up and shrivel rapidly, particularly if the conditions of storage are warm. So far ordinary methods of seed disinfection have not proven successful in its control.

There are several obscure leaf diseases of the potato which have recently been recognized in Europe, and which are known under the names of leaf roll, potato rosette, curly dwarf, mosaic disease, etc. which have appeared to a limited extent in this country. The names indicate more or less the character of the foliage of the affected plants. Potato fields, particularly those intended for the production of seed should be watched carefully, and all plants which show abnormal or unhealthy foliage should be removed. There is reason to believe that some if not all of the diseases of this type are of a physiological nature, and are more or less closely associated with poor seed. There is also evidence that at least a part of them are carried with the seed, and if tubers from affected plants are used for this purpose that the crop will rapidly deteriorate.

Diseases of the Cereals and Forage Crops.

Three rather interesting diseases of this nature have been under observation during the past year. One is a stripe disease of barley, which has been reported as doing more or less damage in some of the western states, particularly Wisconsin, and the same malady has been reported as very injurious in certain parts of Russia. It is of a fungous nature, and appears as yellow-brown stripes on the leaves. Since the disease may be carried by the seed the hot water or formaldehyde treatment the same as for smut is advised.

A new leaf spot disease of timothy was found in Orono last summer. The fungus which caused it has been previously reported on orchard grass in Vermont, but so far as determined this is the first case recorded on timothy. It appears in the form of light yellow spots with reddish borders, and having many small black dots scattered upon them. These latter are the fruiting bodies of the fungus. No method of treatment can be advised at the present.

An anthracnose disease of clover has been observed in Maine for the past two or three years. This appears similar if not identical with one previously reported from Tennessee. This appears as brownish spots and streaks on the stems and leaves of red clover which eventually result in premature ripening and dying. There is no doubt that this disease has done considerable damage in Maine. The only remedy yet obtained is the selection and growing of resistant strains of clover.

APPLE SCAB ON THE LIMBS A SOURCE OF SPRING INFECTION.

From a financial standpoint apple scab is probably the most important disease with which the Maine orchardist has to contend. Anything which tends to increase the amount of knowledge which we have regarding the life-history of such a parasite simplifies the problem of its control. During the past year the Station pathologists have made a discovery regarding one of the means by which the apple scab fungus passes the winter in condition to start new centers of infection the following spring which is of considerable local significance.

It has been generally taught, and often asserted with considerable assurance by writers on this subject in this country that apple scab lives over winter only in one way, namely upon the fallen leaves of the season before where it produces an entirely different form of spore—the so-called perfect stage of the fungus. Last year's report mentioned the fact that specimens of apple branches had been obtained which showed the growth of the current season badly attacked and in some cases killed back by apple scab.

Cases of limb infection were followed through the winter and it was found that the fungus was alive upon these limbs in the spring, that the summer stage spores thereon were still viable as spring approached and were capable of infecting the leaves as soon as the latter were put forth. A small orchard of McIntosh trees badly affected in this way in 1912 developed a severe attack of scab on the leaves early in the season of 1913, although they had been sprayed in the usual way with summer dilution lime-sulphur. On the other hand adjoining trees which showed equally bad cases of limb infection, but which were sprayed with a strong, or dormant spray of lime-sulphur just before the leaf buds opened were practically free from scab on the foliage during the summer of 1913. It would seem then that to control this form of the disease requires a dormant spray, just before the leaf buds open.

It is not claimed that the spores of the perfect stage of the apple scab fungus, formed on the leaves of the season before, which have lain on the ground under the trees during the winter, are not the source of a large amount, and usually all of the spring infection. It is maintained, however, that with certain varieties limb infection is an important and serious factor in carrying the disease over winter and that this form requires a special treatment with a dormant spray if it is to be effectually controlled.

The data regarding varieties of apple trees which are affected in this way is incomplete, but while this form of the disease has been recorded before in this country it must be remembered that this is the first case where it has been definitely proven in America that apple scab remains alive over winter on infected limbs. It is to be expected that those varieties which are most susceptible to leaf and fruit infection will be more likely to have the limbs attacked. Observations so far made indicate that this supposition is correct. In an orchard containing 7 varieties, McIntosh and Fameuse were the worst attacked. Milden and Westfield ranked next in order of susceptibility. Only an occasional twig was found affected on the Northern Spy trees and these but slightly, while Oldenburg and Tolman trees were entirely free from injury.

THE EUROPEAN APPLE CANKER IN MAINE.

Observations made during the past season show that the European apple canker is not only present in Maine but that in some localities it is quite common. In one young orchard the cankers were found on the trunks of several trees while in older orchards they appeared more abundant on branches an inch or two in diameter. Several were found in crotches, suggesting that they might have followed winter injury. The larger part of them, however, showed the remains of a dead twig in the center indicating that the fungus may have gained entrance thereby.

The fungus associated with the cankers was easily isolated and while it is too early to make definite conclusions it appears to be capable of producing the disease upon inoculation to healthy limbs and twigs. These cankers as they occur in nature are illustrated in Bulletin 223 of this Station.

ORCHARD SPRAYING EXPERIMENTS IN 1913.

The fourth series of experiments in orchard spraying were carried out at Highmoor Farm during the summer of 1913. While the crop was very short on account of unfavorable weather conditions at blossoming time and apple scab was not so severe as was the case the previous season, some very interesting results were secured.

Perhaps the most important result from a practical standpoint was from the use of arsenate of lead as a fungicide. This is a well known and effective insecticide but its fungicidal properties either have been overlooked or have not been fully appreciated. The use of 4 pounds of arsenate of lead paste to 50 gallons of water in 1912 resulted in fruit as free from scab as where lime-sulphur was applied with 2 pounds of arsenate of lead paste to each 50 gallons. These results were fully confirmed in 1913 with 2 pounds of dry, powdered arsenate of lead instead of 4 pounds of the paste. Even one pound of dry arsenate of lead to 50 gallons proved to be two-thirds as efficient in controlling apple scab as lime-sulphur combined with the same amount of poison.

Arsenate of zinc used with lime-sulphur in 1912 resulted in no injury but in 1913 the same lot of material caused severe leaf-spotting and considerable defoliation. The same effects were obtained with 2 pounds of "Soluble Sulphur Compound" and one pound of dry arsenate of lead in 50 gallons of water. This last combination appeared to be quite efficient in scab control, however. "Atomic Sulphur," another proprietary compound, also gave satisfactory results as a preventative of scab, but caused no injury to fruit or foliage.

The results secured in 1913 strengthened the conclusions suggested by the work of the previous year that a dilution of lime-sulphur 20 per cent stronger than standard could be used on Ben Davis trees with little more danger of injuring the leaves or russeting the fruit and the increased efficiency in scab control would more than pay the added cost, particularly where the lime-sulphur concentrate is prepared at home.

"LITTLE POTATO" OR RHIZOCTONIA DISEASE.

Every New England housewife is familiar with the little brownish or almost black patches or nodules of what is generally supposed to be dirt, very frequently found closely adhering to the surface of potato tubers. Unless these are numerous or large they are not usually noticed till an attempt is made to wash the tubers. The notion that these bodies are simply particles of closely adhering, black soil is farther strengthened by the fact that they may be, with some difficulty, removed by means of a stiff brush or the thumb nail, leaving the skin of the potato smooth and uninjured. As a matter of fact they are a mass of closely woven threads or the resting stage of a fungus which has long been known under the name of Rhizoctonia. It was classed among the so-called sterile fungi till it was discovered that in the summer it grew up around the base of growing potato stalks and there produced spores of a definite type.

Rhizoctonia is an almost universal inhabitant of potato soils all over New England and doubtless the same thing is true for all potato growing sections of the country. While it has been known for years as capable of attacking the below-ground parts of the stems of a considerable variety of unrelated plants it has not in the past been generally recognized or accepted as a serious cause of potato disease, except in a very few localities.

It appears to have been the cause of a partial failure of the crop on one field in Maine for the past two years, and evidence is being accumulated which shows that it does more or less damage in some other sections, particularly on Irish Cobblers. It may be that this fungus is one of the factors responsible for imperfect germination some seasons.

It is possible to give only a preliminary report on the occurrence of the disease in this state at the present time. Nothing is known as to what conditions or kinds of soil are favorable or unfavorable to it. The fungus is so common in all kinds of soils that disinfection of the seed will be of little help unless new land is being used for planting. If disinfection is attempted, corrosive sublimate should be used as formaldehyde is not entirely effective upon it.

The injury is all below ground and the plants may be attacked at any time after the sprouts begin to start from the seed pieces. The sprouts which are attacked first or most severely, either never reach the surface of the ground or come up much more slowly than the healthy plants. The diseased stems show brownish patches or areas of varying size, situated anywhere on the parts below the surface of the soil. These lesions start at the surface, are not so black as those produced by blackleg, and do not invariably start from the base and work upward as is the case with the latter disease. Badly affected plants are either cut off and killed or have a stunted appearance, frequently showing leaf-roll or rosette characteristics. Sometimes a stalk will be cut off and then throw out new branches from below.

Fields attacked with Rhizoctonia are quite sure to prove deceptive in the matter of yields. While the plants may be considerably affected by the fungus the majority will appear strong and thrifty till a few weeks before normal maturity. Then, especially if a period of dry weather comes on, they will suddenly wither and die. When the crop is dug the yield falls far short of what it should be and consists of an abnormally large number of small tubers, many of them not much bigger than marbles—hence the name "Little potato disease." The little potatoes result from the fungus cutting off the tuber-bearing stolons as fast or nearly as fast as they are produced.

POTATO SCAB.

The work upon potato scab which has been going on for several years has been continued. Much of that which has been done during the past year has been along the line of laboratory studies of the organism which causes the disease, which while important and necessary are not of general interest except where the facts discovered admit of practical application.

Comparative studies of a large number of cultures of organisms isolated from scabby tubers checked up by inoculation tests, showed that potato scab obtained from many parts of Maine, from several different states and from Canada and Russia is the result of the attack of the same parasite. This of course refers only to the common type of potato scab.

Laboratory experiments showed that the common potato scab organism is extremely susceptible to the effects of direct sunlight. Fifteen minutes exposure was sufficient to kill all of the germs of the disease when spread out in a thin layer in a culture dish. This explains why sunning potato seed for several days before planting tends to reduce the amount of scab on the crop. It was also determined that the organism is very readily killed by drying and that it is destroyed by much weaker dilutions of formaldehyde and corrosive sublimate than are usually employed for disinfecting purposes. However these stronger solutions are necessary for disinfection on account of the fact that the scab organism is fairly well protected by the corky tissues covering the diseased spot.

In an experiment to test how long potato scab would remain alive in the soil without the presence of any crop, the details of which it is not necessary to give here, it has been found that the organisms causing the disease were able to persist in the soil kept entirely free from vegetation and outside contamination for at least 3 years. This work will be continued for several years. A part of the same experiment has also to do with the question of what effect growing various grains, grasses and clovers on scab infected ground has upon the continuance of the germs in the soil.

A TWO-WHEELED POWER SPRAYER FOR POTATOES.

The ideal potato sprayer is one which will cover all parts of each and every potato hill thoroughly. This means that by the use of such a sprayer the lower leaves and the under sides of all leaves are as well coated and protected from fungous attacks as the upper sides of the outer leaves of the hill. Bordeaux mixture is a preventative and not a cure and it must be on the leaves before the spores of the parasitic fungus which causes the blight. Any application of a spray which only partially or slightly meets these requirements must not be expected to give complete protection from disease.

One nozzle to the row and 50 gallons of bordeaux mixture to the acre should never be expected to give complete protection, and should never be used except when the plants are small. As the plants increase in size the number of nozzles should be increased, using 2, 3 or 4 to each row as required and so arranged that they will cover each row thoroughly, but so directed toward the row that the cones of spray will each strike it independently and not interfere with each other. This is the ideal but so far it has not been possible in the past to entirely realize it.

Some very efficient traction sprayers have been developed but to haul a 100 gallon tank of spray and supply pressure for 4 nozzles to each of 4 rows or16 nozzles in all requires a combination of a most efficient pair of horses and an equally efficient pump. In an attempt to solve some of these difficulties an experimental two-wheeled, gasoline-power sprayer was constructed at Highmoor Farm and used there during the summer of 1913. This machine was by no means perfect but it is felt that it does point the way toward the next step in the improvement of potato sprayers.

This sprayer was mounted on a pair of extra heavy wheels with an equally strong axle. For power the engine and pump from one of the orchard sprayers was used. To save expense as this was an experiment which might prove impractical a 50 gallon barrel was used for a tank. A 100 gallon tank would be necessary in practical work and this full, with the combined weight of it and the engine, would have hauled easier than a traction power sprayer carrying the same size tank.

A special spray boom was constructed and when the plants were large 4 nozzles were used to each row, 2 on top and 2 between the rows. Those above the row were placed 6 inches apart or 3 inches each side of the center, one being directed forward and downward and the other backward and downward. In this way the cones of spray did not interfere with each other, the whole top of the row was covered, the spray striking the row in a slanting direction instead of directly downward, thus securing greater penetration to the interior of the hill and partially forcing the surface leaves upward and hitting the undersides. The nozzles between the rows were of the 45° type. They were attached to a T at the end of a 3 foot pipe which nearly reached the ground between the rows. This T was placed parallel to the rows to avoid catching the vines as much as possible and to permit the adjustment of the nozzles in the proper direction. By rotating the 45° nozzles on the axis of the T they could be adjusted so as to direct the spray forward and upward against the underside of one row and in a like manner backward against the opposite row.

SPRAYING FOR BEAN ANTHRACNOSE.

Bean anthracnose, commonly known as rust, is frequently a very serious and destructive disease in Maine. Rather contradictory results have been secured in attempting to control it by spraying. Based on the assumption that failures in the past might be due to beginning too late and not spraying thoroughly enough some experiments were planned and carried out at Highmoor Farm last season.

The field was planted with seed from a crop where much injury from anthracnose was recorded the season before, and this seed showed plenty of evidence of anthracnose upon it when planted. The field was divided into 3 equal parts, one-third to be sprayed with bordeaux mixture, another with lime-sulphur diluted the same as for summer spraying of apple trees, while the remainder was left as an unsprayed check. The first application was made soon after the first foliage leaves formed and this was repeated every week or ten days till the pods were all set and some of them had attained considerable size.

Unfortunately weather conditions apparently were not favorable for the best development of anthracnose, for less than 5 per cent of the pods were affected on the unsprayed check. The disease was almost entirely controlled where the bordeaux mixture and lime-sulphur were used, there being less than two-tenths of one per cent of the pods affected on the sprayed plots. It is important to note however that heavy applications of bordeaux mixture at the same strength as used for potatoes and equally thorough applications of lime-sulphur diluted as for use on apple trees in foliage produced no detrimental effects whatever on the bean plants.

COMPARATIVE STUDIES OF THE GENUS FUSARIUM.

A preliminary account of these studies was given in this report for last year, with special emphasis upon the practical significance of the results obtained. That part of the work which has to do with the relationship of the organisms and a large amount of data concerning their cultural characters and their ability to attack different host plants, as shown by inoculation tests, has been written up and published in Bulletin 219. While some very important immediate practical results have been secured this was primarily a research problem involving several factors of a broad and fundamental nature. The collection of the published data required much painstaking and careful labor on the part of Doctor Lewis, the author of the bulletin.

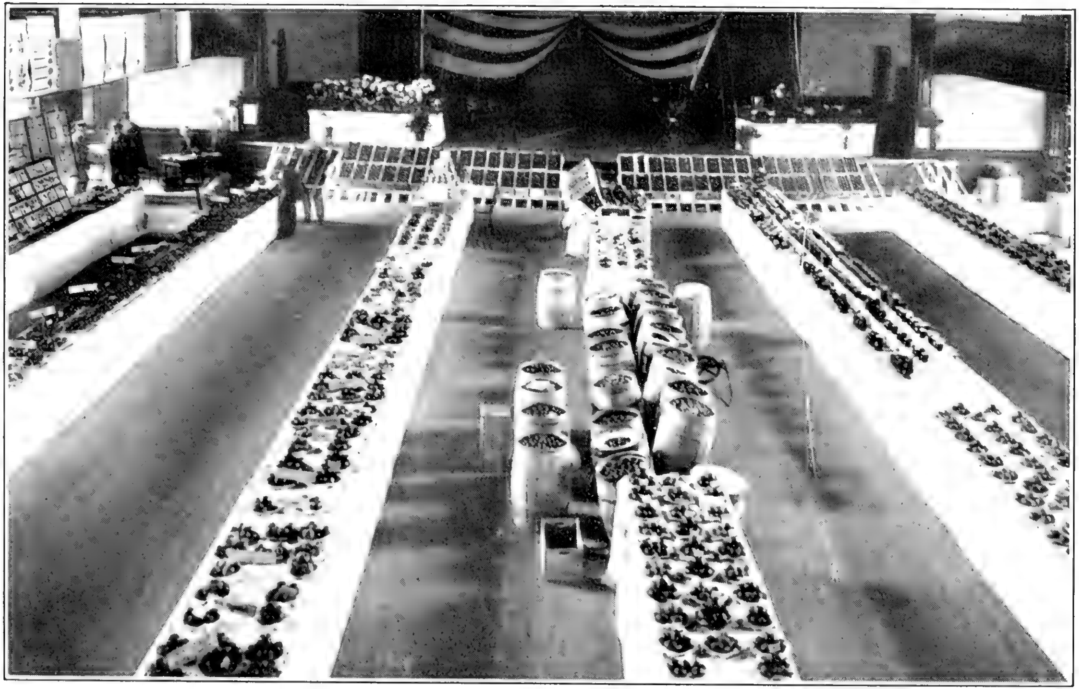
As has been suggested above, this study has been carried on for some years, Dr. Lewis paying especial attention to the pathogenicity of the various species isolated from different hosts. His conclusions regarding relationships were based largely upon the behavior of the different organisms in culture. About 2 years ago a full set of these cultures was turned over to Dr. H. W. Wollenweber of the Bureau of Plant Industry at Washington who was making a special study of the relationships of the members of the genus Fusarium. The determinations made by the latter, based on the size and shape of the spores, etc., were accepted and the names which he gave to the strains obtained from different hosts were adopted. It may be said that his conclusions were largely in accord with those obtained by Doctor Lewis working independently and based upon the cultural characters of the organisms.

In all 46 different strains of Fusarium were studied, all but 3 of which were isolated in this laboratory from diseased plants. The following list gives an idea of the wide range of hosts involved; Apple fruit, china aster, dent corn, flint corn, sweet corn, cucumber, fowl meadow grass, June grass, quack grass, redtop, timothy, pea, potato, summer squash, winter squash, sunflower, tomato and wheat.

Definite conclusions were reached as to the identity of 32 of the 46 strains of organisms under consideration or practically all of those which were carefully studied. In all it was found that only 11 species were represented in the entire collection. Ten of these proved to be species already described, although 2 of the 10 were classed as new varieties and one had been previously described as belonging to an entirely different genus. This last, *F. poæ*, is of particular interest as it appears to be of considerable economic importance in Maine, being associated with "silver top" of various grasses. It was isolated from dent, flint, and sweet corn, fowl meadow grass, June grass, quack grass, redtop, timothy and potato tuber. This same fungus has been credited with being the cause of a decay of carnation buds in Nebraska and New York. In this connection an important fact was discovered. It was found that the strains from June grass, quack grass, redtop and timothy were capable of causing the carnation disease while the remaining strains of the same species did not do this, but so far as discovered were identical with the first mentioned in every other respect.

The final studies have shown that neither of the species which are commonly associated with decay of apples in Maine are identical with that which produces a similar apple rot of Europe. This work represents the first record of an apple disease caused by any representative of the genus Fusarium in America. This is somewhat remarkable as all of the strains tested were more or less pathogenic to apple fruits, and at least one more in addition to the 2 mentioned produced a rapid and complete decay.

It is also interesting to note that 5 species of Fusarium were isolated from decaying potatoes and 2 of these are also the cause of apple decay. Numerous other facts of a similar nature were brought out with reference to other, unrelated host plants, all going to show, as has been proven with certain other plant diseases, especially the powdery mildews, that the old notion that a different host means a different species of the parasite is by no means correct. At the same time, as has been pointed out in connection with *F. poæ* strains which to all appearances are of the same species may differ biologically in their ability to attack a given host.



A general view of a part of the exhibits at Annual Meeting, State Pomological Society, Lewiston, Nov. 18-20, 1913.

ANNUAL REPORT

OF THE

State Pomological Society

1914-1915

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Roak, George M	Auburn
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Sawyer, Andrew S	Cape Elizabeth
Saunders, Ernest	Lewiston
Seavey, Mrs. G. M	Auburn
Simmons, H. J. A	Waldoboro
Skillings, C. W	North Auburn
Smith, Frederick O	New Vineyard
Stanley, H. O	Winthrop
Staples, Geo. W., 904 Main St.,	Hartford, Conn.
Stilphen, Asbury C	Gardiner
Supt. Maine Sanatorium Farm	Hebron
Taylor, Miss L. L. (Lakeside)	Belgrade
Thomas, William W	Portland
Thomas, D. S	North Auburn
Thurston, Edwin	West Farmington
Tilton, William S	Boston, Mass.
Townsend, Mrs. B. T	Freeport
True, John W	New Gloucester
Twitchell, Geo. M	Auburn
Vickery, James	Portland
Wade, Patrick	Portland
Walker, Charles S	Peru
Walker, Elmer V	Oxford
Waterman, Willard H	East Auburn
Waugh, F. A	Amherst, Mass.
Weston, Joseph	Gardiner
Wheeler, Charles E	Chesterville
White, Charles M	Bowdoinham
White, Mrs. Annie	Bowdoinham
White, Edward L	Bowdoinham
Woods, Chas. D	Orono
Wright, Frederick	Bath
Yeaton, Samuel F	West Farmington

ANNUAL MEMBERS FOR 1913.

Adams, F. S. .... Bowdoinham
Allen, Albion P. .... East Hebron
Bailey, Mrs. E. A. .... Winthrop Center
Bailey, F. C. .... North Auburn
Bass, Lizzie E. .... Wilton
Bass, Mary A. .... Wilton
Bisbee, Herbert L. .... East Sumner
Bird, M. C. .... Orono
Blanchard, C. .... Farmington
Bowers, Dr. J. W., 732 Congress St., Portland
Bray, Norris E. .... Auburn
Bragger, W. B, Route 3 .... Dexter
Brown, Sydney F. .... West Sumner
Bryant, C. A. .... Livermore Falls
Burr, Perez .... Freeport
Buker, J. D. .... Monmouth
Carll, E. C. .... Augusta
Case, Charles L., 84 Williams St., New York City
Cleaves, W. W. .... Sangerville
Colby, J. W. S. .... South Paris
Conant, A. H. .... Auburn
Conant, H. L. .... Hebron
Conforth, W. H. .... Auburn
Cummings, C. W. .... Hebron
Cummings, R. L. .... West Paris
Dickey, E. A. .... Greene
DeCoster, Miss Helen .... Buckfield
Deering, Arthur L. .... Augusta
Dolloff, E. W. .... Standish
Dolley, Walter .... Old Orchard
Donnell, A. H, Route 1 .... Bath
Dunn, F. G. .... Norway
Dunlap, E. J. .... Farmington
Elder, George K. .... Lewiston
Erskine, George B. .... Jefferson
Fletcher, Mrs. Nora L. .... Wilton
Fowles, A. W. .... Auburn
Frost, A. C. .... Sabattus
Frost, H. L. .... Arlington, Mass.
Gardner, A. K. .... Augusta
Gee, Charles C. .... Lewiston
Gibbs, B. W. .... Bridgton
Goodspeed, Mrs. F. J. .... Wilton
Guptill, E. E. .... Cornish
Guptill, Mrs. W. T. .... Topsham
Haines, William T. .... Waterville
Hardy, Walter M. .... Brewer
Harris, A. N. .... Portland
Harrison, J. G. & Sons .... Berlin, Md.
Hinds, William T. .... Winthrop
Hobart, Oscar B. .... Auburn
Hopp, W. L. .... Dryden
Ingraham, William M. .... Portland
Irish, Dr. I. C. .... Bowdoinham
Irish, James E. .... Buckfield
Johnson, E. E, Route 1 .... Hebron
Jones, Austin .... Bangor
Jones, George T. .... Fairfield Center
Leavitt, Arch D. .... Turner
Lee, Lyman K. .... Foxcroft
Lewis, Dr. C. E. .... Orono
Littlefield, Eben E. .... Belfast
Littlefield, J. R. .... Brooks
Long, Hon. John D. .... Buckfield
Maddocks, H. Fremont .... North Ellsworth
Maloon, W. L. .... Sabattus
Manter, A. N. .... Wayne
Markley, H. A, Route 4 .... Auburn
Marson, H. F., 111 Dudley St., Medford, Mass
Merrill, A. L. .... Auburn
Merrill, C. A. .... Auburn
Merrill, Dr. Leon S. .... Orono
Millspaugh, L. H, Route 21 .... Winthrop
Morang, C. L. .... Ellsworth
Morse, Lawrence G. .... Buckfield
Mosher, C. M. .... Wilton
Nichols, W. A. .... Hebron
Nowell, F. E. .... Fairfield
Noyes, Reno P. .... Wilton
Page, E. E. .... East Corinth
Patch, Edith M. .... Orono
Patten, R. T. .... Skowhegan
Payne, Henry S. .... Gardiner
Pease, Charles M. .... Anson
Perley, C. A. .... Winthrop
Philbrook, E. E., 233 Spring St. .... Portland
Philbrook, H. C. .... Greene
Pierce, Arthur W. .... Woodfords
Pierce, Franklin .... Hebron Station
Pollard, D. A., 461 Court St. .... Auburn
Pratt, O. M., R. F. D. .... Plymouth, N. H.
Purkis, A. L. .... Buckfield
Record, G. B. .... Buckfield
Record, John P. .... Buckfield
Reynolds, W. E. .... Monmouth
Ricker, W. J. .... Turner
Rines, J. H. .... Portland
Roberts, John A. .... Norway
Roberts, W. G. .... Alfred
Robbins, W. K. .... Camden
Russell, A. C. .... Kents Hill
Sanderson, E. B. .... Greene
Savage, Will N., Route 38 .... Waterville
Sawyer, C. F. .... Hebron
Schrimpt, William E. .... Farmington
Smith, M. J. .... Hebron Station
Spaulding, S. J. .... Buckfield
Soule, A. M. G. .... Wiscasset
Stetson, C. S. .... Greene
Sturtevant, Ernest F. .... Auburn
Sweetser, F. R. .... Cumberland Center
Sweetser, Herman P. .... Cumberland Center
Tainter, Albert W. .... Dixfield
Thompson, C. R. .... Jay
Thorne, Sadie A., Route 4 .... Auburn
Walker, S. W. .... East Dixfield
Warren, F. W. .... Buckfield
Warren, M. A., Route 1 .... Buckfield
Washburn, C. C. .... Mechanic Falls
Whiting, F. E. .... Hebron
Whittier, A. L. .... Chesterville
Wood, H. O. .... Lewiston
Woodward, J. H., Route 6 .... Auburn
Woodworth, W. H. .... Berwick, N. S.
Wyman, F. L. .... West Paris
Yeaton, G. A. .... Norway

A portion of the exhibit of jellies, preserves and canned goods at Annual Meeting, Maine State Pomological Society, Lewiston, Nov. 18-20, 1913.

ANNUAL MEETING
OF
MAINE STATE POMOLOGICAL SOCIETY,

LEWISTON, NOVEMBER 18, 19 AND 20, 1913.

TUESDAY EVENING, NOVEMBER 18.

ADDRESS OF WELCOME.

HON. W. B. SKELTON, President Lewiston Chamber of Commerce.

I rejoice in the opportunity in behalf of the business and professional interests of Lewiston to participate with you in the opening exercises of your annual exhibition. A word of appreciation of the work of your organization is pleasant and appropriate. A word of explanation of the work and purposes of our organization will, I trust, not be out of place. And a suggestion or two concerning our reciprocal obligations cannot be entirely without profit.

Your society has been in existence for a period of forty years. The Act of incorporation was signed by Gov. Perham, February 17, 1873. I am not familiar with its more remote past. I presume it must have traveled the up-hill road common to all pioneers in a work of general uplift. The fact that it has maintained its organization during all this time and is today a state-wide institution drawing patronage and exhibits from all parts of the Commonwealth speaks well for the purposes of the society and the persistence of its officers and members.

When we read the announcements for the meetings and see the exhibits shown we are impressed with your present strength. You have drawn together a list of speakers that amply testifies to your standing at home and abroad. You are offering 272 cash prizes aggregating $1,141, and three silver cups. This is doing business on a breadth that would be a credit to a society much more general in its purposes.

This exhibition is, I am aware, only an incident in the campaign the State Pomological Society has conducted during the past few years. And to its efforts very largely is due an active work throughout the state which, from the very nature of things, cannot bring large immediate results, but will gradually and surely put Maine where she ought to be among the producers of good fruit. The old practice of planting an orchard and waiting complacently to harvest the crop is being discarded. It is no less humiliating than unprofitable for our people to be furnishing a market for Oregon apples, when we can beat them at their own game if only we will. To you who are successfully struggling for this end we say, Welcome, and God speed.

Of our own work, that of the Lewiston Chamber of Commerce, which I have the honor to represent, I may say that our purposes are much like yours. Our slogan is, "Lewiston, the Industrial Heart of Maine," and if you will look at the map you will agree that it is not inappropriate. You will find us nestling at the foot of one of the best powers of a river that has as good natural facilities for furnishing power as almost any in the country, and whose natural facilities have been augmented largely through the engineering genius of a member of our Chamber of Commerce until we no longer fear spells of low water. We are the center of a steam railroad system that taps directly our county and Franklin to the north clear to the Rangeleys, our own county and Oxford to Rumford and the lakes again, our own county, Kennebec and thence on to the northern and eastern parts of the state and the provinces, our own county and through Cumberland, Sagadahoc and Lincoln to the coast, by the Grand Trunk to central Oxford and beyond to Canada, and by the Maine Central to Portland and beyond. We are the center of a great trolley system linking us with the suburbs and extending to Waterville in one direction, and through Brunswick to Bath and Portland in the other, with a direct line to Portland nearly completed. Geographically we are the center of a circle with a radius of fifty miles whose sweep would include eight cities and nearly half the population and more than half the wealth of Maine.

As the business organization of such a city, so located and so blessed by nature, we realize that our mission is a state-wide one. Ambitious to increase Lewiston's industries and beauties, we neither expect nor hope to accomplish it in any selfish manner. The time is past when any man or body of men can prosper alone. We have unsurpassed schools, unsurpassed natural power privileges, unsurpassed systems of communication with the world, and an unsurpassed citizenship. But we must have a market for our products, as you must have for yours. The nearer and the more easily accessible that market is for us and for you the better for each of us. In a word, we hope to increase Lewiston's prosperity by doing our part with you and all other citizens toward making it a center of a more prosperous community, a more prosperous state. We want to become better acquainted; we want to make our relations more intimate; we want to share in your prosperity; we want you to share in ours. The hope that we may in some degree accomplish this is the controlling reason for seeking these conventions. Do not understand me to mean that we are not glad of your presence as a social event, because we most certainly are. What I do mean is that in the great economic struggle in which we all are engaged, your fight is ours and ours is yours, and each may best help the other and thus himself as he best appreciates that fact.

These are days of great undertakings,—big business, as we often hear it termed—and we can best succeed by keeping that condition in mind. We may and should keep our minds open and our thoughts active to correct the errors that attend it, as we would punish them elsewhere. But it is useless, even if it were desirable, to crush it because it is great. It cannot be done without substantial waste and hardship, waste of present facilities for production and hardship to those involved.

Some one may say he has no tears to shed for a multimillionaire whose property would depreciate. Stop a minute. Do not think the millionaires are the only ones involved in big business. When you think of the American Sugar Company, consider that it has 18,000 stockholders. The Pennsylvania Railroad has 84,000, and the American Tel. & Tel. Company has more than 53,000. Fifty-three per cent of the stockholders of the Sugar Trust are women; 49% of the Penn. R. R. and 52 1-2% of the Telephone Co. They are not all large stockholders, but their holdings are large for many of them individually. They reach every village and hamlet in the land. They are your customers and neighbors, and ours. One-half of the funds of the savings banks of this state are invested in corporation stocks and bonds. And those funds represent the accumulations of more than 233,000 depositors, 312 out of every thousand men, women and children in the state. Where is greater proof that every man owes his neighbor a duty, and must coöperate with him.

The lesson is plain. Our work must be constructive, not destructive. The corporation is but an aggregation of individuals. The merchant and the mechanic and the farmer are all units in the great mass, and what truly benefits the individual benefits the mass. We have no right to oppose legislative reforms conceived by the Grange, nor you those put forward for the manufacturer, the merchant and the laborer. In our several walks and interests we perceive separate and distinct needs, but so long as they severally look to the improvement of the general condition of humanity they will be generally beneficial, and we must give and take as we work toward that end.

Again I say, we gladly welcome you here. We welcome you because you represent the best citizenship of the state. We welcome you because your increased prosperity prospers us. We welcome you because our mutual contact and better acquaintance makes for broader views, broader mindedness and that spirit of coöperation without which there can be no real social, educational, political and financial growth and stability. We earnestly hope that when your labors are ended and you repair to your several homes, you may each and all carry with you a warm spot in your hearts for our city and our citizens.

RESPONSE.

Dr. G. M. Twitchell, Auburn.

As a private in the ranks, it is a pleasure to me to stand here at the request of our president, and accept the cordial words of welcome, so feelingly uttered. I thank him in behalf of the society, and thank you as citizens of Lewiston for these earnest words, and the many evidences we have of a meaning which is deeper sometimes than words, of a desire to coöperate with us.

Almost fifty years this society has been holding these annual gatherings through the towns and villages and cities of the state of Maine, with the hope that thereby we might increase the interest, and strengthen the desire for the growing of better fruit. These are your sessions, as well as ours, and I wish that every member of the chamber of commerce, and every citizen of the city of Lewiston, might feel tonight, as he goes out of the hall, that he is an ambassador, sent out by this society to spread the word that this hall is open for the next two days to the citizens of Auburn and Lewiston and the adjoining towns, and to the whole state of Maine, and that we shall not be satisfied unless the people come here in numbers to examine the fruit, to listen to the addresses, to talk over the subjects which interest us all, and then to go home with a better appreciation of what we are doing. The sessions are for the state of Maine, and not alone for the State Pomological Society.

Sometimes, according to the local press, somebody has evidently suffered because he has bought a peck of apples, and has not got what he expected, for I read occasionally a complaint about the quality of apples grown in the state of Maine. But I want to say that the citizens of Lewiston can buy as good apples as the citizens of London or Edinburgh if they want to. The price of apples in the state of Maine this year is from three dollars to three and a half, per barrel, for choice, No. 1 fruit, and there is not a man in Lewiston but could have all he wanted. But if you prefer to go into your stores and pay thirty-five cents a peck for cider apples, do it. But do not blame the Pomological Society, and do not blame the growers. Every fruit grower in Maine is doing, or trying to do, just what every good business man is trying to do,—find the best market for his fruit. And he is not at fault for doing it.

I have been looking through some of the stores the past few days, and I have been surprised at the price which was asked, and the quality of the fruit which I found there. And dealers told me that it was the best that was offered. And yet, as I know, and as you know, in Auburn, and Turner, and Lewiston, and Greene, and Wales, and all the adjoining towns, just as good fruit is raised as can be grown anywhere upon the face of the earth. And the farmers grow it to sell, and they sell it where they can get the best market.

Now, Mr. President, we ask you and your chamber of commerce and the citizens of Lewiston to join with us and help translate your words into deeds, that we may make the work of this society more effective in years to come. The representatives from Lewiston and the senators from Androscoggin county stood valiantly and loyally with us in our efforts to secure the law which was passed last year, which aims only at one thing, and that is that every man who buys a barrel of apples shall know, when he looks at the brand, that the contents of the apples inside the barrel correspond from top to bottom with the brand upon the outside. We stand for a clean pack, a true grade, and an honest brand; and that is all the law aims to accomplish. And we ask of you your coöperation that we may make this law more effective in the future than it has been in the past. And when we get that law enforced throughout the state, and demand of those who handle our fruit that the apples shall be packed in that manner, every man can buy just what he wants, and be certain that he is getting just what he buys.

But with that, there is another thing in which it seems to me we need some assistance and some coöperation. We want to make more lively and earnest this discussion as to the need of better fruit. There is a great study before us, in order that we may solve the problems. Those of us who have been working along year after year are conscious today as we never have been before, that we know very little about the subject. Its magnitude is growing upon us. We need the help and assistance and coöperation of everyone who is interested, that we may solve those problems and be able to combat the diseases and pests and difficulties which are to be found all along the line. And doing this, instead of raising a million and a half barrels, the normal crop of the state of Maine, we will be raising five or ten millions, and every town and every city will be enriched, as will the hillsides and valleys of the good old state of Maine.

Gentlemen of the chamber of commerce! we ask you to unite with us from this time forward, as you have in the past, but even more earnestly and devotedly, in helping to translate our words into tangible results for the good of all.

ADDRESS.

DR. ROBERT J. ALEY, Orono.

Ladies and Gentlemen: I am very glad indeed to have this opportunity of meeting with the society and with the citizens of this city. I am especially glad of the opportunity of seeing the splendid exhibit and the fine products of this state. I believe we need to learn two great lessons if we are to be the great people that we have seen ourselves in our dreams. I believe it is true of every individual, everywhere, that if he is to realize what it was intended that he should realize, he must be, in the first place, the best individual that it is possible for him to be. He must be able, as an individual, to seize upon opportunity, and to use all things that come to hand in the best way possible. But he must be more than that. He must be able to see in the work of another, simply another side of his own work. He must be able to join with his fellows in the best sort of team work.

One of the hardest things that confronts the captain of a foot ball team is driving the lesson into each member of the eleven that he must be the best individual player that he can be, but he must also be the best team player that it is possible for him to be. The player who can only play a star game to the grand stand does not last long. On the other hand, the one who can do nothing except in unison with others, has a life equally short. The team, when it is finally in shape to win victories, is a team that has in it eleven men, each of whom is capable of a great play; but it is also a team of eleven men who can become, as occasion demands, one man. And that is the lesson, it seems to me, that confronts us in life. If we are to make the state of Maine as great as we ever dreamed she should be, we will make her that only when every citizen of the state realizes that he must be the best individual citizen that it is possible for any man to be, and at the same time realizes that he must coöperate with his fellows, and must sink, when necessity requires it, his own personal individual traits into the common good. To put it another way, it is necessary, it seems to me, today as it has never been before, that we all realize that progress is a sort of unity,—that no individual can progress very far by and of himself, that no organization with some particular work to do can do that work successfully for a long period of time, unless that society takes into consideration the work of other societies, probably far remote from it in purpose and interest.

The man who would be a great man must be greater than the thing he does. The doctor who sees absolutely nothing but the narrow line of his medical profession, who does not see that all other professions and all other businesses must grow or decline with his, is not the doctor who contributes much to the life of the community, or to the general advancement of his fellows. The business man who lives for his business alone, who fails to see that the business of his competitor, the business of his friend, in some other line of activity, is important, who looks upon all other things as sort of enemies of his, is the business man who sooner or later, generally sooner, goes into the hands of a receiver, or into bankruptcy. No one can get very far in this world if he bases his life upon a selfish interest. Recent years in the business world have given us some splendid examples of the fact that business that grows and waxes strong is business that takes into consideration the general welfare, not only of those immediately connected with it, but of all of those who in any way are remotely served by it. The old method of railroading of a generation ago, a method that looked upon practically everything as an enemy, a method that proposed to extract the largest amount in pay, and render the smallest amount in service, is a method that has been found fatal to development and progress of the business itself.

Out in the far northwest J. J. Hill, the great railroad builder, brought into activity the new and modern idea, which is accepted by practically all great business enterprises today. His guiding principle was that the business of the great corporation that he was developing would grow great only if he could make every other interest of the community through which his lines went, great also. He gave to this country perhaps one of the first and one of the best illustrations of this matter that I am talking about, the unity of progress. He realized that if his money was to bring him returns, returns must come to others. And so he interested himself in the improvement of the cattle that were growing upon the great pasture lands of the region through which his railroads went; he interested farmers in improving their methods, and increasing their yield; he did everything needed to bring prosperity to others, realizing that in that prosperity his interests would have a proper share.

It seems to me that if this principle that the progress of any of us is intimately bound up in the progress of all of us can get into the thinking and the acting of our people, many of the problems that have troubled us in the past will become remarkably easy of solution in the future. We see many evidences that this is coming to be true. It is not an uncommon thing today to find business men uniting to give credit and strength to a rival who may be hard pushed by some business trouble. I can well remember the time, as many of you can, when if a business man was in trouble, all his rivals helped him over the divide, and gave him a push down the other side. But we are seeing better than that today, and we are realizing that the failure of this enterprise or that or the other, in some way comes back and reacts and reflects upon the enterprise in which we are engaged. We need to see that this principle applies in all parts and activities of our lives. Sometimes the relation is very remote. Sometimes we grow impatient with the man who is working upon this line or that or the other, that to us seems unimportant. We fail sometimes to realize that the scholar working in his laboratory, upon some problem that seems to us remote from any activity upon which we are engaged, is not merely a dead expense to the community.

I suppose over in Germany a generation or more ago there were a great many people who looked upon Hertz, the great German scientist, as a man who was being supported in idleness and worthlessness when he was devoting his days and his weeks and his months and his years to the study of waves. There are people, no doubt, who looked upon him as almost out of his head when they saw him out there by the side of the lake, studying the action of waves, under different influences, seeing how these waves interfered with each other, and how under certain conditions they destroyed each other, while under other conditions they tended to increase and multiply each other. Then when he extended his study to the action of heat producing waves in the air, and finally to sound waves, and then to waves produced by electricity, there were perhaps none who realized that he was doing anything of value. But one day a Marconi took up the work that Hertz had done, carried from the point to which he had brought it, and gave to the world wireless telegraphy, the greatest invention that we have had in many ages. We need to see in a larger field that all the work that men of intelligence and honesty are engaged in, will either now or ultimately contribute to the progress of us all.

We have been slow, in America, to realize that our progress is tied up, in the knowledge that becomes common to us all. We have not paid, in America, very high tribute, as a rule, to men who know. We have been slow to believe that the man who is devoting his life to the finding of new knowledge, to the pushing out of the boundary of knowledge, is a man of any interest to us. But we are beginning to realize that. You have in this hall tonight a splendid exhibition of fruit, largely because men in Maine and elsewhere for years have devoted themselves with great zeal to the discovery of truth, because they have hunted down disease to its very foundation, and found the methods and means of combatting it,—because they have traced this pest and that to its lair, and understood its life history, and found out how to control or exterminate it.

What is true in fruit growing, is true in a thousand industries today. We are only beginning, however, to rest, as we ought to rest, upon this foundation of knowledge. If, somehow or other, we could as a people increase our faith in knowledge, it would mean much for our progress. That means a unity. It means that all of us must unite in believing that there is such a thing as truth, that there are men who by devoting their lives to the search of truth may find some of it, and in being willing to follow their control.

Perhaps the two greatest words linked up with the progress of the future are the words "honesty" and "coöperation." It was suggested here by one of the speakers a moment ago that this society whose meetings we are attending stands for a barrel of apples or a box of apples that is uniform throughout. Most of us can remember, not very far back either, when in the business world there was not much honesty, when you could not trust a merchant as to the quality of the cloth in the coat you bought, when you could not trust him as to the quality of the sugar, or the coffee, or the rice, or the flour, when you could not trust a trader as to the quality of anything that he offered for sale; when the whole business world, the world of exchange and barter, was filled with distress. Today that has been largely replaced, because there has gone into the hearts of all of us in this matter of business a principle of common honesty. We believe in our fellow man, and in turn we expect him to believe in us. And that mutual faith has been aroused because there has gone into the practice of us all a larger modicum of honesty.

I well remember the story of John Wanamaker, when he opened his store in Philadelphia and announced through the papers of that city that in his store all articles would be marked in plain figures, one price to everybody, and that any buyer dissatisfied could return his purchase and receive his money back without any question being asked. Without a single exception, every merchant in the city of Philadelphia prophesied that John Wanamaker would be bankrupt inside of three months; that no business could be conducted on that basis; that unless you had different prices upon the same article to different people, that unless you insisted that when a sale was made it was made, and must stick, you could not live in business in the good old Quaker city of Philadelphia. But John Wanamaker based his practice upon faith in people. He proposed to deal in absolute openness and honesty with those who dealt with him, and he is still in business.

Thousands of men—hundreds of thousands of men—have followed that example. And so I want to say again, that one of the greatest words in life today is that word "honesty." It is the great key-word of our progress and success for tomorrow. But along with it goes that other word that has been mentioned I think by all the speakers, so far, this evening, "coöperation," coöperation in the broadest sense, coöperation with the man who is in a business entirely different from ours, giving to him the same courtesy, having in his operations the same faith, believing that there is in him the same honesty that we expect him to believe there is in us,— coöperation in such a broad sense that it reaches out and touches all the activities of all men.

There are many things that perhaps at first sight do not seem to have any relation whatever to our own prosperity. And yet, as I have already indicated many times, these things finally come around to be the greatest things in our own development.

May I illustrate by a story connected with the development of the telephone? Some thirty or forty years ago there came into the city of New York, on an emigrant ship, a boy from Servia, very poor, landing there with nothing, securing work upon one of the docks at a very low wage. He managed to live in the simplest sort of a way. Filled with a desire to know, however, he was soon enrolled in one of the night schools of New York City. His desire to know was so great, and his ambition so strong, his intellect so acute, that in a few years he was able to take an examination and enter Columbia University. He made such a brilliant record there that upon his graduation he was taken into the faculty as an instructor, received rapid promotion, and soon became a professor in that institution. His chosen branch was mathematics, that dry subject. He devoted himself particularly to the application of mathematics to various mechanical, electrical, physical problems. He learned one day that the telephone was in trouble because when it extended its line beyond a few miles it was impossible to carry on conversation. There seemed to be a muffling of the sound, an interference of some sort. This man decided there was a problem worth studying, and he began applying his mathematics to it, and his knowledge of the interference of wave motions, and he figured out that under the known laws of electricity this interference ought to occur at about a certain distance. He determined almost exactly what that interference ought to be. He contrived a means of overcoming it, tested what he had worked out as a result of his theory, and sold it to the telephone company for two million dollars, and the telephone company was at once able, by means of his diagram, to extend their lines, and we have the long distance telephone as a result of this man's work.

Here was the coöperation of a man devoting his time to a pure science, a man simply immersed in formulas and theories, with one of the most practical inventions of the age, making it really worth while, as an instrument of conversational relationship, bringing all parts of the country into what we might term conversational relationship. I might give you many more illustrations, but I must not trespass upon your time to do it. I merely want to say again, that if our progress is to be what we want it to be, we must rest it upon these two great modern notions of absolute honesty and the most complete sort of coöperation. And we must realize, I take it, as we have never realized, that in our progress we are all bound up together, and that no one line of our development can get very much ahead of other lines. No one man can get very much ahead of his fellows. The whole of us must go together, or our progress is tied up in that way, and if a large number lag behind, presently all of us are pulled back. But if all of us are pushing forward by this spirit of honesty and coöperation, then those leaders of us who are ahead can step up a little faster, for because of our honesty and coöperation we can follow their leading with greater speed. That we may be able to do this, I am sure is the hope of all of us. And I may say further, I believe it is the abiding faith of all of us.

IMPROVING THE MARKETING AND DISTRIBUTING OF FARM PRODUCTS.

By Hon. Charles J. Brand, U. S. Department of Agriculture, Washington, D. C.

The time has come when we, as workers for betterment of agricultural conditions in the United States, have got to begin to instruct our farming public just as earnestly about business and business ethics and commercial practices as we do about the rotation and cultivation of crops which the farmer is to employ, how and when he shall spray, or how to feed his stock. Agriculture is a business industry, and as such is merely one part of the great business structure of the country. If farming is to continue profitable and farm life is to be made attractive, we must in the next decade or two give the same attention to the business side of farming that we have in the past two decades to the producing side.

The farmer especially needs help and information along three distinct lines:

First, education and assistance in all matters relating to the improvement of the methods of producing and handling his many crops.

Second, suitable and convenient arrangements for securing the credit that is necessary to enable him to conduct his business from one crop season to another.

Third, he needs assistance in the establishment of a marketing system which will return to him the true value of the particular qualities of the various crops that he produces, minus reasonable charges for handling, transportation and the legitimate profits of middlemen.

Numerous efficient agencies are now engaged in assisting the farmer in a multitude of useful ways on the production side of his activities. The agricultural colleges and experiment stations, the United States Department of Agriculture, many railroad systems, commercial bodies and other organizations are giving valuable assistance along this line. The devising and adoption of a credit system suited to the farming industry is now very much in the public mind and may be realized in the near future.

As one step toward the goal of a more rational system of marketing and distribution, the Department of Agriculture has established an Office of Markets for the study of the basic principles involved in this problem, for the wide dissemination of information relating to it, and for the demonstration of such methods as may seem to promise best results. Several of the states and a number of municipalities have also established commissions or set aside funds for activities toward the same end.

A great many people seem to consider the matter of getting more money for the farmer as an end in itself and not as a means to an end. To make farming more profitable without at the same time educating the farmer as to how to spend his additional gain would fail wholly of any useful purpose. This money must be devoted specifically to making the farm home a place where the young people will be glad to stay, to promoting social life in the country, to providing rural recreation, better roads, better schools, better churches and a higher type of manhood.

The work of the Office of Markets has not yet progressed sufficiently so that we can say much about what has been accomplished. Hence, though disinclined to do so, we are compelled to present plans rather than results.

In too many cases one of the greatest difficulties surrounding the farmer's marketing problems is his inability to get short-time loans on anything like reasonable credit. No matter how useful the purpose to which he intends to devote the money, the banker is loath to give him credit and the commission house exacts a high rate of interest. This was brought to my attention recently in connection with the cotton investigations of my office. We are trying to develop the grading, handling and marketing of cotton on a community basis at various points in the South. One of our most earnest community groups is located at a small town in Arkansas. To sell cotton to any advantage, an association should have at least 50 bales of each grade to offer. As there are nine full grades and many other recognized qualities, it requires considerable time before a group of growers can accumulate enough bales to offer even-running lots. Inasmuch as they are under heavy expense for picking, ginning and baling and at the close of the long season of outgo without income, they must borrow money or let the cotton go a few bales at a time as ginning proceeds.

This particular group of growers was enthtusiastic enough so that they united to construct a creditable sheet-iron warehouse with their own labor devoted to the work when they could spare time and on rainy days. In the hope of securing moderately reasonable credit, one of our men accompanied the leader of the growers' association to one of the leading banks in Little Rock. The president of the bank, while expressing interest and anxiety to assist, stated that no money was available for such loans, that they now had $3,000,000 loaned out on cotton, all of which is to local cotton buyers and commission men. The president stated that no farmers had any of this money, and further that he was one of the committee handling the Arkansas allotment of the $5,000,000 of government funds distributed for crop-moving purposes, and that so far as he knew no farmer was able to avail himself directly of the use of any part of this fund.

Not wholly discouraged in this quest, the seekers for money went to one of the largest commission houses trying to secure a loan on 175 bales of cotton which had all been graded and which averaged strict middling. The best arrangement that could be secured promised to result in the following monthly charge against each bale of cotton, estimating the bale as worth $70:

2 1-2% commission	$1 75
Insurance	25
Interest at 10%	58
Warehousing charges	25
Charges per bale per mo.	$2 83

This represents 57 points or more than 1-2 cent per pound per month, which is more than any grower who is holding cotton from a purely non-speculative point of view could consider. It should be remembered that the purpose in holding this cotton was to get a sufficient number of bales of even-running grades for commercial transactions.

The farmer suffers not only in the securing of money loans, but also in securing the necessary store credit for carrying him through that part of the season when he has no considerable product to market. This is especially true of the cotton farmer. Part of the difficulty can be obviated by diversification so that something may be in hand for sale at any season of the year; but even so, capital or credit is required to carry on any business. Store credit comes high, both on account of the rate of interest charged on store accounts (particularly in the South) and because prices are elevated to an unreasonable extent to this class of credit purchasers. Work is necessary along many lines.

The plan of the Office of Markets at present in view includes the following:

(1) The study and promulgation of market grades and standards.

(2) Market surveys, methods and costs.

(3) Investigation of transportation and storage problems.

(4) City marketing and distribution investigations.

(5) Studies and demonstrations in coöperative production and marketing.

(6) Cotton handling and marketing investigations.

Standardization is of the utmost importance. Only when products have been properly graded can they be traded in to the advantage of both the seller and the buyer. This is no truer of farm products than of mill and factory products. Until standardization was introduced, the steel industry had a very varied career. Now standard patterns and grades are manufactured in practically every plant of the world which can be used interchangeably in any type of construction calling for a particular pattern. Standards are necessary in order that the purchaser of a given product may know within reasonable limits what the seller proposes to deliver at a given price. Prices cannot be made rational without them.

Second only in importance to the establishment of standards is the living up to them. On this point there is opportunity for a great deal of educational work among farmers. They must learn, as practically all large manufacturers have learned, that only the highest quality brings the highest price and that rigid adherence in spite of obstacles to the established quality is essential to business success. Too often the farmer sees some temporary or apparent advantage in delivering a product of inferior quality at a higher price. This practice must be discouraged and the farmer must learn that even though it sometimes entails loss, his business contracts, for such they are, must be lived up to.

Another type of error which the farmer is very likely to fall into is the failure to fulfill an agreement when he has contracted to furnish definite qualities and quantities of product at a definite price at times when the price has advanced. Too often the man who has purchased from him is told under such circumstances, substantially the following: "Oh, I sold that to so-and-so day before yesterday. He offered me a cent a pound more than you are paying." Business confidence and stable conditions in marketing can never be established until the farmer abides as scrupulously by his agreements as does the higher and more successful type of business man. I do not wish to be understood as criticising the farmer over-severely along these lines. He has unfortunately frequently dealt with buyers who indulge in chicanery, so that he has come to the conclusion that this is business and that such are the methods of all business men, and he is merely attempting to protect himself against similar sharp practices.

Next to standards in importance, or perhaps even of greater importance, is the necessity for genuine coöperative organization in the handling of both producing and marketing problems. Agriculture is the only industry of any importance in the United States which does not have a considerable degree of organization. Some industries are very completely and perfectly organized; others but loosely. Agriculture, in a large sense, is unorganized. The individual producer cannot accomplish with small unit quantities what the carefully organized association, shipping and selling by car or even train lot, can accomplish. I do not wish to be understood as saying that there are not many organized producing, marketing and distributing organizations. What I do mean is that considering the extent of our agricultural industry, the organization of today is a mere beginning. It has become quite the custom to hold up to the American farmer the perfection of organization and methods that exist in Denmark, Ireland, Germany and Italy. I will venture the guess, as there is no definite information on the subject, that in the aggregate purely coöperative or semi-coöperative organizations in the United States buy and sell a product exceeding in value the total product coöperatively bought or sold in all of the countries mentioned put together. The coöperative grain elevators alone, which are not truly coöperative in large part in a technical sense, handle through their selling and buying departments crops and other materials having a value of probably no less than $600,000,000 per annum. Add the millions of dollars' worth of dairy products handled by the coöperative creameries and cheese factories and the tens of millions of dollars' worth of products sold by the coöperative citrus and deciduous fruit associations and the truck growers' organizations, and it will be readily seen that the total value of products handled by organizations partaking in some degree of a coöperative nature will reach possibly the enormous total of $800,000,000. Indeed it would not surprise me in the least if the total amounted to a billion.

The scattered occurrence of coöperation in the United States is responsible for the impression that coöperative activity is not extensive. The large aggregate value of products handled disposes effectively of any idea that coöperation is rare in the United States relative to other countries. It is merely undeveloped so far as the opportunities within our own country are concerned.

The two greatest problems in the success of coöperative organizations are competent management and the keeping up of that keen interest and the securing of that active participation of members which is essential to success and without which no true gain for country life will have been secured. An organization that is successful in its handling of these two matters is practically sure to meet with general success.

Coöperation cannot be foisted upon the people by outside agencies. The desire for it must either be occasioned by difficulties in marketing or other farm activities or must be cultivated by education as to the benefits to be obtained. We must appeal in this country to the intelligence of our farmers more than to their necessities. The economies to be effected justify a certain degree of government assistance and encouragement.

It is our purpose to make a thorough-going study of existing marketing, distributing and purchasing organizations, and where conditions warrant, to aid so far as the authority of the Department permits in the establishment of new organizations. We will aim to make the office a sort of clearing house for coöperative marketing information of interest to both associations of producers and consumers. This work will be carried on in close coöperation with the Rural Organization Service, of which Dr. T. N. Carver is the Director. In coöperation with the Office of the Solicitor, a careful study of the laws of the different states under which coöperative enterprises must operate will be made. Drafts of constitutions and by-laws suitable for different farming industries which will enable them to organize and operate with efficiency will be prepared. Systems of accounting and auditing for coöperative associations will be devised and the information obtained will be made available through publication of bulletins and otherwise.

It is important that this gathering should carry home to their respective spheres of labor this definite thought:—Educational work in regard to coöperation is necessary all along the line and uniform and efficient methods and ideals must be developed. Courses of study should be outlined in the colleges and universities suitable not only for their own curricula, but for the agricultural high schools of the states and for other educational institutions offering courses of agricultural instruction. Only in this way can be devoloped a common body of information which will result in the extension of the application of the principles of coöperation and in the dissemination of necessary knowledge for making coöperation successful. We do not attach as much importance to the absolute adherence to the Rochdale principle of one man, one vote, as do coöperators in some of the countries abroad. In many communities the truly coöperative plan can be applied. In others, the attempt to apply it absolutely would doom to failure efforts to bring about united activities.

To another and highly important class of activities of the Office of Markets we are applying the name of Market Surveys, Methods and Costs. The purpose of this work is to determine the normal marketable quality of specific products within certain trade areas with the possibility of increasing such supplies as well as determining the immediate prospective supply at given periods or to be marketed within specified periods of time. Studies of the demand for various products at consuming centers, the mapping of areas usually drawn upon for supply, time when the areas ship, normal prices and prices in periods of scarcity or over-supply, will be carried on.

The interest in a market news service for perishable products is so great that we propose to investigate methods of bringing the information developed in market survey work promptly to the attention of producers and distributors. It does not seem at all likely that telegraphic market news service would be feasible, but it does seem likely that certain classes of information not requiring telegraphic or expensive forms of distribution can be obtained and be made available, especially to associations of growers. Communication with individual producers is almost a physical impossibility, which is another excellent reason for coöperative organization.

Further lines of work which will be included in market surveys, methods and costs are the investigation of the efficiency and limitations of various methods of wholesale disposition of farm products through brokers, commission men, public auction, etc., and a determination of the usual and necessary costs, charges and profits incident to each system. Similar studies of the subsequent retail handling and distribution of products will also be conducted.

We succeeded this fall in making a small beginning in this work by a survey, in which the Bureau of Statistics assisted, of the quantities of cabbages and onions for winter withdrawal which have gone into cellar and other storage in the North during the season just closed. It is of the utmost importance to the southwestern grower that he know in advance of planting whether the quantities stored in the North are sufficiently great to injure or demoralize the market for which the southwestern grower plants. In 1912, ignorant of these facts, cabbages were over-planted to such an extent as to ruin the market for both the fresh and the stored product. With cellars and storehouses full, the fall plantings were so heavy that the prices were depressed to as low as $3.50 to $4.00 per ton in shipping sections where right now prices from $18.00 to $20.00 per ton are being paid. The information obtained, even though of a fairly indefinite character, was wholly sufficient to indicate that generous plantings in the Southwest could be in order. Work of this kind will have to be handled carefully and conservatism will have to rule. I cite this merely as one of the many specific things to be done.

At the present time the South Atlantic and Gulf States derive practicaly no commercial advantage from the early maturity of their corn crop. A complication of excellent reasons no doubt exists for this condition, nevertheless a method of handling and marketing should be devised to bring this crop upon the market promptly at a season when prices are usually high and when corn is generally difficult to obtain. It seems a shame to have ripe corn hanging on the stalks in the South when the western crop is not yet ready for market, only to be offered later when generous supplies, due to the western harvest, are naturaly depressing prices.

It is our intention that the work of the Office of Markets shall be definitely practical and helpful to the country. While the Department is chiefly interested in assisting the farmer producer, nevertheless it has a very direct, intimate interest and desire to assist the consumer. In order to be in a position to help in some measure in the solution of the problems involved in provisioning metropolitan populations of various sizes, investigations of city marketing and distribution have been undertaken. This work contemplates a study of the uses and limitations of farmers', municipal, wholesale and retail market houses, curb markets, huckstering, and other systems of city distribution, and an investigation of the feasibility of direct dealing between producers and consumers not only through open market houses but by means of parcel post and express shipments, family hampers, and other methods.

In this connection also, we propose to encourage the development of local production of perishables in connection with rural and urban marketing systems. Why should Chicago be getting her cauliflower from Long Island or California at a time when the local producing area could well furnish it? Why should peaches be hauled from Arkansas to Philadelphia at a time when West Virginia can well supply that market? How is it that truck growers in the Mesilla Valley cannot sell their produce in El Paso because of the low price at which the shipped-in California product can be bought by the commission men? What can we do legitimately to bring about conditions under which the grower near to El Paso can market his product at home without being ruined by the low-priced diverted shipments which are put into that market to avoid sending them to over-supplied markets farther east? This matter of developing home production or production near the large cities is one of great importance.

In connection with the study of the utility of parcel post I may say that we have made good progress in determining suitable containers for butter, eggs and certain vegetables. A recent shipment of twenty-five dozen eggs in one and two-dozen lots resulted in a breakage of only five eggs. Here the container is the important thing, and it also seems likely that it may be necessary to ask the Post Office Department to amend its rules in order to make this excellent means of communication of greater practical utility.

In this connection it may not be out of place to say just one word about that threadbare subject, the cost of living. The consumer himself is the only person who can do anything immediately in this matter. Let him stop telephoning each morning for market supplies and instead, in cities that are supplied with market houses, visit the market and select his produce there. Let him take the trouble to get acquainted with near by or even slightly distant farmers within the first two parcel-post zones, within which express rates also for large quantities are reasonable. Let the housewife standardize her needs to some extent and overcome the false pride or laziness which prevents carrying home even so small a purchase as a spool of thread. Let the retail merchants give a discount to patrons who pay cash and more particularly to those who carry home their purchases, and savings will be effected immediately. I do not mean that this provides a final solution of the problem. It merely presents some of the ways in which to make a beginning.

Individual retailers insist, and there is no reason to doubt their truthfulness, that they are not making excessive profits. The trouble is that there are so many retailers and the methods of distribution and delivery that have developed are so expensive that the overhead charges which the product must bear add excessively to the price. A two or three per cent reduction for cash with a further substantial reduction for self-delivery should result in decided economies all around to the consumer.

Transportation, both on account of its cost and on account of the deterioration which farm products frequently suffer in transit, is one of the most important of the general problems relating to marketing. In a broad sense it is unlikely that freight rates on farm products are unreasonably high, though there are probably particular commodities which pay a higher rate in proportion to the care they require than others, and there are no doubt points or even areas which suffer unduly through freight-rate differences. However, the chief problems related to transportation have to do with other points than rates. I will merely run over some of those which require investigation with a view to possible improvements. I am of the opinion that most of our railroad systems will coöperate in bringing about changes for the better wherever the facts leave no doubt as to the desirability of the changes. Their willingness to assist the farmer in his production and other activities indicates this. We need a more comprehensive organization of transportation companies for the continuous carriage of products from points of origin in producing centers to terminal markets and points of consumption, including probably more general privileges of diversion or reconsignment from terminal markets to other points. Refrigerator-car construction deserves careful investigation, as there is very general complaint from shippers and receivers as to the bad condition which frequently prevails when cars are received.

The demonstrated economies and reduction in deterioration and waste due to precooling at production points leave no doubt but that we should urge a far more general introduction of precooling practices. Present demurrage regulations are such that even in times of distress and car famine refrigerated, heated, or ventilated cars are retained for purely storage purposes on side tracks at terminal points when they should be rolling back for new loadings. This practice is necessary in part at present, due to insufficient terminal storage facilities.

In connection with transportation studies there will also be made a study of storage problems, beginning with refrigeration and cellar storage in the home, intended to promote family buying in larger quantities and extending through the practicability of local cold storage at shipping points and in smaller markets, as well as at the large terminals. Investigations tending to a just and equitable distribution of refrigerator and other cars in times of need are also desirable, as well as a study of the efficiency and utility of iced pick-up car and other special services.

The opportunities for developing trolley freight service from near by producing sections have not been utilized to the extent that they deserve. Work in this direction is also projected.

Careless car and train handling are responsible for large aggregate injury to perishable products. A particular case has come to my attention in which 800 baskets of grapes in a single car received in the Cincinnati market were so badly smashed as to require repacking. The railroads are at the mercy of their employees in this matter and are deserving of assistance in educating their employees and interesting them in the economies of more careful handling.

Exhibit of W. G. Conant of Hebron, at Annual Meeting, State Pomological Society, Lewiston, Nov. 18-20, 1913.

We are not using our water transportation facilities to the extent they deserve, and at specific places it may be possible to encourage such use by the presentation of rational plans.

I will not detain you further with the enumeration of the many specific problems that require study. The Department realizes fully that it will be difficult to change practices which have grown up through a long series of years. Nevertheless, we are confident that a determination of points at which wastes can be eliminated and the suggestion of methods for accomplishing this result will bring about many savings.

In developing the work of the Office of Markets, I desire to emphasize especially my wish that so far as possible this work be done in coöperation with the colleges, stations and departments of agriculture of the states. If you have problems in the solution of which we can help you, let us know and we will give our best efforts to assist.

I hope that it will be possible for the Office of Markets to develop a service which will be as definitely useful to the farmers of the country with reference to marketing as that furnished by other branches of the Department has come to be in the province of production.

WEDNESDAY, NOVEMBER 19.

PRESIDENT'S ADDRESS.

MR. HOWARD L. KEYSER, Greene.

Ladies and Gentlemen: I am glad to welcome you here this morning to the annual meeting of this society, and also to congratulate our members on the encouraging outlook for our future.

After the season of 1912, and the greatest of all nightmares of orchardists, over-production, we open the season of 1913 with the greatest shortage of winter apples the world has known for years. Surely nature is fickle, and in the usual course of events the season of 1914 will most likely find our old friend, over-production, with us again. And I want to say here, there is no such thing as over-production until every man, woman and child in America and abroad, that we can reach, have had all the apples they need or can eat. But there is such a thing as under-consumption; and we suffer from both.

One of the best ways to correct over-production is to advertise the apple and increase consumption. And the plan proposed by the International Apple Shippers' Association to sell stamps to be placed on barrels and boxes, the proceeds to be used in an active advertising campaign, is a good sound business proposition, and should meet with the assistance of the growers of our state. The only good adverse criticism I have heard of the so-called stamp act is that, as usual, it all comes out of the producer. But we have grown accustomed to that. Proper distribution, fortunately for us all, has at last been recognized by the government, and the agricultural department now realizes that while the man who can show us how to grow a good red apple where poor ones grew before is a public benefactor, he also will be a benefactor who can solve the problem as to how the grower can secure sixty cents instead of thirty-five cents of the consumer's dollar.

We are partly to blame for the present condition ourselves, in not coöperating for our mutual protection. The success of so many who have tried it, proves it a part solution of the trouble. An old farmer said to me a short time ago, "This talk of coöperation may be all right, but oxen and horses don't work well together." I agree with him; but in such cases why not have a separate association for each?

The city press would have its readers believe that part of the high cost of living can be laid at the door of the cold storage warehouses, which are, in reality, an equalizer of prices, and a necessity to the fruit business. In fact, I consider cold storage such a necessity that I again urge upon our members some action, at this meeting, looking to the future establishment of some local storehouses through the fruit belt. I am firmly convinced that concentrated action along this line will bring results.

Our insect pests and fungus troubles seem to multiply, and your officers this year have tried, in the program to be presented to you, to cover the important ones, and have been fortunate in securing the best authorities in the country to instruct us in the best and latest methods to combat them. I desire to mention, in particular, the grave danger that is with us in the last and greatest invasion of the brown-tail moth we have ever had, and that we urge upon our commissioner of agriculture the great necessity of a vigorous enforcement of the law regarding the removal of the winter nests.

A very large per cent of the fruit raised in our state is exported to Europe by way of Liverpool, and I desire to call the attention of the members again to the steady increase in freight rates to that port. In the last five years that increase has amounted to thirty per cent, and to some other foreign ports the increase has been greater. It is fair to presume from the past, that the industry will be burdened to the limit, unless such societies as ours take some concentrated action to protect themselves.

Let us also urge upon our fellow fruit growers in Massachusetts the importance of some action on their part, urging legislation similar to the New York State Commission Bill, providing for the licensing and governing of the business of the commission men. This law enacted by the last legislature of New York cannot help being of great benefit to producer and consumer, and it is legislation to which surely no honest commission man can take exception.

I want to congratulate the society upon the greater recognition it received from the state during the meeting of our last legislature, giving it an opportunity to widen its scope and increase its field of activities. Also, that after a struggle of four years to correct the evils of our lack of uniform pack, the legislature passed a law giving every grower a right to ship any quality of apple grown, but making it a misdemeanor unless stenciled true to name; a hardship on no grower, only a demand that if he use the word "Maine," he must be honest. This law will be enforced by our present commissioner in an able, honest and efficient manner, and cannot help being of great benefit to the fruit industry. It is to be hoped that our members will be more than careful of their personal pack, and report any known violation of the law to the inspector, promptly. In years of plenty, Maine apples will be in demand if our stencil is known to be true.

"In union there is strength." We want every man and woman who is interested in orcharding in Maine as a member of our society. We need them and they need us. If they are not interested in "Better fruit for Maine," we will make them so. Let us all pull as one strong team together.

I have referred to the necessity of cold storage, the investigation of freights, and the increase of members, and I recommend the appointment of standing committees of three members each, to be known as storage committee, transportation committee, and membership committee.

At the close of two years administration of the office to which you have twice honored me, I want to thank the members and the officers for the loyal support I have received at all times, and bespeak the same for my successor, and pledge him my hearty coöperation in his work, which, while at times he will find it exacting, will also have its pleasant side, in the knowledge that he is doing his utmost to place a great industry on a sure foundation for succeeding generations.

FACTORS INFLUENCING SUCCESSFUL ORCHARD SPRAYING.

Donald Reddick, Professor of Plant Pathology, Cornell University.

In attempting to speak on such a subject, I realize fully that local conditions and special adaptation for work will require that I confine myself strictly to general fundamental considerations. The differences in conditions in the state of Maine and in New York are sufficiently great to make reference to specific cases and to different years impracticable. One of the most noticeable examples of this occurs in the present year in the case of potato blight. We have not seen a blighted potato in the state of New York, but I find that your growers have had a great deal of this disease, particularly the tuber rot stage. Neither am I sufficiently familiar with the general location and size of your commercial apple orchards to be of particular service to you in making specific recommendations. There are, however, certain fundamental factors which will hold true in the spraying of any apple orchard and it is to these factors that I would direct your attention.

The Apple Scab Fungus.

In order to freshen our memories a little, allow me to recite briefly the life cycle of the apple scab fungus. The scab disease is selected because it is the most important disease of fungous origin that northern and eastern apple growers have to fight. The habits of fungi in general are not so commonly understood as those of insects, owing to the facts that most of the important structures of fungi are microscopic in size and that their devastating work has been done even before they are apparent to the naked eye.

Winter Stage. The fungus causing the scab of apples, as you will recall, passes the winter in the infected, fallen leaves on the ground. In New York state we have never been able to discover any other stage by which the fungus gets through the winter. Within the past few weeks, however, Doctor Morse, of your Experiment Station, has recorded some very interesting observations in which it seems quite certain that the fungus has been able to hibernate on infected twigs of the previous year. How generally such conditions may prevail remains yet to be seen, but apparently this discovery will not materially affect the method of scab control, inasmuch as experimental work in most of the eastern states has shown that a proper application of fungicides as generally recommended is effective.

Spore Discharge and Dissemination. The fact that the scab fungus certainly passes the winter on the fallen leaves leads at once to the question of how the organism is able to get from the ground to the developing foliage and fruit of the tree. The way in which this is accomplished is exceedingly interesting, but to be appreciated fully, should be observed under the microscope. An examination of old leaves in the early spring often reveals the presence of minute globose bodies developed within the tissue of the leaf. These bodies are exceedingly small and for the most part are barely large enough to be detected with the naked eye. With the occurrence of the spring rains, these bodies increase slightly in size and break through the epidermis of the leaf on the side which happens to be lying upward. Doctor Wallace, who was formerly a student with us, has followed the development of this body, technically known as a perithecium, and he finds that there is a definite correlation between the development of these bodies and the pushing forth of buds on the apple tree in the spring. At about the time the blossom buds are unfolding, at least by the time of opening of the blossoms, it is found that the perithecium has become fully matured. Upon examining into the structure of one of these bodies with the microscope, it is found that it is essentially composed of a thick, black protective covering, on the interior of which there are numerous tubular sacs, each of which contains eight oblong, brown spores or reproductive bodies. If the perithecium is carefully pricked out of the leaf tissue and placed in a drop of water for examination with the microscope, it will be observed, if the spores are matured, that the tubular sacs absorbing the water become very much lengthened and protrude from the apex of the perithecium through a minute opening which does not appear until the perithecium makes its last increase in size. The spores enclosed in the sacs are crowded to the apex and spore after spore is violently ejected, all eight spores being discharged within a minute or two. When all of the eight spores have been ejected the empty sac collapses and its place is taken by another and thus the process repeated. As a single perithecium may contain two hundred such sacs, one can readily calculate how many spores might be cast from a single one of these bodies. Leaves are often found on which the perithecia are exceedingly abundant and in one case, in an examination by us, it was found that if there were a continuous layer of leaves under a tree spreading 40 feet, bearing perithecia in the abundance of the fragment under examination, there might be ejected during a period of 45 minutes of rainy weather not less than eight billion spores.

While it has just been stated that these spores are ejected with violence, the height into the air to which they are ejected is not more than one-fourth of an inch. The exceedingly small size of these spores, however, permits them to float about in the air more readily than particles of dust, and the impulse afforded by the mechanical ejection from the sac is sufficient to place them in air currents which may carry them to apple foliage. It is obvious that the greater majority of spores lodge in unfavorable places and die, since their lodgment on apple foliage is left entirely to chance. However, as all of you know, a sufficient number of spores do lodge on apples to make it exceedingly unpleasant for us in certain years.

Conditions Necessary for Infection. If one were to drive through an orchard with a sprinkling cart about blossoming time and wet the dead leaves on the ground, it would be perfectly possible to bring about the ejection of spores just described. It does not follow, however, that scab spots would develop on the foliage and fruit. It is absolutely necessary for the germination of these spores and penetration of the cuticle of leaf and fruit, that moisture be supplied in sufficient quantity and for a sufficient length of time to permit the spores to germinate. During periods of high temperature, germination may occur in five or six hours, but during colder weather, 18 or 20 hours may be required. It will be seen, therefore, that conditions favoring the ejection of spores are also essential for spore germination. The ideal condition for abundant germination and infection would be a rain of sufficient extent to moisten thoroughly the leaves on the ground, to eject the spores from the perithecia, and this rain followed immediately by calm, foggy weather. Every opportunity would be afforded for spore germination and abundant infection might be predicted.

Once the germ tube of the spore has punctured the cuticle, there is no way possible of preventing further growth by the application of spray substances that might be used safely on apple foliage. It should be borne in mind that the spore is exceedingly small and that the germ tube issuing therefrom is also very small. From day to day food substance is absorbed from beneath the cuticle and a gradual development occurs. In the course of a week or ten days the development has reached such a point that one can see small olive green spots on leaf and fruit.

Secondary Infection. Almost as soon as these spots are visible to the naked eye, microscopic examination will show that a new kind of spore is being developed. These do not differ materially from the spores already described, but their position and abundant production makes rapid and wide dissemination very easy.

Perithecia which are not in condition to allow ejection of spores during a given rainy period are apt to ripen during the following warm days and be ready at the next period of rain for spore ejection. Thus it may happen and frequently does that new infections at favorable periods are continually recurring, both from the leaves on the ground and from earlier infected leaves on the tree.

So it goes throughout the season. Rainy weather followed by periods of calm, foggy weather, permit new infections to occur. When we have a dry summer, as not infrequently happens, many spores are produced which perish for the want of moisture, but with the occurrence of fall rains, sufficient spores are found to be in a viable condition to cause further infection, as many of you know only too well.

Philosophy of Disease Control.

Spray Before the Rain, Not After. From what I have said you will see that it is coming to be understood generally, by men who have fungous diseases to fight, that any fungicide to be at all effective must be one that will adhere to the foliage during periods of prolonged rainy weather and, above all, that fungicides must be applied to the parts attacked before the conditions arrive which make spore germination possible. It is believed that more failures to control apple scab and many other fungous diseases are attributable to the failure to recognize this one point than to any other cause. It is, therefore, worthy of repetition, that any fungicide, to be at all effective, must be one that will adhere to the foliage during periods of prolonged rainy weather, and that, above all, fungicides must be applied to the parts attacked before the conditions arrive which make spore germination possible.

Weather Forecasts. I presume many of you are already wishing to ask the secret of predicting rain periods and, in order not to arouse your hopes, I wish to say at once we have no way of telling certainly whether rain will occur or not. We have, however, a very effective way of determining whether atmospheric conditions are such as to permit rain to fall if there is moisture in the clouds. This service is free to every person in the United States. I refer to the weather reports issued daily by the United States Weather Service of the Department of Agriculture. The weather map, made up and issued at 11 o'clock A. M., also at 8 o'clock in many places, is a satisfactory way of predicting the general conditions. A little study of these maps from day to day will soon place one in position to tell when storm periods are likely to occur. It is commonly known that storm areas travel from west to east. In general, the rate of daily travel is about 500 miles, but there are, of course, many variations from this. One can readily locate storm areas on the map from the fact that such areas are always indicated by a low barometer and by the fact that the word "Low" is printed on the map.

When to Spray. Having become acquainted with the progress of a storm area by a little daily study, one can then determine with some degree of certainty what day the storm center is likely to be over the state of Maine. With these facts in mind and watching the development of foliage and buds very carefully and knowing the approximate number of days necessary to cover a given area of orchard with spray, one can figure ahead when each spraying must be commenced in order to finish ahead of the storm. If there is some one in the community who can use a compound microscope, he can follow the development of spores on the fallen leaves and in this way the number of days can be narrowed down even more.

That one not especially trained can predict storm periods with some degree of certainty is attested by the fact that the speaker some years ago, in doing vineyard spraying in the state of New York, was successful in predicting storm periods at the five critical times for grape spraying and in every case the applications were made before infection occurred. In one case rain began falling in less than an hour after the spraying was finished, while in another case rain did not occur for about 24 hours. These grapes were carried through the entire summer absolutely free from rot, whereas grapes on adjacent unsprayed rows were so badly rotted as to be unmarketable.

That one cannot always be so successful in predicting rains may be shown by the fact that the speaker, only last spring, in connection with some orchard spraying, made an application of spray which it eventually developed was entirely unnecessary. It ought to be explained, however, that the conditions existed which would have permitted rainfall within 24 hours after the spraying was done, but it so happened that the clouds bore no rain.

Apple Scab Control.

Hindrances. It may seem like a relatively simple matter to follow these things through and come out successfully, but I can assure you it is not. Storms are often erratic, coming with much more speed than ordinarily. Fruit buds may develop slowly and following an unexpected warm day may come out more rapidly. The period involved in the first two summer sprays is a most critical one, and those of us with experimental work on our hands spend some very unpleasant hours trying to guess whether the buds will have developed far enough to be sprayed satisfactorily before a given storm period arrives, or whether the scab fungus has produced spores in a quantity sufficient to insure infection. I can assure you that we search the daily paper for the weather map before we look for baseball news or the latest developments in the Mexican situation.

There is still another difficulty involved. The expense of spraying is such that it is always necessary to bear in mind that protection of foliage from fungi must be coupled in some way or other with an application of an insecticide to kill insects. I have this in mind in connection with the first application for apple scab, holding off the application until the bud clusters are expanded sufficiently to drive the spray down on the pedicles and at the same time getting the poison on early enough to kill the bud moth in its early stages. Then again, there is the necessity of combining the first codling moth spray with the application of spray to the young fruit to prevent scab. A few warm days may cause a rapid development of the young fruit and the calyxes may close before it was anticipated. In following these conditions in a number of places in western New York during 1911 and 1912 it was found, except on early blooming varieties for which no record was kept, that there were only four days time when either of the applications could be made effectively in these two years. The actual number of days when spraying might have been done, so far as the development of the buds was concerned, might have been extended but for the occurrence of rain in one case, and in another the intervention of a Sunday with rain on the following Monday. In the present year the majority of orchards in Western New York did not receive the application before the blossoms opened because it was predicted that an application would not be necessary until a certain Monday. The result was that three successive warm days forced the buds at a tremendous rate and by Monday many of the trees were in full bloom. A very few men began spraying on Friday and Saturday. However, subsequent developments showed that this application of spray was not effective so far as scab was concerned, inasmuch as no infection weather occurred for a period of nearly three weeks thereafter.

It appears, therefore, from what has just preceded, that there are three variables involved in making a successful application of a fungicide to control scab. These may be enumerated as follows: First, temperature and its resultant effect on bud development; second, rainfall and attendant atmospheric conditions; third, occurrence and development of the scab fungus. It will be seen at once that the inter-relation of these variables leaves the fruit grower with very little option in the matter. It, therefore, behooves him to be prepared to take advantage of every slight opportunity. With these considerations in mind some of the accessories that have proved time savers may now be mentioned.

EQUIPMENT FOR SPRAYING.

It is not uncommon to find orchardists who require more time to fill their spray tank than to empty it. It must be borne in mind that filling spraying tanks is not spraying. With us it is an exception rather than the rule to find a grower who is able to spray out more than ten 100-gallon tanks per day, even barring all engine and nozzle troubles. In order to do a thorough job of spraying at any time, it requires from six to ten gallons of spray to cover a tree 40 years old. I think you can readily calculate that under these conditions one cannot expect to spray more than 600 to 800 full grown trees with one outfit and hope to control apple scab in an epidemic year.

Equipment needed. Most of you will doubtless raise the objection that it would be very expensive to keep two spraying outfits for an orchard of 1,200 to 1,500 trees, to say nothing of the difficulty involved in supplying teams and men at such a busy time of year. My only answer to the objection is that it *must* be done that way if you are to secure the best results. The only alternative is to put out daily more gallons of spray per outfit or to find a more rapid way of applying the fungicide. Some of the items that we have found of importance in permitting a larger output I wish to discuss a little more fully.

Equipment for Rapid Filling. My personal experience the past summer in helping perform extensive experiments has brought forcibly to my attention the great importance of being in readiness for making an application. One of our experiments was located on the farm of a progressive orchardist in Wayne county. The other experiment was located out of the apple section and on a farm where the apple was a secondary crop—in other words, an ideal place for our purpose so far as disease was concerned. In the first case every provision was made to keep the men and outfits working at full capacity. If there was the slightest tendency for the ground to be heavy, three horses were put on the 200-gallon gasoline sprayer. When the spray tank was empty the horses were run from the field to the central filling point. At the central filling point every provision was made for very rapid work. As a matter of convenience powdered arsenate of lead was used. This had been weighed out in paper bags several days previous. The lime-sulphur solution was allowed to run out in a large tub and could be dipped up without any delay whatever. A gasoline engine located at a nearby spring kept a very large supply tank full of water. This tank was elevated on a platform and opened into a second tank of 200 gallons capacity. As soon as the empty sprayer reached the filling station one man made it his business to attend to the lime-sulphur solution and the other to stirring up the arsenate of lead. The outlet from the 200-gallon tank to the sprayer was five or six inches in diameter. The young men who attended to these operations were sons of the owner and a part of the firm. The result was that they worked at top speed, and on several occasions I have seen them load their sprayer and get away in seven minutes' time. The speaker was ostensibly helping the applications in the experimental plats, but in this orchard it worked out practically that his time was taken up largely in keeping time records and things of that sort. Indeed, as the dusting outfit was working at the same time he had all he could attend to. In this orchard the experimental applications of spray to 100 20-years-old trees were finished each time in less than four hours.

At the other orchard it was entirely different. The owner was very willing to do all he could but he lacked the experience that the other man had, and he did not have full appreciation of the great importance of the time element. It, therefore, worked out practically that the writer and his associate had to help toggle up the engine, help bail water from the spring to fill the spray tank and handle the spraying poles in addition to making the records. Working under these conditions, the best record we ever succeeded in making was 30 minutes for filling and the same amount of time for emptying.

Equipment for Rapid Emptying. The ways of the gasoline engine are beyond the comprehension of a great many men. Not only is time lost in toggling up parts that are out of order, but not infrequently it happens that some part is broken and must be ordered from the factory. The time when spraying is to be done is entirely too precious to be taken up with engine troubles, and it is, therefore, desirable that the engine be thoroughly overhauled some time in advance of the spraying season. Parts that are apt to wear out or break under strain ought to be kept on hand in duplicate. Extra pieces of hose to replace ones that develop breaks may also save several hours of precious time. The discs in nozzles wear out very easily, especially in applying the dormant spray and these discs ought to be purchased by the dozen. Splicings for a bursted hose may likewise prove great time savers. Packing for pumps and couplings for spray hose should have a place in every tool kit.

SPRAYING AGAINST THE WIND.

Another important feature in reducing the time element is to make a practice of spraying each tree as you go—in other words, to adopt the practice of spraying against the wind. Unless some of you have heard Professor Whetzel talk on this subject already, I am sure you will at once say that this is entirely out of the question. I wish to assure you that it is not out of the question at all and that while many of our growers insisted at first that it could not be done, still we find many of them are practising it regularly now. We also found that there were men who followed the practice for a long time before we agitated it at the New York State Fruit Growers' meetings in 1911. The idea in spraying against the wind is to hold the nozzle at such a point as to cover one side directly and allow the wind to carry the mist back and cover the opposite side of the twig or branch. The team is headed into the wind. The spray poles are thus held out laterally and one is able to comb the tree with spray and still wet neither the operator nor horses. The only condition necessary is that the man on the ground be provided with a hose of sufficient length so that he can work on the next tree back from the one the man on the tower is spraying.

LIMB SPRAYING VERSUS TREE SPRAYING.

You will notice that I said comb the tree. I have in mind here that each particular branch must receive special attention. It is not enough to spray a tree at a time. Each branch must be treated as a unit and the nozzle passed up and down each individual branch. This, of course, requires time and a considerable quantity of material. I have considered that if it is worth while to make a spraying at all it is worth while to do a thorough job. It is for this reason that I stated a moment ago that from six to ten gallons of spray would be required for a 40-years-old tree, and that to cover 150 trees was a big day's job for one outfit working at maximum capacity.

It is scarcely necessary to more than mention two conveniences that should be a part of every outfit. I refer to the tower and the poles. The two most important summer applications of spray cannot be applied at all effectively to trees of any size unless one of the operators is sufficiently elevated so that he can drive the spray down into the blossom clusters and later into the calyx cup. I have used the word pole advisably.

The spraying rod is a menace to good work, meaning, of course, the heavy iron rod that is used too frequently in spraying. The pole should be just as lightly constructed as possible. Any one who has held an iron rod all day realizes that towards the end of the day, the rod is held, not operated, and that pointing a rod in the general direction of a tree is not spraying according to the general definition of the term.

PROVISION FOR SUFFICIENT HELP AT SPRAYING TIME.

I am not sufficiently acquainted with Maine conditions to more than touch on another feature that is becoming an important consideration in the state of New York. This is the question of whether or not individuals are not planting too extensively. The point involved has nothing to do with overproduction, but rather the question of maintaining a proper balance between the orchard and the other farm operations, so that the orchardist may be assured of having men and teams in sufficient number to do orchard work at the effective moment. If this is not done the orchardist must put up with transients at spraying time or he may even find it impossible to get his spraying done at all.

High Pressure Spraying.—As was intimated a few moments ago, there is another way out of this difficulty—the possibility of applying the fungicide in some other form or with some kind of apparatus whereby a great deal more territory can be covered. The possibility of spraying with extreme high pressure has received some consideration in Massachusetts and in the far west but has not been adopted generally as yet, probably because of the high cost initial.

DUSTING.

All of you have noticed that when lime-sulphur is applied to the foliage, changes set in immediately and in the course of half an hour the sprayed leaf takes on a whitish appearance. This, as most of you know, is due to the liberation of a certain amount of sulphur. The individual particles of sulphur thus set free are exceedingly small and are held more or less firmly to the leaf by the calcium sulphide or other inert ingredient and by the arsenate of lead. As soon as these facts became evident, trials were made of the fungicidal value of finely ground sulphur in preventing the spores of the apple scab fungus from germinating. As was to have been expected, finely ground sulphur proved equally as effective as lime-sulphur solution. It seemed, therefore, that the only question needing consideration was to determine whether sulphur applied directly to foliage and fruit of the apple could be depended upon to adhere for a sufficient period of time to prove of value. If this proved to be the case there seemed to be no reason why the fungicide might not be applied in the dry state. It is well known that a much larger area can be covered with a dusting outfit and that orchards in which the soil is too wet to be sprayed with the ordinary liquid sprayer might be covered satisfactorily with such an apparatus. Work was started in the summer of 1911 to determine whether the dusting method would prove effective or not. A dusting machine was obtained and dust mixtures of various sorts carrying various amounts of insect poison in addition to sulphur were applied. It was realized from the outset that the satisfactory control of insect pests by means of a dry poison was equally as important as the control of apple scab with a dry fungicide, inasmuch as the two operations must be combined if for no other reason than the item of cost. Owing to the very unusual season no results were obtained in 1911. In 1912 the work was continued, but not on a very extensive scale, owing to the fact that orchards could not be found in which a reasonable amount of scab might be expected to develop. With the rather late fall rains of 1912, however, scab spread abundantly on the foliage and accordingly extensive experiments were planned for 1913.

DUSTING COMPARED WITH SPRAYING.

Two orchards were selected for the work and in each case 100 trees or more were included in the experiment. I exhibit here a chart showing the results obtained in a Greening orchard at North Rose, N. Y.

Picked Greening apples, Catchpole orchard, North Rose, N. Y.

PLAT.	Count trees.	Total apples.	Perfect.	Imperfect.	Scabby.	Bud moth.	Codling moth.	Curculio.
			%	%	%	%	%	%
Check	4	6363	8	92	80	39	12	4
Lime sulphur	4	8864	61	39	21	23	1	.48
Dust	4	11000	64	36	33	4	.4	.14

The blocks of apples were so selected that trees were nearly uniform in size, of the same age and equally exposed to the possibility of scab infection. The materials used were as follows: Commercial lime-sulphur was diluted at the rate of 1-40 and to this was added powdered arsenate of lead at the rate of two pounds to 100 gallons of liquid and applied at the rate of two and one-half gallons per tree. The dusting mixture was composed of finely ground sulphur mixed with powdered arsenate of lead to make a 20% lead mixture. This was applied at the rate of one and a half to two pounds per tree. All of the work was done on the same day and no external factors entered to influence the results one way or another. In many spraying experiments check plats do not receive sufficient consideration, and I, therefore, wish to call attention to the fact that as a check against the work we left a block of 32 trees untreated throughout the season. Coming now to the table, you will notice first that in the case of insects we secured better results with the dust mixture than when the poison was applied in the liquid form. It should be borne in mind, however, that codling moth, which is ordinarily our chief insect enemy, was not particularly abundant even in the unsprayed block. The control of bud moth and other spring caterpillars listed here under bud moth was exceedingly good. It might be stated parenthetically that equally as satisfactory results were obtained in 1912 when a mixture containing only 10% of arsenate of lead was used.

We come now to the figures in the table of most interest to me as a Plant Pathologist. You will notice that the dust mixture has not given as satisfactory control of scab as was obtained with lime-sulphur solution. The percentage of control, however, is very gratifying, considering the fact that all of the other dusting experiments thus far reported from Experiment Stations, with the possible exception of some work done in New Jersey, have been entirely against the use of dust. It seems quite possible that we may be able to refine our method another year to such an extent that we may secure as satisfactory results with the dry application as with the lime-sulphur solution. It appeals to me that the biggest obstacle, namely, the control of insect pests, has been overcome. I am not in a position to recommend to any one that he abandon the liquid spray. After we have accumulated data from another year of experimentation I shall feel in a position to offer more definite information on this subject. I believe, however, that a man with a young orchard coming into bearing, who is seriously contemplating the purchase of an additional spraying outfit, might well wait another year with the idea that dusting may be so far perfected that it will prove profitable for him to purchase a dusting outfit instead of a spraying machine.

Ques. How long would a lime-sulphur spray for scab be effective?

Ans. For a long time. Bordeaux mixture will be there during the season, that is, on an area which is not increased in size.

Time is precious in spraying an orchard and the machinery should be kept in proper condition. Filling the spray tank and fixing the gasoline engine, mending poles and cleaning out nozzles are not spraying, and these are not things that ought to be done during the spraying period. That time is precious and the apparatus ought to be put in shape so no time will be lost.

Ques. What is your standard pressure?

Ans. We get lots of standards out in the orchards. They run up to 200 pounds, and the big nozzles that we like best and are in common use don't work satisfactorily at a pressure under 150 pounds. Some people like to get out a row of nozzles. We never have been satisfied that we could do the best work with more than two nozzles on a pole.

Ques. Do you use the largest size disk?

Ans. Yes, providing we have the pressure.

Ques. Is 150 pounds a satisfactory pressure?

Ans. It is, for the large Friend nozzle that we commonly use; 150 pounds is necessary to produce the fog that is needed. Two hundred pounds will work all right, but anything under 150 does not give the fine spray that is really desirable.

Ques. With good sized trees, how many would you cover with 100 gallons?

Ans. We find that trees 40 years old, large trees, that haven't been trimmed and trimmed, require six or eight or even ten gallons per tree. It takes a lot of the spray to cover them satisfactorily.

Ques. How long does it take to put out 200 gallons?

Ans. It took us 30 minutes—seven minutes to fill and 30 minutes to empty.

Ques. What kind of sulphur do you use in the dusting process?

Ans. A brimstone ground exceedingly fine, so 90% of the sulphur would pass through the 200 mesh to the inch. In other words, it is finer than can be bought ordinarily. It is a preparation that can be manufactured if there is a demand for it.

Ques. If the spores winter on the limbs, would the spraying with lime-sulphur prevent those spores from developing?

Ans. I rather question it. We didn't seem to get that effect.

Ques. We understand that Bordeaux stays on better than lime-sulphur?

Ans. Yes. The only reason I wouldn't spray with Bordeaux is, about three times out of five we get so much Bordeaux injury the apple looks worse than as though it had the scab on it.

Ques. You get lime-sulphur injury?

Ans. Very little. Lime-sulphur injury with us is largely a question of burning through the leaf where the skin has been lifted up and the spray gets down in.

Ques. Do you think climatic conditions have anything to do with injury by spray?

Ans. They do unquestionably with Bordeaux mixture, but with lime-sulphur I do not know. We get some rather conflicting results there. The lime-sulphur we certainly can use on apples. It is decidedly preferable to Bordeaux mixture.

ADDRESS.

By Hon. John A. Roberts.

This association, in its forty years of work, has had a great influence upon the business of orcharding, in the state of Maine, and its influence is increasing from year to year. I wish, in a very brief time, to take a survey of orchard interests in this state, as I view them at the present time, and then I want to speak a minute upon organization work, to see if some of the problems that confront us cannot be worked out more economically, and at a more rapid rate.

The orchards of this state, of which there are many thousands, as a rule are small. We have many hundred orchards that number 50, 100, 150 or 200 trees. We have very few large orchards, and we find, as I view it, this condition of affairs: While there are many growers of fruit who give excellent care to their trees,—cultivating, pruning, fertilizing, looking after insect pests and diseases, and doing everything possible, we find on the other hand a large percentage of men who are neglecting their trees. Those men are a drag upon the business, and if there is any influence that can be brought to bear upon them to do better work, that is what we are after.

Again, when we come to the handling of the fruit, everything seems to be disorganized. Some sell their fruit to speculators, some to commission men. One ships fruit here and another there. There is no system in the matter of marketing our fruits. And again, there is no system in the matter of packing and branding our apples. There is no common agreement among the men who pack apples, the shippers and the buyers, as to what a No. 1 apple is. Even under the law which was passed last winter, we find that one man will contend that a certain barrel of apples is a No. 1 class, while another one, who has been in business perhaps an equally long time, will contend that it is not. There is no standard. Everything seems disorganized. I do not know as I should use the term "disorganized" because there never has been any organization. So the situation of the fruit industry in this state is that we have very little system. But if we are to succeed and make Maine really a good orchard state, raising good apples, packing them properly, and putting them upon the market where and when we can get the best price, it seems to me there must be organized effort.

We hear a great deal about the Oxford Bears' organization. You all know about them and about their success. There is no question but this organization has been a success, and a great success. Now what I believe we want in this state is more of such organizations. We want every community organized. And when we have these local organizations, we want a central organization. And with that central organization, if properly conducted, I believe a great work will have been done, or at least that we shall be in a position then to accomplish a great work. This central organization will work out many things. It need not be an organization of much capital, but if the local organizations were agreed upon a central organization to handle the crop, and the sole business of the central organization was to handle the crop and market it in the markets of the world, compelling the fruit as it comes to them to be graded and branded according to their desire, and as the markets demand, it seems to me that we would then be in a position to market our apples and put them upon the market according to the demand, and not, as now, produce a glut at one time and a scarcity at another.

Now out of that might grow, it seems to me, some beneficial results, and I am going to name them,—not necessarily in a logical order. First, if our apples were in the hands of a few men to sell, we could develop our home markets. And that is one thing in this state about which we are negligent. We have a population in our cities of several hundred thousand people who like apples, who like good apples, and who would buy Maine apples if they could get them. The fact of the case is, wherever you go into a city in this state, or a large village, even today, when apples are plenty in the period of harvesting, we find apples from the states of Washington and Oregon in large quantities displayed in the windows, and taking the place of the fruit that we ought to be putting in the windows of the stores of this state. I believe there is an opening for the farmers to take possession of our own market. We know the apples can be raised, we know they will be raised, and if we had a central body, if we could be organized and had a board of managers, they might develop this market and into these cities and towns of our own we could put many thousand apples and boxes of fruit every year.

I also believe that under organization we should have packing houses and storehouses, and those are things we need. If this great machine which has been used here this morning, the grading machine, and other makes, prove a success, as I am sure they will, it will go far towards solving the question of grading apples. Then, whoever handles the apples, whether it be the speculator or whether you organize and handle your apples yourselves, the use of this machine will lead to the erection of packing houses, and the apples of the men who produce small quantities of apples, the men with small orchards, will be brought together and put into these packing houses, and they can be put up in a uniform manner.

And again, we need more storehouses to hold our apples into the cold season. As I hinted a moment ago, when there is a large crop we rush it upon the market. We haven't any place to store the apples. Many of the farmers with 100 or 200 barrels of apples, cannot take care of them. A man with 500 barrels, unless he has made a special provision, is unable to store them through the cold season. So I believe that the organization work will develop into the organization of packing houses and storehouses. When we get to that point our apples will become standardized. Of course the tendency of the apple packing law is in that direction. That is one of the reasons why it was enacted, but it never will be fully accomplished until we come to the point when our apples can be packed in packing houses, when the apples coming from different farms, different varieties, grown under different circumstances, can be brought together and packed at a common packing room.

We want to standardize not only the fruit itself, but also the brand, and that was the intention of the law, but under the condition that exists today, a No. 1 barrel of apples in one section and packed by one party, is a different thing from a No. 1 apple in another section, packed by another party. This is a matter which seems to me of serious import.

Again, we find men who want to mark the No. 1 apples with about four X's on them, or something of that kind. I suppose they think it adds to the merits of the apple in some way, but

I think we want to get rid of that thing, and that all the apples packed in the state of Maine that are branded as No. 1's should be marked under the same brand,—for instance, "No. 1 Maine Baldwins," and all the apples that are packed as fancies should be marked simply "Fancy."

I will say a word in regard to the new apple packing law. This law, passed by the last legislature, has created much discussion among the people of the state, and when the department, with whom it was left to enforce the law, commenced operations and sent out inspectors, we found a condition of affairs that in some respects had not been dreamed of. Our work this year has been largely educational, teaching men what the law is, what it means, and trying to induce them not only to follow its precepts, but even to do better. We find a large number of farmers who ship a few barrels of apples to market. Many of them seem to have very little knowledge of how to brand a barrel of apples. They do it with a pencil, in the old way, writing in a way that is almost illegible. Now of course it was one task of ours to try to counteract that, to try to induce growers and those people who were not in the habit of shipping many apples to use a printed form, a printed blank, or something that would look neat and would cover the law. We have succeeded in a measure, and it is our intention before another year to work this matter out and try to teach those men who ship apples in small quantities to brand them better. Of course the shipper of apples, the buyer, stencils his apples as a rule. But for these people who do but little business we hope that we may work out something that they may all use, and that when we come around to another crop we may not find the difficulty which we have found this year.

As I said before, we find buyers, speculators in apples, with all sorts of minds, and we found some buyers that didn't want to grade their apples, but mark them "unclassified," which we did not like. We found some who still wanted to continue the old practice of putting in poor apples and marking them No. 1, but as a rule the shippers have been ready to conform to the requests of the law. It seems to me, if they could get together themselves and agree upon a standard pack, so that a barrel of No. 1 apples might be pretty near like another barrel of No. 1 apples, it would be very helpful.

Our orchard interests are very important, and very briefly I have tried to show you that I believe it is for our interests to organize and to work in coöperation in packing and in marketing our fruit. I believe that the men of Maine, the growers of apples, should take it into their hands to market their own apples. I believe with this organization, if you can get the central organization, even if you do not go to the point of leaving the sale of the fruit in the hands of a central board, that with twenty-five or fifty of these local organizations, as much of our fruit is shipped to Europe, you could send a man to England and another to Germany to look out for your interests, and you surely need them. We are selling our fruit now to the first man that comes along; we are paying large freight rates on the railroads and steamers; we are paying a commission in England and we are paying wharf charges and other charges, and they are eating up the profits. We are putting our apples into the hands of strangers, commission men and others, to sell for us, and we know nothing about it, we have no control over it, we are not superintending it. This is wrong, so I will recommend that you organize. I recommend that you make some of these small organizations, and you men who are interested, who are leaders in the orchard movement, you men who have been successful, you men who bring these beautiful apples to these exhibitions, you are the men to whom we are looking to organize the orchard movement in this state. I recommend that you divide this state into districts, and that in each district you have a committee that shall see to it this winter, right away, before another crop comes around, and have an organization created.

I remember a little story of a Frenchman who came to this country for the first time. A friend of his in this country, a Yankee, took him to one of the leading hotels. The Frenchman had heard very much about pumpkin pie, that we love so dearly ourselves, and he said, "I want a piece of pumpkin pie." It was given him, and then he was asked how he liked it. Why, he liked it, but he said, "There seems to be ginger, or something of that kind in it." The answer was, "There is ginger in everything in America," and that is what we need in our orchard interests.

THE FERTILIZATION OF APPLE ORCHARDS.

By Dr. John P. Stewart, Experimental Pomologist, State College, Pa.

The experiments started in 1907-8, by the Pennsylvania Experiment Station, have shown that the available supply of plant-food in an orchard may be the most important check on its production. By variations in fertilization alone, we have obtained average increases in yield ranging from 50 to 370 bushels per acre annually for the past 5 or 6 years. This means that, with a valuation of only 50 cents per bushel for the extra fruit, proper fertilization has given us average net returns running up to more than $160 per acre annually. The accompanying increases in growth and general vigor of the trees have been almost as marked.

It is our present purpose to indicate briefly the general conditions under which these results were obtained, and to outline a simple plan for determining whether or not similar responses can be secured in any particular orchard.

At the outset we may say that our present results and deductions are derived more or less directly from the results of 13 experiments involving 10 soil types, 12 different locations, 2653 trees (excluding those strictly on cultural methods), and over 42,300 bushels of fruit in the last 6 years. Only six of these experiments, however, are entirely on fertilization and in bearing, and only the more important results from three of them will be considered here, although the results from all six are summarized. These six experiments involve six soil types, 800 trees, and about 15,300 bushels of fruit in the past 6 years.

The Amounts of Plant Food Actually Taken Up By a Mature Orchard.

Before examining the results themselves, however, it will be well to consider briefly the actual fertility requirements of a mature apple orchard. This is a matter upon which there is much misconception and misinformation. It is not uncommon to hear that apples consist almost entirely of water, one writer having stated recently that they contain 98 per cent water, and hence have no need for any actual fertility or plant food. It is true that apples actually are about 84 1-2 per cent water on the average, but it is also true that in the remaining 15 1-2 per cent of solids much actual plant food is contained.

The real amount of this food can be approximated chemically by determining the average composition of apple wood, leaves, and fruit, and by applying these figures to what may be considered good annual amounts of these products. This we have done both for apples and for a 25-bushel crop of wheat, with the results shown in Table I. The annual weights for apples are based on a yearly production of 100 pounds each of wood and leaves, and of 14 bushels of apples per mature tree. All these amounts are distinctly less than those actually observed and reported, but inasmuch as they give an annual yield of 490 bushels per acre of 35 trees they are considered sufficient for the present purpose.

TABLE I.—THE RELATIVE PLANT-FOOD DRAFT OF WHEAT AND APPLES.

(In Pounds per Acre Annually, Based on American and German Averages.)

Annual Weights.	Wheat grain Lbs. 1500	Wheat (Total) Lbs. 4200	Wood Lbs. 3500	Leaves Lbs. 3500	Fruit Lbs. 24500	Apple (Total) Lbs. 31500
Nitrogen (N)	30.00	43.7	11.3	25.6	16.2	53.1
Phos. Acid (P_2O_5)	10.00	15.8	3.6	5.3	6.4	15.3
Potash (K_2O)	9.80	26.8	6.6	15.9	41.5	64.0
Lime (CaO)	0.84	8.0	29.1	29.5	3.0	61.6
Magnesia (MgO)	3.00	6.1	4.4	8.9	3.4	16.7
Iron (FeO)	-	-	0.5	1.5	0.8	2.8

This table shows that in total food draft, the apples exceed the 25-bushel wheat crop in every constituent except phosphoric acid, and in it they fall behind only by half a pound. Notwithstanding this fact, apple trees are usually able to maintain themselves much better and longer than wheat. This is doubtless largely because of their much longer season of root-activity, their more natural demands,* the annual return of most of the plant food in their leaves, and their ability to furnish

*This is especially marked in the case of the fruit as compared with the demands of the grain in wheat. For further discussion, see article by the writer in the Annual Report of the Pennsylvania Experiment Station for 1910-11, pages 447 to 449.

all these materials indefinitely in the amounts and times required, and, unless proper assistance is rendered there must come a time when production is materially reduced and off seasons occur.

On the other hand, it may be noted that part of the orchard's product requires comparatively small amounts of the important elements. This is especially true of the wood, even when the annual production of mature trees is considered. Incidentally this accounts for the fact that young trees are much less likely to make a profitable response to fertilizer applications than those of bearing age. Such trees often respond very well to manure or to any other satisfactory mulch, as shown in three of our experiments considered elsewhere. This, however, is apparently due more to moisture conservation than to any direct increase in fertility.

The large amount of lime contained in the wood may have some significance, because, as shown later in several of our experiments, its application has resulted in considerable improvement in growth. In the fruit, however, very little lime is required, and hence its application should not be expected to affect the yields materially, and this corresponds with our field results. Moreover, the total effect of adding lime alone is surprisingly small, in comparison with the large amounts that are taken up. Either these amounts are merely drawn in and deposited mechanically, and hence are largely without physiological significance, or else the average soil is still able to supply the lime needed.

With iron the case is very similar. This element is almost universally present in agricultural soils and the total amount required is so small that its addition can scarcely be expected to produce any important effect. This also is borne out by such experimental results as are now available.

The fruit, on the other hand, carries a large amount of potash. From this, one might suppose that its addition to the soil would be very important in improving yields, and this idea has been widely proclaimed, especially by those considering only the chemical composition of the fruit. As indicated later, however, most orchard soils are already sufficiently supplied with potash, and the chief shortages occur in nitrogen and phosphates, although the latter materials are actually required in considerably smaller amounts.

From these facts it is evident that there is comparatively little relation between response and total requirements in the case of plant food, and that something more than a knowledge of the chemical composition of the fruit and wood is needed before one can properly fertilize an orchard. Even with the additional knowledge of the composition of the soil, the problem is not much simplified, because it is impossible as yet to duplicate sufficiently the conditions existing in any soil. A chemist may determine the total amounts of plant food present, but he can not yet determine their actual availability to the trees with sufficient accuracy to be of much value.

The practical and proper fertilization of an orchard, therefore, becomes an experimental problem. The first stage of this problem involves general experiments for the purpose of developing the most promising application for general use, where fertilizers seem to be needed. This general formula can then be adjusted to the exact needs of the particular orchard involved, by means of a local testing plan. Our present data on these questions are as follows:

Rates and Methods of Application.—The rates of application that we have been using in the series of experiments in Pennsylvania are as follows: *Actual nitrogen,* 50 pounds per acre, carried about half in dried blood and half in nitrate of soda; *actual phosphoric acid* (P_2O_5), 100 pounds, carried in acid phosphate, with "floats" and recently basic slag used in certain plats for comparison; *Potash* (K_2O), 150 pounds, carried at present in the high-grade muriate, with the high-grade sulphate and recently also the low-grade sulphate used in comparison in certain experiments. The manure is applied at the rate of 12 tons per acre, and the lime at 1000 pounds per acre. All applications are made annually. In the Johnston and Brown experiments considered below, the fertilizers are not cultivated into the soil, but are simply spread over the surface and left to be carried in by the rains. They are cultivated in the Tyson experiment. All fertilizer applications are made somewhat after petals fall, but the manure is put on any time during the spring.

These applications were naturally designed at the beginning of the experiments, before there was any definite experimental evidence as to the most desirable proportions and amounts to use. The amounts now advised for general use are shown later.

Results from the Johnston Orchard.

The following table gives the yields obtained from the above applications during the past 6 years. These results are obtained from an experiment with Baldwins, now 25 years of age, located on a Volusia silt loam in Lawrence county, north of Pittsburg. On first inspection these trees did not seem to be suffering especially from a lack of plant food, but they had not been bearing satisfactorily and their annual twig growth was averaging only about an inch, with occasional maximum growths of 5 or 6 inches. These rates of growth are continuing on the checks or unfertilized plats, but they have been practically tripled on the plats receiving proper fertilization. In estimating the influence of the treatments, the yields of the first year are uniformly excluded because they can never be materially affected by the applications of the first season.

TABLE II.—INFLUENCE OF FERTILIZATION ON YIELD.
(JOHNSTON ORCHARD.)

Yields in lbs. per plot and bu. per acre, 1908-1913.

Plot.	Treatment.	1908.	1909.	1910.	1911.	1912.	1913.	Totals last 5 yrs.—Lbs.	Average Annual yield per A.—Bu.	Annual gain over average check.—Bu. per A.
1	Check	90	675	2575	283	1024	1210	5767	138.4	–
2	Nitrogen and Phosphate	528	6018	3265	7563	1225	3563	21634	519.2	348.7
3	Nitrogen and potash	237	5257	1822	7816	696	3489	19080	457.9	287.4
4	Check	446	1932	3168	617	1382	1777	8876	213.0	–
5	Phosphate and potash	57	3089	3552	1227	1385	1207	10460	251.0	80.5
6	Complete fertilizer	759	6621	2108	8209	189	2320	19447	466.8	296.3
7	Check	211	2008	1639	1362	1226	1635	7860	188.6	–
8	Manure	278	3531	6149	4874	6698	1314	22566	541.3	370.8
9	Lime (and fertilizer)	558	1216	3185	388	741	2174	7704	184.8	14.3
10	Check	106	1266	3505	106	474	578	5929	142.3	–

The average check has yielded 170.5 bushels per acre annually.

The results in 1913 were very seriously interfered with by the heavy frosts that occurred on May 11 and 12. The frost effects were especially severe on plats 2, 3, and 6, as this was their full-crop year, and their blossom indications were as good as or better than in 1911. They were estimated to have 100 per cent of a full bloom in 1913, while the other plats averaged about 30 per cent.

Looking at the total results, however, it will be noted that the average yields of the checks, or unfertilized plats, have run fairly uniform, producing an average annual yield of 170.5 bushels per acre during the last five years. Lime alone (at the rate of 1,000 pounds per acre annually) showed no improvement over the average check during the first four years, and it is only being brought above now by the addition of a complete fertilizer during the last two years. The phosphate and potash combination here is also poor, although it may have some advantage in location, as indicated by the fact that its adjacent check is the highest producer among them and is now averaging within 38 bushels of the phosphate-potash treatment. The growth on the latter plat, also, is nearly 3 per cent less than that of the normal unfertilized plat, and its general appearance is in no way superior. It is evident, therefore, that these trees are still vitally in need of something, although it will be noted that they are receiving the fertilization commonly advised for orchards,—largely on the basis of chemical analyses.

This need is being quite thoroughly met on the adjacent plat 6, which differs from No. 5 only in the addition of nitrogen. The mere addition of nitrogen in this case has more than tripled the gain. Also it will be noted that wherever nitrogen appears in the treatments, very large yields are observed, and the foliage and growth of the trees are also very satisfactory,—the average gains in trunk girth ranging from 25 to 90 per cent.

Plat 2, receiving nitrogen and phosphate only, at the present time shows a distinctly better gain than No. 6, which receives potash in addition. This is directly connected with the almost complete crop failure that occurred in the latter plat in 1912, and it is also partly attributable to an unusual amount of crowding that is occurring among the trees of plat 6. It shows, however, that little or no additional potash is needed in this orchard, and that its addition thus far has actually been a detriment so far as the yields are concerned.

Phosphates are next in importance to nitrogen here, as indicated by the 9-bushel average deficit that occurs on plat 3 as compared with No. 6, when phosphorus is omitted in the former, and also by the high yields in plat 2. Manure, as a result of the extra large crop of 1912, when most of the other plats were having an off season, is now in the lead in this experiment, with the excellent average yield of 541 bushels per acre annually for the past five years, notwithstanding the frost injury of 1913. This gives an annual gain over the check of 370 bushels per acre, which is a very satisfactory exchange for 12 tons of manure. This benefit from manure is also largely due to its nitrogen content, the proof of which becomes more evident later.

Time Required for Results to Appear.—It is a common impression that long periods are required to determine the value and kind of fertilizer needed for an orchard. It will be noted here and in the following experiment, however, that both these facts were thoroughly evident in the season immediately following the one in which the fertilizers were first applied. In other words, both the value of fertilization and the kind of fertilizer needed were clearly evident in these two cases within but little more than a single year after the first application, and the general conclusions formulated then have not been materially changed by the results of the 4 or 5 additional years that we now have. In all other cases, except one, also, where these facts did not appear in the first two or three seasons of bearing, they have not appeared in the results of the six or seven years that are now available. This is of special importance in connection with the local tests recommended later, though in them we advise at least 3 years of trial for the sake of greater safety and greater stability in the resulting conclusions.

The one exception made above has been in the Mynard orchard, which did not show any special benefits from fertilization until the sixth year, chiefly because it was already being limited by a shortage in moisture.

Results from the Brown Orchard.

This experiment is located in Bedford county on DeKalb stony loam,—a residual, foot-hill soil chiefly of sandstone origin, which is widely used for orchard purposes. This soil had been cropped very heavily before the orchard was planted. The trees are York Imperial, now 25 years old. They had borne some fairly good crops before the experiment was started, but they were no longer bearing well except on occasional trees, and their annual twig growth was very small,—averaging scarcely half an inch. This rate of growth has also been greatly increased by fertilization.

This experiment involves the same treatments as those in the Johnston orchard and four others besides,—those in plats 6, 9, 11 and 12. It also was started a year earlier, in 1907, and the results of that season are excluded in the present table for reasons stated above. The results for the past six years are given in Table III.

TABLE III.—INFLUENCE OF FERTILIZERS ON YIELD. (BROWN ORCHARD.)

Yields in pounds per plot, 1908-1913.

Plot.	TREATMENT.	1908.	1909.	1910.	1911.	1912.	1913.	Totals.	Benefit over normal.—Per cent.	Annual gain over av. check.—* Bu. per A.
1	Check	2402	23	4052	1588	453	3155	11675	-	-
2	Nitrogen and phosphate	4153	588	5920	2219	7281	1170	21331	136.2	289.3
3	Nitrogen and potash	3079	78	3838	1567	5402	963	14927	133.6	198.9
4	Check	754	9	470	1260	309	942	3744	-	-
5	Phosphate and muriate	1014	252	2381	1643	616	1501	7407	62.4	70.4
6	Phosphate and Sulphate	292	266	1368	1299	356	1509	5090	-5.3	6.4
7	Check	254	192	1115	1568	1117	1949	6195	-	-
8	Nitrogen, phosphate and potash	1219	454	2436	3241	4931	1369	13650	122.5	206.1
9	Nitrogen	863	1575	120	3082	1614	2721	9975	64.3	120.3
10	Check	458	515	787	1448	222	2583	6013	-	-
11	Acid Phosphate	104	892	787	794	64	2910	5551	5.2	17.1
12	Raw Phosphate	100	124	581	703	123	3184	5815	2.1	23.3
13	Check	266	257	2096	498	727	1692	5536	-	-
14	Manure	621	1947	778	7334	1117	2422	14219	212.2	219.4
15	Lime	152	160	1029	1060	288	2643	5332	49.3	12.0
16	Check	246	36	943	387	166	813	2591	-	-

In general, we have the same types of results here as in the preceding experiment,—large gains from nitrogen, phosphates and manures, with relatively small effects from potash, and

* In plats 2 and 3, the average gains over the "normal production" are given, on account of the unusual conditions near plat 1. Their annual yields were 4977 and 3483 bushels per acre respectively. The average check, omitting No. 1, has yielded 4816 pounds per plot or 112.4 bushels per acre annually.

Yields per acre in 1912. Plots 1 and 4 equal 73.2 bushels. Plot 2, picked, 1086.7 bushels. Total, 1397.9 bushels. Plot 3, picked, 925 bushels, total, 1037 bushels. 48 trees per acre and 50 lbs. to bushel are used. The Baldwins have produced less than 2-7 of the totals in this experiment, hence each plot is considered as slightly less than 7 trees or one-seventh of an acre.

again no advantage at all from lime. Incidentally there are greater irregularities in this experiment, owing somewhat to its greater size, but chiefly due to the presence of a woods on the mountain side above the first check plat, from which the latter is separated by a single row of trees. The leachings from the floor of the woods have acted much like a nitrogen fertilizer, and as a result the trees nearest the woods, although of the same age as those farther down, are considerably larger, thus accounting for the greater yields of the first 2 or 3 plats. This influence practically disappears, however, before the fourth plat is reached, as shown by its low yields which are those of a typical check.

The differences observed in the last two columns are due partly to these irregularities, partly to a certain amount of leaching and cross-feeding on the part of some of the checks in spite of separation rows below each treated plat, and partly to a different method of calculation. In one column, the benefit is figured on the basis of the normal production of the immediate plat concerned, which method is supposed to eliminate soil irregularities to the greatest extent. When the adjacent checks are being benefited by leachings or cross-feeding, however, this method fails to show the full benefit due to the treatment. The average check itself is not entirely free from the cross-feeding influences, since it only distributes their extra yields, and hence it is probable that some of the benefits indicated in the last column are still lower than they should be.

Returning now to the results themselves, and especially to those treatments not included in the preceding experiment, we may note first that the muriate of potash in plat 5 has given much better gains than the sulphate in the adjacent plat. This is contrary to the results of the Massachusetts experiment, but similar results are now being shown in all our experiments wherever this comparison occurs. Hence the difference in the Massachusetts experiment would seem to be due to something other than the difference in potash carrier. At present, therefore, we believe that the muriate is at least as efficient as the sulphate, and in view of the facts that it is cheaper, more soluble, and much less subject to "caking" in the mixtures, we are now using and recommending it for apples.

In plats 11 and 12, and in similarly treated plats of our other experiments, we see the apparent futility of attempting to improve yields materially by applying phosphates alone. The present slight gains on these plats have only been secured by the addition of nitrogen and potash to "complete" their fertilization during the past two seasons. This failure of the phosphates when applied alone is not due to the fact that phosphorus is not needed, nor can it be largely attributable to the absence of cultivation, as may be seen by comparing the results in plats 9 and 2. Nitrogen by itself in No. 9 shows an annual gain of 64.3 per cent or 120 bushels per acre, but when phosphorus is added in plat 2 these benefits are more than doubled. Phosphorus, as usual, therefore, appears to be next in importance after nitrogen in improving yields.

The Permanence of Fertilizer Influence.—It is another fairly common impression that the influence of fertilizers is transient and that, even where their effect is favorable at first, this effect soon wears out and may leave the soil worse than before. This evidently depends very largely on the character of the fertilization, and in this respect apples are not different from other crops. If the gains are induced by some caustic action of such materials as gypsum or lime when used alone, this may actually be the final result.

On the other hand, it should be noted that in plats 2, 3 and 8, where definite plant foods are being supplied, the effects of fertilization were greater in 1912, the sixth year of the experiment, than ever before. The steadiness and regularity of the increases also are especially notable in plat 8, which shows a distinct gain in every year except 1909, and in that year the yield would have been fully 1,000 pounds greater had there been sufficient moisture available to properly develop the fruits that were actually present. In 1913, all the yields were reduced here also by the unusually late and severe frosts in May.

In plats 2 and 3, only two fertilizer elements have been applied, and also the yields have been so large in the evenly numbered years that it was impossible to prevent some alternation with lighter crops in the odd years. This same general condition is evident to a considerable extent in the Johnston orchard. In other experiments, however, and especially in one primarily on cultural methods in the Fassett orchard, with proper fertilization and with crops ranging from 200 to 600 bushels per acre, we have had relatively steady yields on Baldwins and Spies, similar to those in plat 8, which have been maintained for a period of five years without any important decrease appearing.

The unusual size of the 1912 crops on plats 2 and 3 in the Brown experiment deserves special attention. While their adjacent checks, 1 and 4, were showing an average yield of 73.2 bushels per acre, plats 2 and 3 were producing the tremendous average of 1,217.5 bushels per acre, and 1,006 bushels of this were picked fruit. The terminal twig growth of the checks, in the meantime, averaged scarcely half an inch for the season, while that of the fertilized plats, in spite of their enormous crops, averaged from 6 to 8 inches, with frequent terminals running up to 2 feet. All these differences were brought about solely as a result of differences in fertilization. The spraying, pruning, soil management, variety and age of trees, and all other visible features were just the same on the checks as on the fertilized plats.

Results in the Tyson Orchard.

In the two preceding experiments, we have seen large annual gains resulting from certain fertilization, particularly that rich in nitrogen and phosphorus, regardless of whether these elements were carried in manure or in commercial forms. In these cases also, the gains from potash were relatively small or entirely absent. Thus far in the Tyson experiment, so far as the yields are concerned, we have practically the reverse conditions.

The trees in the latter experiment are much younger, being now but 15 years of age. The varieties are York Imperial and Stayman Winesap, the latter having been top-worked on certain York rows about 6 years after planting. The soil is a relatively heavy silt loam, and tillage and annual cover-crops have been maintained near the trees practically uniformly since the orchard was started. The annual growth and general appearance of all the trees in this experiment are much better than those of the average check trees in the preceding experiments. Practically no fruit had been borne by these trees when our experiment was started in 1907, and there have been but two fairly full crops since then,—those of 1911 and 1913. The treatments are the same as those in the Brown experiment and the results are shown in Table IV.

TABLE IV.—INFLUENCE OF FERTILIZATION ON YIELD AND GROWTH IN EXPERIMENT 215. (TYSON ORCHARD)

Yield in pounds per plot, 1908-1913.

Plot.	Treatment.	1908.	1909.	1910.	1911.	1912.	1913.	Totals.	Benefit over normal.—Per cent.	Gain over av. check 4 years.—Bu. per A.	Growth gain over normal 6 yr.—Per cent.
1	Check	14	95	343	2053	549	3990	6947	-	-	-
2	Nitrogen and phosphate	26	73	301	2277	464	4645	7786	14.6	34.5	7.4
3	Nitrogen and potash	43	115	418	3043	542	5264	9425	41.8	68.4	17.7
4	Check	21	54	260	1555	719	3886	6495	-	-	-
5	Phosphate and muriate	26	146	476	2828	495	5178	9049	45.4	59.0	8.1
6	Phosphate and sulphate	61	179	483	2352	975	4110	8160	37.1	36.0	2.3
7	Check	18	45	235	1777	862	2740	5677	-	-	-
8	Comp. fertilizer	21	74	300	2885	190	5132	8602	49.7	50.2	12.7
9	Nitrogen	17	83	229	1746	551	4159	6785	17.8	6.5	7.9
10	Check	17	89	150	1579	504	3547	5886	-	-	-
11	Acid phosphate	3	43	153	1359	655	3891	6104	-3.4	-8.4	4.4
12	Raw phosphate	4	62	164	2010	842	3825	6907	2.2	9.1	0.8
13	Check	31	46	103	1886	615	4511	7192	-	-	-
14	Manure	15	52	190	2333	262	5363	8215	16.3	41.3	14.6
15	Lime (and fertilizer)	27	86	186	1765	1113	3620	6797	-2.0	6.5	-1.6
16	Check	10	76	115	1922	739	3947	6809	-	-	-

Average Check equals 6501 lbs. for 6 years and 6415 for last 4 years or 154 bushels per acre for last 4 years.

The relative growth of these trees makes both their yields and differences much less than those in the preceding experiments. With increasing age, it is probable that some of the results may be different, especially in view of the relative growth that is now being made under the different treatments. At present, however, certain facts are of interest.

In the first place, the comparative failure here of both manure and nitrogen is quite remarkable. The regular annual application of 12 tons of stable manure, in this case, has resulted in an annual gain of less than 15 bushels of apples per acre. During the same time, nitrogen alone has shown, and nitrogen and phosphates, which were so effective in the preceding experiments, here show an annual gain of only 34.5 bushels per acre,—but little more than enough to pay for the treatment.

Potash, on the other hand, in direct contrast to its effect in the experiment above, here shows a distinct gain in yield wherever it is applied. The best of these gains—the one in combination with nitrogen—is only 68.4 bushels per acre annually, but this is more than 40 per cent increase over the normal yield, and it shows a fair profit over the cost of treatment, besides giving over 17 per cent of an increase in growth. Potash applications, therefore, have evidently been of value in this orchard, even when those of manure and of nitrogen and phosphates were largely failing.

The Action of Manure vs. that of Commercial Fertilizer.—The above facts, taken in connection with those shown in the two earlier experiments, indicate that the plant-food action of manure is practically identical with that of a commercial fertilizer rich in nitrogen and phosphates. It also apparently indicates that the potash in the manure may be less readily available than that carried in commercial forms. The old controversy over the relative value of manure and commercial fertilizers, therefore, is without any particular significance, so far as plant food is concerned. Either type of fertilizer may be successful or either may be a failure, depending upon the particular conditions involved.

The manure, however, often has some additional value as a mulch. This naturally can not be duplicated by commercial fertilizers alone, though it may be duplicated by any other kind of mulch, as has been shown especially in our experiment in the Mynard orchard in Bradford county, and also in most of our cultural method experiments. The matter of availability also is often important, as manure cannot always be secured, and it is for this reason that the relation between manure and nitrogenous fertilizers should be well understood. Moreover, it sometimes happens that large and regular applications of manure may result in a distinct increase in the amount of blight, and also in an undue increase in the size of the fruit and in the amount of punky pitting in the flesh of the latter. In such cases, a reduction in the applications or the partial or complete substitution of a proper commercial fertilizer is desirable.

A Summary of Fertilizer Influences on Apples.

It is impossible in the present space to consider all our experiments singly, to the extent done with the three just considered. Before passing to the last stage of our discussion, however, it seems desirable to present a brief tabular summary of the fertilizer influences shown in six of the experiments, including the three just considered. This summary shows the calculated influences of the various fertilizer elements on the four most important characteristics of apples, viz., their yield, color, average size and amount of wood-growth. The relative values of the different elements during a five-year period, in terms of benefit over the normal results obtained without fertilization, are shown in Table V.

TABLE V.—INFLUENCE OF FERTILIZER ELEMENTS ON APPLES.

Average Benefits over the Normal Results without Fertilization 1908 to 1912.

(a) Expts. 215, 216 and 220.	Yield.	Color.	Size.	Growth.
	%	%	%	%
Nitrates in combination	62.7	-11.6	-0.7	10.43
Nitrates alone	32.5	-12.7	-4.3	15.51
Phosphates in combination	20.2	-2.1	0.3	2.28
Phosphates alone	-10.7	2.7	-0.6	2.45
Potash in combination	15.1	3.2	5.8	3.67
Complete fertilizer	78.3	-15.4	5.2	17.67
Manure	75.9	-11.4	5.8	29.07
Lime alone	-8.24	-0.3	-2.0	6.31
(b) Expts. 336, 338 and 339.	1908-12	1909-12.	1909-12.	1908-12.
Nitrates in combination	74.5	-12.7	-0.4	27.00
Phosphates in combination	33.5	-2.8	4.9	-0.23
Potash in combination	-3.6	1.4	7.1	2.79
Complete fertilizer	80.5	-15.6	5.2	29.63
Manure	168.8	-15.9	25.2	37.34
Lime alone	29.8	-5.4	15.9	15.48

Without going into details it may be noted that in general the same influences that have materially increased the yields have also increased the growth. In other words, our best growing plats have as a rule been our best fruiting plats. On sound, healthy trees, this will generally be the case *unless either occurs to an abnormal extent,* in which case the other may be somewhat reduced. Mild injuries may also stimulate yields at the expense of growth, and thus obscure the general rule.

In Table V, the most marked exception to the present rule appears in the case of the phosphates, especially in the lower section of the table. This may be connected with the fact that old wood especially is very low in phosphoric acid, as shown in Table I, and our present definite growth determinations are based upon increase in trunk girth alone. On twig growth, however, our observations indicate that phosphate additions have been very helpful, particularly in the Brown orchard, a fact which tends to bring it in line with the general rule just stated.

The Control of Average Size.—So far as fertilization is concerned, manure and potash are the only materials that have consistently benefited size. This influence of manure is doubtless very largely due to its mulching effect, since moisture makes up about 84.6 per cent of this fruit, on the average.* The potash influence also, so far as it is a definite benefit, is probably exercised through the same medium, inasmuch as potash is credited with some ability to increase the osmotic power of the cells and thus enable them to compete more successfully for whatever water is present.

There is also a distinct possibility that the apparent benefit of potash on size may be largely due to the fact that it is associated with much lower yields than the other materials, especially nitrogen. Conversely, the failures of the latter to increase size may likewise be due to association with markedly increased yields.

This brings out the general proposition to which we have called definite attention elsewhere,† viz., that with a normal moisture supply and sufficient growing season, the dominant influence controlling size in apples is the number of fruits on the tree, after this number has passed a certain optimum or "critical point." This point, however, is relatively high, our data showing that even on trees up to 15 years of age, little or no correlation appeared until the number of fruits had reached 1,400 or more per tree. Above this point, proper

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* See Table XVIII in the writer's article in the Annual Report of the Pennsylvania Agricultural Experiment Station for 1910-11, p. 435.

† See article referred to in footnote 3, pages 500-503.

thinning is the most important means of increasing the size of the fruit. Below it, the size can usually be markedly affected by moisture supply, cultural methods, manure, and possibly by fertilizers,—especially those rich in potash. The latter factors may also coöperate in such a way as to materially raise the critical point. In general, however, proper thinning and moisture conservation are the most important means of improving fruit size.

The Control of Fruit Color.—In Table V, it will be observed that none of the fertilizer treatments has resulted in any marked improvement in color. Slight and irregular benefits are shown by potash and by some of the phosphate applications, but nothing of any importance. The same is true of iron applications, so far as experimental evidence is concerned.

These facts again lead up to the general propositions that color in apples cannot be materially increased by fertilizer applications, and that their red colors are essentially dependent upon maturity and sunlight. Conditions that tend to increase one or both of the latter factors, such as late picking, open pruning, light soils and sod culture, tend to increase the red color. Opposite conditions decrease it.

These propositions make it clear why the nitrates and manure apparently injure color. It is simply done by retarding maturity and diminishing the available sunlight, as a result of the increased density of foliage. To determine the truth of this, in 1911 we left the fruit on the nitrate plats in the Johnston orchard until it had reached approximately the same degree of maturity as that attained by the checks when their fruit had to be picked on account of dropping. The delay required was fully three weeks,—from September 29th to October 19th, and even then the later fruit was picked with much more difficulty than that on the checks, besides showing a much lower percentage of fruits dropped. The amount of color on the nitrate plats at the later date was actually greater by 10 per cent than that shown on the checks at the time of picking.

The occasional marked increase that sometimes occurs in color as a result of spraying is largely explainable on similar grounds. The spray reduces the worminess and thus enables the fruit to remain longer on the tree. It also may reduce the amount of foliage somewhat, as a result of spray injury, thus permitting more light to reach the fruit. In general, however, in improving color, chief reliance must be placed on those methods that tend definitely to secure fuller maturity on the trees and to get the maximum amounts of light to the fruit.

Applying Present Data to Individual Orchards.

In the three experiments discussed separately above, it was noted that the materials found most valuable in the first two were failures in the third, and vice versa. In still other experiments, we can show cases where no form of fertilization has yet shown a profit. These and other experiments prove conclusively the local nature of the problem. Hence even the experiments of others can offer no more than general advice on the fertilization of a particular orchard.

This advice can doubtless be made more exact after a personal examination of the orchard concerned, by one who is familiar with orchard fertilization work, or it may be done with greater certainty if the owner will note and look for some of the more important characteristics of orchards needing fertilization. The latter are best observed in late summer and fall.

In general, the characteristics of an orchard that is certainly in need of a fertilizer are those of starvation. They are usually sufficiently familiar to need no extended description. They are found most commonly in the older orchards, especially in those that have once borne well but are no longer doing so although still fairly free from important diseases or improper drainage. The foliage is sparse and pale in such orchards, and the annual growth stops early and averages short,—often not more than a half inch, and from this it may range up to two or three inches. In such cases, one can usually apply fertilizers rather liberally with practical confidence of profits, provided the varieties and general handling are right. Even in such an orchard, however, it is advisable to leave a small typical portion unfertilized to really determine the value of the treatment.

Under the opposite conditions, such as obtain in most young orchards or in any orchard that is still growing and fruiting well, and retaining its foliage until late in the season, fertilization is much less likely to show a profit. Even in these cases, however, there is often enough probability of benefit to warrant a limited trial of fertilization, but only over a relatively small area, and with most of the orchard left unfertilized as a check.

These trials are especially necessary, in the intermediate orchards,—those on the zone lying between the two extreme types just described. Occasionally this intermediate type will respond very strongly to fertilization without necessarily showing the characteristic marks, as is practically illustrated in the Johnston orchard.

A General Fertilizer Recommendation for Apples.

For preliminary use in orchards that are apparently in need of fertilization, on the part of those who are unable to carry out such a local test as is shown later, we are now recommending the general fertilizer indicated in Table VI. The fertilizers are stated in amounts per acre rather than in amounts per tree, because of the varying numbers of trees that are planted on an acre. The amounts per tree are readily obtainable, however, by dividing the present amounts by the given number of trees per acre. For young trees, these amounts may be reduced approximately in proportion to the area of soil covered, making this area correspond with the lateral distribution of the roots so far as possible.

TABLE VI.—A GENERAL FERTILIZER FOR APPLE ORCHARDS.

(Amounts per Acre for Bearing Trees)*

Nitrogen 30 lbs. (N).	Phosphoric Acid 50 lbs. (P_2O_5)	Potash 25 to 50 lbs. (K_2O)
Carried in: 100 pounds nitrate and 150 pounds dried blood, or in 150 pounds ammonium sulphate	Carried in: 350 pounds acid phosphate or in 200 pounds bone meal or in 300 pounds basic slag	Carried in: 50 to 100 pounds muriate or in 100 to 200 pounds of low-grade sulphate

* For young orchards, reduce these amounts in proportion to area covered.

This table means that a fertilizer carrying about 30 pounds of actual nitrogen, 50 pounds of actual phosphoric acid (P_2O_5) and 25 to 50 pounds of actual potash (K_2O) should be applied to an acre of bearing trees. Where potash is not known to be lacking, the smaller amount should be used, or after a little testing it may even be omitted entirely. With the smaller amount of potash, the essentials of the present combination are carried in 500 pounds of a 6-10-5 fertilizer or its equivalent. In the usual ready-mixed fertilizers, the nitrogen is likely to be carried in ammonium sulphate, with which some liming may be necessary if many applications are made, and especially if leguminous cover crops or permanent covers are desired. In special or in home-made mixtures, the various elements may be carried in any of the materials indicated in the table.

In the work of this Station, the nitrogen is carried in the combination of nitrate of soda and dried blood indicated in the table. This combination carries about equal amounts of nitrogen in each material, and it thus gives a quick action as as well as one that is prolonged well through the season. The nitrogen, being the costliest and most active ingredient, requires close watching and possible variations in amount, in order to get the most out of it. It may also be secured, wholly or in part, by the use of stable manure or leguminous plants where they are available. In the case of the other carriers indicated in the table, we have very little evidence on their relative values as yet and hence those that are actually least expensive or most convenient should be chosen. All applications should be made annually, subject to the variations indicated below.

Time and Method of Application.—The time of application we believe to be of distinct importance, especially in the case of nitrates. While our evidence on this is by no means complete, yet there are good indications that nitrates can easily be applied too early in the season and thus be wholly lost to the trees. Other evidence leads to the opinion that distinct harm may result from their application about fruit-setting time,—especially in the case of the peach. We feel, therefore, that the nitrates should be applied not earlier than petal-fall in apples and probably not later than the middle of July. In general, about the middle of this period should do very well, though some of our most striking results have come from applications made as late as the 8th of July.

With the peach in Missouri, Dr. Whitten reports that the time of application is very important and that large increases in yield have been obtained from moderate quantities of nitrate of soda alone, when "applied at the right time."* This is considered to be "after the main length-growth has taken place in the early summer." Such applications kept the trees from going into the rest period too early, and maintained a green and healthy condition throughout late summer and autumn without renewing the growth in twig length. It may also be noted that in the English work, at the Woburn Experimental Fruit Farm, July applications proved beneficial, while those made in February were of no avail.

An incidental advantage of the delayed applications appears in the fact that it gives an opportunity to vary the rate somewhat in accord with the size of the crop set on the trees. When the crop is light, much smaller applications are required, because of the natural tendency of the trees to develop a sufficient number of fruit buds in the off season. In the full years, on the other hand, the applications should be rather liberal, in order to prevent the total absence of a crop the following year and in the long run to steady the yields. Proper utilization of such a plan as this should save much in a series of years, and also enable one to secure the maximum return for the fertilization applied.

In the case of the mineral ingredients, with their lower solubility and slower action, the time of application is less important. Some careful observers in commercial work regularly apply their phosphates and potash in the fall, on their peach orchards, and believe that this gives best results. Thus far, however, we have felt that the time of application for the minerals is of relatively little importance, since they are rather quickly fixed in the soil, in any case, and they do not leach readily. We therefore apply them along with the nitrogen at the time considered best for it. Manure also can be applied at almost any time, excepting possibly late summer or fall, without danger of loss or of ill effects.

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* See Proceedings of the Society for Horticultural Science 1911 p. 37.

The method of application that we have followed is merely to scatter the fertilizer or manure broadcast over the surface of the ground, taking care not to get it too close to the tree trunk, where there are few absorbent roots, and extending the applications well out beyond the spread of the branches. To conform more closely with the distribution of feeding roots, the rate of application is made heaviest in the central part of this area, or in general it is applied most heavily under the outer two-thirds of the spread of the branches. This fertilization may either be left on the surface to be washed in by the rains or it may be harrowed or lightly plowed into the soil. With all this done, it should be remembered that the fertilizer applied in any given season can hardly materially affect the yield of that year, since the fruit buds are formed in the latter part of the preceding season. Important results, therefore, should not be expected before the following season, at the earliest, and as indicated in some of our experiments, they may not appear until considerably later and still prove of value.

Determining the Actual Needs of an Orchard.

The general fertilizer formula indicated above is for use only until the exact needs of the particular orchard can be determined. In other words, it is intended only to meet the immediate demands. If in the meantime one wishes really to answer the question of how to fertilize his own orchard, he can do so by following the plan outlined in Table VII. This plan is especially adapted to the needs of commercial orchardists and to "community" tests on the part of the smaller growers. Like other things of value, a test of this kind requires some work, but as yet it is the only way that one can become really acquainted with the needs of his orchard, and where the income from the latter is important, the time thus spent should be most profitable.

TABLE VII.—PLAN FOR LOCAL ORCHARD-FERTILIZER TEST.

(Pounds for a Mature Tree in Bearing.)

1. Check (Unfertilized).
2. Nitrate, 2½ lbs.; Dried blood, 3½ lbs.; Acid phosphate, 10 lbs
3. Nitrate, 2½ lbs.; Dried blood, 3½ lbs.; Potash, 2 lbs.
4. Acid phosphate, 10 lbs.; Potash, 2 lbs.
5. Check
6. Nitrate, 2½ lbs.; Dried blood, 3½ lbs.; Acid phosphate, 10 lbs.; Potash, 2 lbs.
7. Same as VI, plus lime, 12 to 25 lbs.
8. Manure, 400 lbs.
9. Check.

This test should be located in a typical part of the orchard, and should include not less than 5 average trees of the same variety and age, in each plat. All the trees should be labeled and carefully measured at a fixed point on the trunk, and definite records of their growth and yields should be kept for at least 3 years. Frequently, good indications of the orchard's needs may be obtained in less time than this, as shown above in the Johnston and Brown orchards, but at least this amount of time should be allowed and more should be used when necessary.

The same time and methods of application should be followed as described above. The materials are indicated here in amounts per bearing tree instead of per acre as above, and the same proportionate reductions should be made for younger trees. In other words, if only a third of the ground is to be covered, then only about a third of these amounts should be used, if the rate of application is to be kept within proper bounds.

Summary.

1. The experiments of The Pennsylvania Station have shown that the fertility needs of an orchard may be the most important check on its production. Variations in fertilization alone have resulted in average differences ranging from 50 to 370 bushels per acre annually for the past five or six years, depending on the experiment. These results were accompanied by similar differences in the growth and general vigor of the trees.

2. In the present discussion, we indicate briefly the methods and conditions under which some of these results have been

obtained, and outline a simple method of determining whether or not similar results can be secured in any particular orchard. The total plant-food requirements of a productive orchard are also considered, together with the more important effects that follow the application of the different fertilizer elements.

3. The total plant-food draft of a mature and active orchard is greater than that of a 25-bushel crop of wheat in every important constituent except phosphorus. It is practically inevitable, therefore, that sooner or later the output will be reduced or off seasons will be developed in any productive orchard because of a lack of sufficient plant food.

4. The mineral requirements of wood are comparatively low. This largely accounts for the fact that young trees usually do not make a profitable response to fertilizer applications, although they frequently respond well to manure or to other methods of conserving moisture.

5. The relative amounts of the various food elements required by the other parts of the apple plant are also of interest, but as a rule they are not especially reliable as bases for making fertilizer applications. The latter are best determined experimentally, as there seems to be very little relation between the response of the trees and their total chemical requirements.

6. Applications of nitrogen and phosphates and also of manure have been especially beneficial in two of our experimental orchards. In those orchards, potash at the same time has been of little or no service. These results are reversed at the present time in a third orchard, so far as yields are concerned.

7. The time required for results to appear has been surprisingly short in all cases where fertilization has proved to be really needed. In such cases, both the value of fertilization and the kinds needed were clearly evident by the middle of the second season, and no material changes have occurred since. In one case, however, in an orchard in the early stages of bearing, important benefits did not appear until the sixth year.

8. Neither acid phosphate nor "floats," when applied alone, have resulted in any important benefit. We are therefore "completing" the fertilization of their plats by the addition of

nitrogen and potash, in order to test further their relative values as carriers of phosphorus for trees. Basic slag was introduced into this comparison in 1912.

9. Lime also has failed in most cases, though it may have some value in aiding growth. In addition, it may have some indirect value in facilitating the growth of leguminous intercrops, and also in correcting a possible toxic action possessed by the basic radicals of a number of salts, some of which are present in commercial nutrients.

10. At present the high-grade sulphate in our experiments is showing no superiority over the muriate as a carrier of potash, but the reverse is usually true. The lower cost and easier handling of the latter, therefore, give it the preference. It is possible that the low-grade sulphate, or the 24 per cent. "double-manure salt," as it is often called commercially, may be superior on account of its magnesia content, but this has not yet been fully demonstrated.

11. The influence of proper fertilization is not transient. The gains from it have been greater in the sixth and last year of some of our experiments than in any earlier year. In one case, these gains have exceeded 1,100 bushels per acre. Where the crops of the full years are not too high, the yields usually have been greatly steadied by proper fertilization.

12. In all our experiments, the action of manure has proved to be practically identical with that of a commercial fertilizer rich in nitrogen and phosphorus. Their successes and failures have coincided with but two exceptions, and in those cases moisture rather than plant food was apparently the controlling factor. The commercial nitrates and blood have acted more quickly than the manure, and the potash in the latter has apparently been less effective than that in the commercial forms.

13. In general, the influences that have materially increased the yields have also increased the growth. This is true generally, unless either occurs to an abnormal extent. The phosphates seem to be a partial exception to this rule, and mild injuries also may stimulate yield at the expense of growth.

14. Manure and potash are the only fertilizing materials that have shown a consistent benefit on the average size of the fruit. This is doubtless associated with their favorable rela-

tions toward available moisture, which is the chief determiner of fruit size. Above a rather indefinite point, however, the size of the crop on the tree becomes the dominant influence on fruit size. Proper thinning and moisture conservation, therefore, are the most important means of improving the average size of fruit.

15. The red colors in apples can not be increased materially by any kind of fertilizer applications, though potash and possibly phosphates may be of some slight assistance. These colors are directly dependent upon sunlight and maturity, with the latter occurring preferably on the tree. Late picking, open pruning, light soils, sod culture and mildly injurious sprays, therefore, tend to increase the reds in fruits, while opposite conditions decrease them.

16. The retarding influence of nitrogenous fertilizers or manure on color makes it advisable to use them less freely on some of the red varieties, especially those in which the color comes on rather tardily, such as the York Imperial. On the lighter soils, or in localities with the longer growing seasons, this precaution is less important.

17. In the sixth section above, it has been noted that the fertilizing elements found effective in certain experiments were not so in others. In one of our experiments, no form of fertilization has yet shown a profitable response, and in two others such responses have come only from manure and mulches. It is evident, therefore, that the actual fertilization of a given orchard is still largely a local problem.

18. It is possible, however, to indicate the more prominent characteristics of orchards that are in need of fertilization, and to formulate a general fertilizer, based on present experimental results, that may be used in such orchards until more definite local data can be secured.

19. Present evidence indicates that the nitrates, or other specially soluble plant foods, are best applied somewhat after the fruit has set. In addition to greater effectiveness, this delay enables the rate of application to be varied somewhat in accord with the amount of fruit set, making the applications heavier when the crop is heavy and vice versa. In the long run, this plan should steady the yields and get maximum benefits from the fertilization applied.

20. The general fertilizer that we are now recommending is a combination carrying about 30 pounds of actual nitrogen, 50 pounds of actual phosphoric acid (P_2O_5) and 25 to 50 pounds of actual potash (K_2O). These are the amounts per acre for bearing trees. Only where potash is known to be needed, should the larger amount be used. Suitable carriers and formulas for obtaining these materials are given in Table VI and its context.

21. This general fertilizer can be modified and directly adapted to the actual needs of any orchard, by following the local testing plan indicated in the discussion. Such a test requires some work, but for those whose livelihood depends to a considerable extent upon their fruit, the time thus spent should be most profitable.

Ques. Is that soil full of potash?

Ans. Nearly all orchard soils are very full of potash.

Ques. Do you get as much potash from a sandy as from a clay soil?

Ans. No, there is much more potash in clay soils, but even a sandy soil is usually better supplied with potash than it is with any of the other elements.

Ques. In that experiment, you have lots of potash, anyway?

Ans. Yes, that is the situation exactly, that while the fruit of apples does require large quantities of potash, that is no sign that the addition of potash to a particular soil will result in a response from your trees. That soil may already have enough potash, but be limited by certain other elements, which in their actual requirements may be much below the potash requirement, so that essentially the fertilization of an orchard is the fertilization of a piece of ground. You have got to be thinking of the requirements of the piece of land all the time.

Ques. What is the size of the plots?

Ans. These plots are one-sixth of an acre each.

Ques. About six trees?

Ans. Eight trees, in this case.

Ques. Do we come to the conclusion that barnyard manure is always a good fertilizer for an orchard?

Ans. We don't want to come to any conclusions yet, because we have some data and some effects of barnyard manure that are not so good as these. But you see barnyard manure is simply a complete fertilizer, plus a mulch. When you are putting on a barnyard manure, you are putting on a moisture conserver. Now, especially in the case of a young tree, moisture is usually the prime thing, so that it is generally better, in the case of young trees, to put a mulch of manure around them, than anything else you could do, because the manure will give them a certain amount of plant food, and much better, it will conserve moisture. But even though we were to prove that manure is by far the best orchard fertilizer, our next problem would be to get a sufficient supply of it. And that is often where the hitch comes, so it is only part of our problem here to find out what the function of manure is. On the other hand, as we go through these experiments you will see that wherever manure has given us especially good results, very similar results have been obtained by a fertilizer rich in nitrogen and phosphates.

Ques. In the experiment with nitrogen and phosphates you of course had tillage?

Ans. No; the tree limbs were too close together to permit it, and the ground was simply untilled.

Ques. Do you think there is any danger of adding to the acidity of the soil by the use of muriate?

Ans. No, I do not believe it will materially affect the acidity of the soil. Of course it might have a harmful influence in a long time, but I am very doubtful about it.

Ques. We are using some basic slag in our orchards. Is that beneficial?

Ans. Well, that of course would carry quite a little lime and might be of service. But notice that here again lime alone has been of no particular advantage to us.

Ques. Was 15 fertilized the same as eight, with the addition of lime?

Ans. Not exactly. Plot 15 received lime alone for the first five years and it has only come above the checks as a result of the fertilizer added for the last couple of years.

Ques. On what varieties was the experiment as to color tried, in which the fruit was left on longer on certain plots?

Ans. In that case it was Baldwin. With some other varieties, such as the York Imperial, we cannot do quite the same as we can with the Baldwin, because the color on the York is

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later in appearing than it is on the Baldwin, and the delay caused by the nitrates is a little too much for the color to appear on those later coloring varieties, such as the York Imperial. But the same general principle applies to them as to the other; that is, it is simply a matter of maturity and sunlight to get the maximum amount of color on your fruit.

Ques. How many pounds of fertilizer will be required by a good large tree, with a heavy crop?

Ans. You can figure that in this way. About 500 pounds per acre of a 6-10-5 fertilizer will give you the plant food called for in our general recommendation. The balance depends on how many trees you have to the acre. If you have 40 trees per acre, it will mean 12½ pounds per tree.

Ques. That will be the limit?

Ans. Well, I have put on 50 per cent more plant food than that right along without any undesirable results. But I am not recommending any more than the present amounts because this is a good, rich fertilizer compared with the average. And it is the kind of fertilizer that brings returns, and it is returns that we are after,—net returns. I do not care to put on a fertilizer that costs me comparatively little, if I do not get anything back. You see I have been putting on lime there. It does not cost much, but it does not return anything at all and I was out my labor. The only kind of fertilizer I would care to put into an orchard is one that would show a margin of profit.

Ques. Do you ever use commercially mixed fertilizer for an orchard?

Ans. No. Our fertilizers are mixed at the factory, but they are all mixed under my personal supervision and I see what goes into every batch. Hence my fertilizers are essentially home mixed, but I use the factory machinery to do it.

Ques. I notice you say the difference in results between the fertilizer plowed in and that left on top was very slight. I would like to inquire if those plots were cultivated at any time of the year?

Ans. One of these experiments is cultivated every year in the typical orchard tillage system. That is in the Tyson orchard, a comparatively young orchard. The other two have not received any tillage at all since the experiment started, and yet you will notice what high yields we have obtained in them, with the aid of a proper fertilizer. In the present experiments, whenever any cultivation was given to one plot, it was given throughout. Every other operation except the fertilization is kept absolutely uniform, so far as this is possible. It was in the other experiments, those directly on cultural methods, in which I had a comparison of the availability of fertilizer under tilled and untilled conditions.

Ques. Was grass growing in those orchards where there is no cultivation?

Ans. Some. Comparatively light sod in both of them.

Ques. You would recommend the application of the same number of pounds of fertilizer per acre, regardless of the number of trees per acre?

Ans. I think so. These amounts are supposed to cover practically the entire area. Now, as I say, we have used and we are using in our regular fertilization experiments, 50 pounds of nitrogen and 100 pounds of phosphoric acid, and 150 pounds of potash. That is because we didn't know when we started these experiments that potash was really so little needed. We were going on the data that was available at that time and the idea was that you wanted to use lots of potash in your orchard. Of course when you start out with a treatment, you have to continue it, when definite experiments are involved.

Ques. It is usually said that in using barnyard manure great advantage comes from the humus. This is fertilization without any cover crops or plowing. What about the humus supply of those trees?

Ans. Well, I don't know that there is very much difference between the different plots. At any rate, you notice that we are getting excellent yields merely from the fertilization, and without the tillage or cover crops.

Ques. I have always been taught that it was the humus that we were looking for in general farming, and that without humus we could not get results. We must keep a supply of humus, or our land would all run out. You are getting no humus stored and I would like to ask how many years it has been going on, and whether I could produce good paying crops under the methods you recommend?

Ans. That brings up the question of the permanence of fertilization. There is often a general impression that the influence of fertilization is relatively short, and where it does do a little good at first, that it will soon run out in its influence. That might be the case if your gains are coming from caustic materials, such as gypsum or lime or something of that sort, which act merely as whips on the soil and push it to a further state of exhaustion. In such case you might get gains for a year or two or three, and then your soil would drop back. But if you are putting actual plant food upon the soil and using a really suitable fertilizer, there is certainly no reason whatever for the influence to decrease with age, and in the second set of results that I showed you I could have pointed out that in the sixth year of that experiment we had by far the largest gains we ever had in it. If it hadn't been for the frost this year in the first orchard, we would have gotten our largest gains from it also in the sixth year, judging from the indications.

Also, in another experiment on general farm crops that is going on at the college, which is now in its 33d year, I might say that the fertility of those plots that have received a proper fertilization has been absolutely maintained for 33 years and, in some cases, it is even better than it was when it started, and they have never had a pound of manure or outside vegetation put back upon them. I certainly would not want to say anything that would upset the system of a whole community, but these are the results that our experiments have shown. I am not certain our results will apply to your conditions, and I would not recommend you to change your methods all over until you have tried the change on a comparatively small portion and seen what it will do, and then, if it works with you as it has worked with me, why extend it over the balance and cut out that extra work.

Prof. Woods: We want to set over against these experiments which are upon particular soil in Pennsylvania, experiments upon another soil in New York that were carried on for 16 years, in which absolutely no trace of benefit whatever could be found from the use of fertilizer.

Prof. Stewart: Well, since this contrast has been raised, I want to call attention to the difference between the results in New York and those in Pennsylvania. The results in New York were obtained from a single soil, and our results are obtained from ten different soil types and a far greater number of trees. Their result was from a single experiment, or to be more exact, they have two experiments, which are both on the same soil. The older of those experiments involved nothing but a comparison of wood ashes against nothing. It was a wood-ash treatment against no treatment. The other experiment involves the various fertilization materials, but it is on young trees and really includes only seven fruiting years. Also, if you will notice their report, you will see that the total production involved in their second experiment is much less than the average production of almost any one of our ten experiments in a single year. The cropping strain, therefore, has not yet reached their second group of trees, hence no definite conclusions are justified on it as yet. I didn't expect to make this comparison, but it is simply a matter of going into the figures for it, and it seems to be necessary in order to get our data into the proper light. In other words, the real experiment on fertilization in New York is not to be compared in extent, yields, soil types, definiteness of results, or in number and range of ages of trees, with the experiments in Pennsylvania, and anyone who will look carefully into the exact data involved cannot come to any other conclusion.

Ques. You didn't state the amount of barn manure per acre?

Ans. Twelve tons is what we have been using, but I don't recommend more than eight.

Ques. What about the cost of your fertilizer per acre?

Ans. Fertilization of this sort runs between $10 and $12 per acre, depending on the market prices. Now that, as I say, is a relatively rich fertilizer, and I would not recommend anybody to put it on extensively until he has tried it out and found out for his own situation whether it will give him as good results as it has us. At the same time, notice that we have put these fertilizers on, not in one place, but in several places, and have obtained practically harmonious results. We do have one or two experiments that as yet have shown no material gain from fertilization, but we are not saying that fertilization is of no consequence in any orchard, simply because we have one or two experiments that have failed to respond as yet. If we had no experiments but these two, we would not consider ourselves in a position to give advice on the subject of fertilization. It is only when a man conducts an experiment that shows something definite that he is in a position to say much about it, it seems to me.

Ques. Is that same formula applicable to old orchards that you want to start the wood growth on?

Ans. Yes. We have used that in an orchard that is 36 years old,—practically this same formula.

I will say, in the first year of taking up an old orchard, run out badly, with much dead wood in it, to bring it up to a healthy condition the first thing to do would be to get the dead wood out of it, of course, and then bring it down, if it is too high, try to get some bearing wood below, and then use an application of about eight tons of manure, if you can get it, or else use this very fertilizer.

And I want to say here that we have run practically this same fertilizer right alongside of annual applications of 12 tons manure for six or seven years, depending on the experiment, and the fertilizer has generally held right up, both in wood growth and in fruit yields.

Of course we have some failures in some of our experiments, but we are getting good results in nearly all of them when we give them time. We are getting them, and they will get results in that second experiment at Geneva, too, if they give it time.

Ques. Should the same amount of fertilizer be used in an old orchard?

Ans. I should think so. You notice that our general formula indicates amounts per acre for bearing trees. This is mature trees. For young trees you should reduce these amounts.

Ques. Wouldn't you recommend the cultivation of an orchard for conserving the moisture as a good plan?

Ans. Certainly, you have got to conserve the moisture in an orchard, but I do not know that cultivation is always the best way to conserve moisture. That is my point. As a matter of fact, that is what we will bring out tomorrow, in discussing the influence of cultural methods.

Ques. How many trees do you advise to take for a test plot?

Ans. I should not use less than six trees of a single variety in each plot. Better use them in double rows and use six trees as a minimum. The double rows cut down the cross feeding and leaching and other possibilities. Use six to eight trees apiece, same variety, absolutely uniform in every way possible. They do not have to be right side by side, so you can exclude a certain tree if it is not right and take in another one a little further along and make everything as uniform as possible. Then I would measure the trees. And it is the diameter of the trunk at a certain definite point that is the best index of tree growth. We have tried every other system, leaf weights, and twig growths, and various things and have discarded them all as practically worthless, with the exception of the trunk diameter or trunk circumference at a definite point.

Ques. How do you fix that point?

Ans. We put a nail in the trunk at the point we want and let it stand out about three-quarters of an inch, and when the tree grows out around it, we either pull it out further or put another one in. Then the fruit should be actually weighed, or measured with extreme care, from every tree and recorded to that tree and the record kept from year to year; then at the end of three or four years, sum up those records and see what those plots have done. Often, of course, where we have the striking results such as I have shown you here, a man does not have to keep a very close record to know what is happening. You can see them as far as you can see the orchard. But in many cases you cannot expect such tremendous results, and in such cases the definite records are needed.

Ques. Have you found that your fertilized plots were more susceptible to disease than others?

Ans. Not materially so, except once in a while our most vigorously growing plots have been more subject to blight.

Ques. What do you call blight?

Ans. The ordinary fire blight.

Ques. Do you have any winter injury caused by fertilization?

Ans. I do not believe I have had a particle of winter injury from any treatment that we have applied there. And I was expecting to have some, because we put on our nitrogen fertilizer in some cases as late as the 8th of July, but I have not noticed even the tip end of a twig that seemed to be injured by winter injury.

Ques. What would be your idea on the conditions here?

Ans. It might cause some winter injury here, but that is another thing that can be determined by trying; and I do not know how it can be really determined in any other way. If the soil about the trees is well supplied with moisture, there is usually less danger from the direct freezing type of winter injury.

ANNUAL BUSINESS MEETING, THURSDAY, NOVEMBER 20.

Meeting called to order by President Keyser.

REPORT OF SECRETARY.

During the year there have been three meetings of the executive committee.

The first was in Augusta, Jan. 22nd. It was voted to hold the Annual Exhibition during the week beginning the third Tuesday in November.

Matters relating to the legislation recommended at the last annual meeting were talked over.

A vote, by letter sent to each member of the executive committee, was in favor of holding the 1913 exhibition in Lewiston, November 18-20.

The second meeting of the committee was held in Dover, June 19.

Voted to offer $50 in prizes at the Bangor Fruit Show, to be held in November, 1913, and to divide it as follows: $25 for the best display of fruit, $15 for the best barrel of apples and $10 for the best box of apples.

The third meeting was held in Auburn, June 27th.

The premium list was revised. A score card for all box exhibits and one for all barrel exhibits was adopted and ordered printed in the premium list.

One Field Meeting was held during the year. By invitation, it was held in the forty acre orchard of C. D. Paine in Dover. There were addresses by Dean Leon S. Merrill, A. K. Gardner and W. H. Conant, also a demonstration in pruning by G. A. Yeaton.

The lessons illustrated in this orchard were many,—namely, spraying, pruning, cultivation and especially the treatment of apple tree canker. The orchard was badly infested, but by diligent and practical work, Mr. Paine now has the disease practically under control.

The attendance was good, although the weather was unfavorable.

The society now has the largest membership in its history,—150 life members and 105 annual members.

The interest being on the increase, the fruit growers realize more than ever that they must continue united in one state organization, in order that they may be able to work with determination and confidence for the procuring of necessary legislation and coöperation.

The Farm Demonstration work being carried on by the University, is solving many problems and convincing the farmers of the state, that Maine is still in the real beginning of fruit culture.

The several Fruit Growers' Associations are proving that by coöperation in buying and selling, the grower is greatly benefited. They are also demonstrating the benefits resulting from cultivation, pruning and spraying, and especially noteworthy are the lessons drawn from honest packing, grading and marking of their fruit, thus obtaining high prices for their products.

When there is a willingness, on the part of all orchardists, to coöperate with the Pomological Society, we may be able to undertake the question of transportation, storage and other facilities for marketing with more certain success than in the past.

The annual appropriation from the state for the work of the society was increased from $1000 to $2000, by the last legislature. This increase, and also the changes in the apple law, relating to the better grading, packing and marking of apples. were brought about by the untiring efforts of the president, who spared neither time nor influence in the securing of these results. That the society appreciates his determined efforts and feels deeply grateful, he may feel assured.

During the year the secretary has received the annual reports of practically all the State Horticultural Societies of the United States. Maine, however, has not been able to return the courtesy, as the reports for the year 1912 have just been received from the printers.

We are encouraged to believe that the report for 1913 will be ready for distribution at an early date.

Respectfully submitted,

E. L. WHITE.

Voted, that the report be accepted.

The treasurer then made his report, which was accepted.

REPORT OF TREASURER, FOR THE YEAR 1913.

RESOURCES.

1913			
Jan.	1	Interest from First National Bank, Farmington....	$12 00
	2	Interest from Bonds, Stockton Springs...........	22 50
July	1	Interest from First National Bank, Farmington...	16 00
	2	Interest from Bonds, Stockton Springs...........	22 50
Sept.	25	Received from State stipend.....................	220 38
Nov.	19	Received from E. L. White, advertising space.....	22 00
	18	Received from E. L. White, advertising space.....	237 00
Dec.	26	Received from State stipend	655 43
	31	Life membership fees...........................	60 00
	31	Annual membership fees.........................	133 00
		Received from State stipend.....................	940 37
		Total receipts	$2,341 18

DISBURSEMENTS.

Orders		
No. 1	The Alden Studio, photos.........................	$2 00
2	W. F. Dunham, post cards.........................	3 00
3	Brunswick Record, envelopes......................	1 25
4	The Times Company, post cards....................	3 25
5	W. W. Brown, 500 stamped envelopes...............	10 62
6	W. F. Dunham, printing...........................	1 75
7	W. F. Dunham, post cards.........................	2 90
8	Auburn Free Press, posters.......................	12 00
9	Will E. Leland, expenses.........................	3 28
10	E. F. Hitchings, expenses	3 20
11	Leon S. Merrill, Federation dues.................	6 00
12	W. F. Dunham, post cards and slips...............	5 75
13	Blethen House, Dover, field meeting expenses......	9 50
14	Lewiston Journal Company, posters................	4 50
15	George A. Yeaton, field meeting expenses...........	5 64
16	E. F. Hitchings, expenses.........................	2 50
17	E. F. Hitchings, expenses.........................	2 48
18	H. L. Keyser, expenses...........................	34 82
19	Will E. Leland, expenses.........................	6 31
20	W. F. Dunham, printing...........................	5 75
21	Maine Farmer, printing 300 letters................	3 00
22	John H. Look, expenses..........................	5 08
23	W. H. Conant, field meeting expense..............	8 23
24	E. L. White, expenses............................	14 32
25	E. L. White, salary..............................	75 00
26	Wallace S. Ladd, stationery......................	5 56
27	Lewiston Journal, circular letters, (3,000)..........	7 50

28	Loring, Short & Harmon, envelopes	1 50
29	Charles E. Nash & Sons, letter heads	2 00
30	Loring, Short & Harmon, envelopes	5 00
31	Lewiston Journal, premium list	48 94
32	Charles E. Nash & Sons, printing	35 30
33	Charles E. Nash & Sons, letter heads	2 00
34	Merrymeeting Grange, storage	2 00
35	W. W. Brown, postage	33 12
36	Cecil Libby, labor	1 50
37	W. H. Woodworth, speaker	54 50
38	William H. Wolff, judge	30 06
39	Mrs. Edna McLaughlin, jellies, (lost)	2 00
40	Charles Dunton, labor	2 00
41	H. L. Keyser, expenses	40 97
42	H. L. Keyser, tickets and expenses	33 30
43	Lewiston Daily Sun, notices	4 00
44	J. P. Stewart, speaker	104 92
45	B. S. Brown, expenses	5 36
46	L. A. Lewis, carpenter	26 40
47	Perez Burr, judge	1 00
48	F. L. Rackley, labor	1 50
49	Katherine M. Lynch, judge	2 00
50	A. B. Andrews, services with lantern	8 00
51	J. R. Reny, cloth	3 52
52	M. C. R. R., freight	3 18
53	W. F. Dunham, printing	1 00
54	Bangor Fruit Show, prizes	50 00
55	Lewiston Journal, notices	5 50
56	E. L. White, expenses	22 35
57	E. L. White, salary	75 00
58	Will E. Leland, expenses	4 55
59	New DeWitt Hotel	159 50
60	E. F. Hitchings, expenses	4 93
61	Donald Reddick, speaker	51 28
62	G. A. Drew, judge	45 45
63	George A. Yeaton, judge	25 00
64	Dr. B. N. Gates, speaker	45 15
65	M. C. R. R., freight	2 34
66	L. C. Mendall, labor	2 00
67	Homer N. Chase, barrel of apples	3 09
68	Lewiston Journal, programs	61 75
69	Edward N. Furbush, speaker	24 80
70	Earl W. Sawyer, printing	17 50
71	L. E. Randall, trucking	25 00
72	F. H. Morse, expenses	6 10
73	F. A. Ricker & Son, 3 barrels of apples	9 35
74	A. R. Prince, music	10 00
75	Maine State Bookbinding Co.	28 75

76	W. H. Cornforth, stenographer	38 20
77	Miss L. B. Raynes, stenographer	43 20
78	Premiums	436 50
79	Transfer permanent funds	60 00
80	S. H. Fulton, speaker	64 53
81	E. L. Lincoln, salary	25 00
82	E. L. Lincoln, expenses	20 95
83	Harry L. Plummer, photos	1 50
84	Charles J. Brand, speaker	2 80
85	L. J. Clark, stationery	4 75
86	Lewiston & Auburn Electric Co.	60
87	J. E. Alexander, paper	2 40

Total expenditures	2,080 08
Cash on hand	252 10
	$2,331 18
Permanent fund for the year 1912	$2,070 00
Life membership fees, 1913	60 00
Total	$2,130 00
Permanent fund invested as follows:	
Four shares stock First National Bank, Farmington	400 00
Two bonds, Stockton Springs	970 00
Deposit in Savings Bank	760 00
Total investments	$2,130 00

Respectfully submitted,
ELLIS L. LINCOLN,
Treasurer.

Voted, that a committee of three be appointed to draw appropriate resolutions on the death of the late ex-vice president, D. D. True. The following were appointed: E. L. Lincoln, Wayne; G. M. Twitchell, Auburn; D. H. Knowlton, Farmington.

The following officers were elected for 1914: President, Wilson H. Conant, Buckfield; 1st vice president, Frank H. Taylor, Winthrop; 2nd vice president, George A. Yeaton, Norway; treasurer, Thomas E. Chase, Buckfield; secretary, E. L. White, Bowdoinham.

Member of executive committee for three years, H. L. Keyser, Greene.

Member of Experiment Station Council, H. L. Keyser, Greene.

Delegates to Maine Federation of Agricultural Societies: E. E. Page, East Corinth; W. H. Conant, Buckfield; E. L. White, Bowdoinham.

Representative to New England Fruit Show, Homer N. Chase, Auburn.

Voted, that the president appoint three committees of three members each, the expenses of these committees to be paid by the society subject to order of the executive committee, which committees shall take under consideration the matters of storage, transportation and membership. The following were appointed:

Storage—Robert H. Gardiner, Gardiner; J. Henry Rines, Portland; Homer N. Chase, Auburn.

Transportation—E. H. Libby, Auburn; W. H. Cornforth, Auburn; R. L. Cummings, West Paris.

Membership—A. K. Gardner, Augusta; Will N. Savage, Waterville; W. G. Conant, Hebron.

Committee on resolutions reported as follows:

Resolved, That, as members of this society, we bear testimony to the faithful and efficient services of our retiring president, Mr. H. L. Keyser. Without his devoted services the success of our apple packing law could hardly have been possible, while his organizing ability, manifested in our annual programs, has added greatly to the value of these sessions.

Resolved, That we thank our officers for the efficient management they have given in the conduct of its affairs and especially for their well directed efforts in securing much needed legislation.

Resolved, That we approve the efforts of our officers and the Commissioner of Agriculture to enforce the law passed by the last legislature to secure an honest packing of Maine fruit and furthermore, that we believe it to be for the interest of all Maine fruit growers to coöperate with the authorities in bringing about this most desirable result.

Resolved, That we recognize and appreciate the assistance of the press of Maine and would express our special obligations to local managers and writers for extended reports of these sessions, thereby insuring the widest possible reading.

Resolved, That our hearty thanks are due the Chamber of Commerce, the city of Lewiston and all who have so well contributed to the success of this annual session.

Resolved, That we urge upon our state officials and fruit growers the importance of strengthening our present apple-packing law to provide more general inspection and in addition to unite for such legislation as will insure more complete spraying and protection from pests and fungus diseases.

Resolved, That we commend to the favorable consideration of Maine fruit growers the recommendations of President Keyser for coöperation in securing better and more general storage and marketing of our fruit.

D. H. KNOWLTON,
G. M. TWITCHELL.

Voted, that the report be accepted.

Committee on resolutions on the death of D. P. True reported as follows:

RESOLUTIONS OF RESPECT.

Whereas, God in his infinite wisdom has again entered our society and removed from our midst our fellow member, Davis P. True, be it

Resolved, That we express our sorrow and mourn the loss of one who has served our society as one of the officers for a number of years.

Resolved, That we as members of the Maine State Pomological Society extend our sympathy to the family of our departed member, and commend them to the Great Ruler, for comfort.

Resolved, That a copy of these resolutions be sent to the family and also published in the annual report.

ELLIS L. LINCOLN,
G. M. TWITCHELL,
D. H. KNOWLTON,
Committee on Resolutions.

THE INFLUENCE OF CULTURAL METHODS AND COVER CROPS, ALONE AND WITH FERTILIZATION, UPON THE YIELD, GROWTH AND COMMERCIAL QUALITY OF APPLES.

By Dr. J. P. Stewart,

Experimental Pomologist, State College, Pa.

In the present discussion I wish to bring before you the principal actual results that we have obtained in Pennsylvania during the past six or seven years from the use of various cultural methods on different soil types and in orchards of different ages. Many of these results are different from what might have been predicted before the experiments began, and they also differ materially from many of the present horticultural writings and teachings. These matters are not dependent on opinions or preferences, however, and our sole duty has been to present the various questions to the trees themselves and then to secure and interpret their answers wholly impartially and without the slightest personal interest in the outcome.

The results considered here are from nine experiments, located in different parts of the state on seven different types of soil. They also involve 1991 trees, 588 of which (in Experiments 331, 333 and 337) were planted expressly for the present experiments. Four of the experiments,—Nos. 217, 218, 219, and 221—were started in 1907 and the remainder in 1908. The data on growth are obtained from annual measurements of all the trees at definite points on the trunks, and the data on yields are secured from the total annual production of fruit. This fruit is studied from three view-points,—those of yield, color and average size. The total amount of fruit thus examined during the past six years is 1,350,392 pounds or over 27,000 bushels. The location, soils, present ages of trees, and other general features of our cultural-method experiments are shown in Table I.

TABLE I.—LOCATION AND OTHER DATA ON THE ORCHARD CULTURE EXPERIMENTS, CONDUCTED BY THE PENNSYLVANIA STATE COLLEGE

Expt. number.	County.	Soil Types.	Varieties.	Age 1913	Number of trees.	Number of treatments.
217	Franklin...	Montalto loam.........	York Imp. & Gano.....	20 yr....	358	12
218	Franklin...	Hagerstown............	York & Albermarle....	14 & 21	400	12
219	Bedford...	Frankstown st ny loam	York, Jonathan, B. Davis and Gano............	10 to 12	320	12
221	Wyoming..	Chenango fine sandy loam	Baldwin & Spy.........	10......	115	6
331	Centre.....	Hagerstown silt loam...	Baldwin, Stayman & York	5.......	288	8
333	Centre.....	Hagerstown silt loam...	Baldwin, Stayman & York	5.......	120	12
336	Chester....	Chester loam...........	Smokehouse & Stayman	10......	105	3
337	Mercer.....	Volusia silt loam.......	Baldwin, Spy & Rome..	5.......	180	4
338	Lawrence..	Volusia silt loam.......	Baldwin...............	24......	105	3
	Totals 7	7	10		1991	

1. The addresses of the owners of the orchards in which these experiments are located are as follows: 217, J. H. Ledy, E. Fayetteville; 218, Ed. Nicodemus, Waynesboro; 219, Jos. R. Sleek, New Paris; 221, F. H. Fassett, Meshoppen; 331 and 333, Department of Experimental Pomology, State College; 336, A. D. Strode, Westchester; 337, Rev. A. M. Keifer, Greenville; 338, J. B. Johnston, New Wilmington.

2. Experiment 333 is devoted entirely to a comparison of cover crops, in which their relative effect on the trees and the ultimate reasons for these effects are the prime objects of study.

GENERAL PLAN OF THE EXPERIMENTS.

The general plan of our cultural-method experiments is shown in Figure 1. Its chief purpose is to determine what combinations of culture and fertilization give the best results under the different conditions involved, and eventually to determine why the various results are obtained. The plan is followed in full in the first three experiments of Table I, with only minor deviations in such matters as number of trees and relative positions of the plats. In the other experiments, for various reasons, certain of the treatments have been omitted, and in the young orchards of Experiments 331 and 337, plats involving intercrops have been added. In Experiment 333, the entire attention is given to a comparison of cover crops, one of which is a permanent cover and hence has received tillage only at the beginning of the experiment. The essential features of these modifications can be seen in the treatments listed for the different experiments in the tables that follow.

I Clean tillage 40 trees	IV Tillage and cover crop 40 trees	VII Sod-mulch 40 trees	X Sod 40 trees
II Tillage and manure 20 trees	V Tillage, cover crop and manure 20 trees	VIII Sod-mulch and manure 20 trees	XI Sod and manure 20 trees
III Tillage and commercial fertilizer 20 trees	VI Tillage, cover crop and commercial fertilizer 20 trees	IX Sod-mulch and commercial fertilizer 20 trees	XII Sod and commercial fertilizer 20 trees

Figure 1. Plan of the Pennsylvania Orchard Experiments on Cultural Methods, Cover Crops and Manures.

As indicated in Figure 1 and Table I, our complete experiment on cultural methods compares the four principal methods of managing orchard soils and it is duplicated, wholly or in part, in several localities on a wide range of soils. Each method occurs without fertilization and also with it in two forms, both applied annually. The stable manure is added at the rate of 12 tons per acre, although 8 tons annually is probably ample, and this amount has given excellent results on other portions of some of the orchards in which our experiments are located. The commercial fertilizer carries all three of the elements usually considered important, at the rates of 30 pounds of actual nitrogen, 60 pounds of "phosphoric acid" (P_2O_5), and 100 pounds of "potash" (K_2O) per acre. About half of the nitrogen is carried in nitrate of soda and the other half in dried blood, about 100 pounds of the former and 150 pounds of the latter being required. The phosphorus is carried in acid phosphate, thus requiring about 400 pounds, and the potash in the high-grade muriate, which contains about 50% of K_2O, and hence requires 200 pounds.

At the present retail prices, such a fertilizer costs about $12.80 per acre. Here again our results indicate that a reduction of at least 10 pounds in the phosphoric acid and of 50 to 75 pounds in the potash would usually be equally efficient, and would effect a saving of about $2.60 to $3.65 per acre. In ordinary practice also, part or all of the nitrogen might be obtained from leguminous crops or by the use of manure, although this has not always proved to be really economical. The manure used in our experiments,—at $2.50 per ton, which is about as low as it can be obtained and applied,—costs nearly 2½ times as much as the fertilizer we are using and its benefits do not average materially better. Considerably more actual plant food is also being added in the manure, since the amount applied should carry about 120 pounds of nitrogen, about 80 pounds of P_2O_5, and 110 to 115 pounds of K_2O.

All the tillage plats are plowed early in May and are kept cultivated until about the middle of July, when those receiving the cover crops are seeded to such plants as crimson or medium red clover, and hairy vetch. On the other tillage plats, cultivation is stopped at about the same time as on those receiving cover crops, but no seeding is done and only such vegetation as comes up naturally is obtained.

On the mulch plats, all herbaceous growth remains in the orchard and it is mowed at least twice during the season. The first cutting is raked to the trees as a mulch, and the second is left where it falls. In the older orchards also, about three tons per acre of outside materials, such as old straw, swamp hay, buckwheat straw, or other vegetation, are brought in annually to form an additional mulch around the trees. In the younger orchards, much less outside material is needed, and in some of them a satisfactory mulch has been maintained from the growth between the rows, after one or two initial applications from the outside. Our mulch method, therefore, differs somewhat from the so-called "Hitchings" plan, the difference being primarily in the maintenance of a definite mulch under the trees, with materials brought from outside sources when necessary. As a means of conserving moisture, the definite vegetative mulch is greatly superior to the other plan.

Incidentally it may be noted here that some definite protection against mice must be provided in any mulching system. This can be done by screens, poisons, or proper coatings, and especially by maintaining a clear space for at least a foot out from the bases of the trees. In ordinary practice also, the best results with the mulch system can doubtless be secured by using leguminous plants of relatively low moisture draft, such as hairy vetch, to act as the permanent cover and to furnish at least part of the mulch. Although essentially an annual, this plant frequently lasts fairly well for two or more seasons after a single seeding.

This is especially true after the soil gets properly inoculated, and where the winters are not too severe. The latter are apparently withstood better when the vetch is planted along with rye, or some similar plant than when planted alone. Incidentally, we know of one orchardist who is apparently maintaining hairy vetch permanently by letting it grow until the seed has formed in considerable abundance and then giving it a rather thorough discing about midsummer or whenever a sufficient number of seeds have matured.

RESULTS OF EXPERIMENTS IN YOUNG ORCHARDS.

These experiments—on trees planted for the purpose—naturally have not yet fruited to any important extent. They are showing considerable differences in growth, however, and it is the latter feature that will be considered here.

The effects on wood growth obtained from various treatments in one of the young orchards at the College are shown in Table II. These trees were planted in the spring of 1908, in a much depleted soil of limestone origin. In the first 5 plats, the soil was plowed in the fall of 1907, and prepared about as for corn before planting in the following spring. In the last three plats, no tillage was given either immediately before planting or afterwards. The trees were simply planted with a spade in the old exhausted pasture, a mulch of about 100 pounds of straw was placed around each tree, and screen protectors were added to provide against injury from mice. Since then there have been one or two slight additions to the mulch from outside sources, but for the most part it has been maintained satisfactorily by the intergrowth in the manner indicated above. The average gains made by the trees under these different treatments for the first five years are shown in Table II.

TABLE II.—INFLUENCE OF CULTURAL METHODS ON GROWTH.

(YOUNG ORCHARD.)

(Average Increase in trunk girth, first 5 years, in Expt. 331.)

Plat.	Treatment.	Av. gain.	Gain over clean tillage.	
		Inches.	Inches.	Per cent.
1[3]	Clean tillage	3.68	–	–
2	Tillage, intercrop and cover crop	3.67	-.01	-0.27
4	Tillage and cover crops	3.61	-.07	-1.90
5	Tillage, cover crop and manure	4.51	0.83	22.56
6	Tillage, cover crop and fertilizer	3.92	0.24	6.53
7	Sod-mulch	4.61	0.93	25.27
8	Sod-mulch and manure	4.86	1.18	32.07
9	Sod-mulch and fertilizer	4.85	1.17	31.80

3. The numbers of treatments here correspond with those stated in Figure 1, except in the present Plat 2. It involves an intercrop, and hence is different from any treatment named in our general plan.

In this table and also in the field, it is very evident that the untilled trees have made the best growth in the present experiment. This may be partly due to the absence of root pruning under the mulch, but the chief benefit thus far seems to be connected with moisture conservation, rather than with the plant-food added. This appears in the fact that the only tillage treatment which has shown much improvement in growth is the one in which manure is applied, and even its gain is surpassed by the mulch alone in Plat 7. In Plats 7 and 8, where the moisture is sufficiently retained by the mulch, thus practically eliminating the moisture-conserving effect of the manure, the gain of the latter over the mulch alone is only a quarter of an inch on the average, or a gain of about 6½% which is apparently all that may be properly credited to its plant-food effect. This fertility benefit is practically duplicated by the fertilizer applications of Plats 6 and 9, the remaining benefit on the latter plat being apparently due to the mulch.

In Plats 1, 2 and 4, there is very little difference,—less than a tenth of an inch in the averages. The slight advantage now possessed by the clean tillage alone is again probably connected with its lower demand for moisture as compared with the cover crop used in Plat 4. It is notable, however, that the net influence of the cover crops in this case has been to check rather than to benefit the growth of the trees. Up to the close of the fifth year, therefore, the cover crop has made no visible return for itself, so far as the trees are concerned. It has consisted chiefly in a mixture of red and crimson clover, sown about July 10th to 20th, and only the last three covers have been really good. In Plat 2, the intercrops have been potatoes, peas, mangel wurzels, and sweet corn, with the fertilization considered best for each. They were kept at a reasonable distance from the trees, and the intervening spaces were cultivated until midsummer and again when the cover crops were sown, which was after the intercrops were removed and hence was usually rather late. None of the intercrops have proved especially profitable, and neither have they proved any serious detriment to the trees, as compared with the other tillage methods, since their check to tree growth is slightly less than that of the cover crops sown in the midsummer. These results are similar to those obtained by Emerson at the Nebraska Station, and reported to the close of the second year in 1903, in Nebraska Bulletin 79, pages 14 to 17.

RESULTS IN THE MERCER COUNTY ORCHARD.

Additional data are available from another experiment started by the Station in 1908 in Mercer County, the latter portion of which is similar to the experiment just considered. In the present experiment, the treatment of Plat 12 corresponds with No. 2 in the experiment just considered. The usual tillage and cover crops have been maintained on Plats 1 to 12, rye being used chiefly as the cover on account of the lateness of some of the intercrops. Plat 13 has received tillage alone, and 14 has been mulched as in Experiment 331, although oftener. The results on growth are shown in Table III.

TABLE III.—INFLUENCE OF FERTILIZATION AND CULTURAL METHODS ON GROWTH. (YOUNG ORCHARD.)

(Average increase in trunk girth, first five years, Expt. 337.)

Plat	Treatment.	Average increase.	Gains over normal growths.	
		Inches.	Inches.	Per cent.
1	Check (unfertilized)	3.28	–	–
2	Nitrogen and phosphate	3.78	.44	13.17
3	Nitrogen and phosphate	3.51	.11	3.24
4	Check	3.47	–	–
5	Phosphate and potash	3.94	.14	3.68
6	Complete fertilizer	4.73	.60	14.53
7	Check	4.47	–	–
8	Manure	4.57	.32	7.53
9	Lime (and fertilizer, 1912)	4.61	.58	14.39
10	Check	3.91	–	–
11	Tillage and cover crops	3.38	.28	7.78
12	Tillage and intercrops	3.60	–	–
13	Clean tillage	3.72	.13	3.62
14	Sod-mulch	4.32	.72	20.00

Here again the trees receiving the mulch are showing decidedly the best growth, though their advantage is not quite so great as in Experiment 331. The cover crop in this case is proving slightly better than clean tillage alone, probably because the relative importance of moisture and plant food seems to be reversed here. But the advantage on the cover crop plat is still too small to show any profit. The intercrop here has been vegetables,—chiefly potatoes, beans and peas. They show the lowest tree growth of any of the cultural methods, but their deficiency is very slight and it is probably chiefly due to their location, which has been somewhat wetter than that of the others. This has now been corrected by tile drainage.

As already intimated, the conservation of moisture seems to be of less importance than plant-food in this orchard. This is not surprising to one familiar with this Volusia type of soil and also with local conditions. Even at that, however, the response to fertilization shown in the first ten plats is somewhat greater than we had expected in so young an orchard, and in a similar experiment at the College this response is not duplicated. The latter result is more natural in the case of young trees for several reasons. The trees have been making their particular demands for a relatively short time, most of the food of the leaves is annually returned to the soil, the mineral content of wood is rather low, and in reality comparatively little of it is being formed in a young orchard. For these reasons we usually do not expect much response to fertilization in the case of most young trees.

The response here is rather irregular, but in general it indicates the value of nitrogen and phosphates, which corresponds with our results on this same type of soil in the Johnston orchard, in which older trees and both yields and growth are involved. The chief irregularity here appears in Plats 8 and 9, in which manure is showing less effect and the lime more effect than would naturally be expected in the light of their behavior in our other experiments. This irregularity appears to be much greater in the percentages than in the actual average gains on these two plats—an effect which is brought about by the abnormally strong growth on the check Plat 7, possibly due in part to leaching or cross-feeding from Plats 6 and 8. Beyond this, however, we can offer no further explanation of the present results in this experiment, and we are awaiting further returns.

RESULTS FROM COVER CROPS AT THE PENNSYLVANIA STATE COLLEGE.

Similar data, bearing especially on the value of cover crops, are available from another of the experiments at the College. The crops used in this experiment are stated in Table IV.

These crops are plowed under annually and the usual orchard tillage is given on all plats excepting the alfalfa. The latter plat was plowed only at the beginning of the experiment, at which time the soil was limed, manured and inoculated, and otherwise prepared as usual for alfalfa. The liming also has been extended to the other plats. The initial stand of alfalfa was unsatisfactory and it was therefore turned under at the beginning of the next season and immediately seeded again to the same crop. Since then nothing has been done with this plat, except to cut the alfalfa two or three times a season and apply it as a mulch about the trees. The mulch obtained in this way has been considerably more than was needed to keep down the growth immediately around the trees, and some of it, therefore, has been hauled away. As the mulched area enlarges, however, this condition will not continue. The relative value of the various crops, as indicated by the growth of the trees, is shown in Table IV.

TABLE IV.—INFLUENCE OF COVER CROPS ON TREE GROWTH. (YOUNG ORCHARD.)

(Average increase in trunk girth, first 5 years, in Expt. 333.)

Plot.	Cover Crop.	Average increase.	Gain over original girth.	Rank.
		Inches.	Per cent.	
1 a	Medium red clover	3.82	183.65	12
2 b	Mammoth red clover	3.73	192.28	11
2 a	Alsike	3.78	204.32	9
2 b	Crimson clover	4.34	245.40	3
3	Hairy vetch	4.42	245.56	2
4 a	Cow peas	3.94	175.11	13
4 b	Soy beans	4.18	201.94	10
5	Oats and peas	4.28	235.16	7
6	Rye	4.07	233.91	8
7	Millet	4.42	238.92	5
8	Rape	4.27	239.89	4
9	Buckwheat	4.58	237.30	6
10	Alfalfa	5.09	306.63	1

Here again, it will be noted that the mulched and untilled trees are distinctly superior to the others in their growth. Also, it is shown that alfalfa can be safely and satisfactorily used, in a young orchard at least, when its growth is prevented from competing directly with the tree roots by means of a mulch.

For use as a permanent cover and as a basis for a mulch, alfalfa is thus shown to be very satisfactory. Its power of nitrogen fixation and its perennial habit are much in its favor, when used as stated above, but its strong affinity for moisture and also for soil nitrogen would suggest caution in using it in direct competition with the roots of the trees. More work is needed on this point, however, and much more work is needed on the relative values of various plants for permanent orchard covers and mulches, and on the best methods of handling them. Almost nothing has been done along the latter line. Hairy vetch, as noted above, has many of the qualities most needed for this purpose, but definite and comparative data on it thus far are lacking.

Among the annual covers and those used along with tillage, the best tree growth has been made in connection with hairy vetch. This is not surprising when we remember that it furnishes nitrogen and has a very low demand for moisture,—two of the most important requisites for a plant to be associated with trees. The surprising moderation of its moisture draft, in comparison with other crops, can be seen readily in the furrow slice, when these plats are crossed with the plow. We frequently observed that the soil under the rye and alsike plats was practically dust dry, while that under the adjacent vetch was turning up almost too wet for plowing. Under such conditions, the ordinary clovers have proved to be about intermediate in the moisture content of their soils, with the advantage somewhat in favor of the crimson,—especially after seed formation had begun, with its accompanying check on vegetative growth,—while the conditions under the frost-killed annuals were more nearly like those under the vetch.

The importance of these differences in moisture can be appreciated when it is remembered that in the average soil it is only the moisture in excess of 8 or 10 per cent that is available to plants. On some of these plats, therefore, the trees were evidently practically in a state of drought, while those on the vetch and similar plats were almost too well supplied with moisture.

In the present experiment, crimson clover has come next to vetch in its relation to tree growth. This again is not surprising, but the low position of the mammoth and medium red clovers is wholly unexpected, since they seem to be very much like the crimson clover in their more important characters. It seems quite probable that the growth deficit on the latter plots is due to some unfavorable feature of the immediate soil concerned, rather than to any action of the clovers themselves, because even their growth has not been very satisfactory until the last two seasons. It is also possible that the greater amount of winter-killing on the crimson clover plats, which evidently reduces the growth and loss of moisture in the spring, may have something to do with its advantage.

In the case of all the other crops, the present effects on the trees are doubtless largely due to their relative influence on the moisture supply, which has already been noted as very important in this orchard, in the discussion of Experiment 331. The rye influence has not been as bad as might be expected, probably because it was usually sown late,—not earlier than the first of September,—and it has always been mowed immediately around the trees as soon as it showed any important growth in the spring. The cow peas and soy beans, on the other hand, are sown some time between June 25 and July 5. The period of cultivation, therefore, is much reduced for the trees and the crops make a vigorous growth, thus undoubtedly competing rather seriously for moisture and materially checking the fall growth of the trees. The gains in nitrogen and humus from these crops, therefore, have evidently not yet compensated for their apparently unfavorable reductions in the moisture supply.

The gains with the rape, millet and buckwheat are larger than might be expected, and in the case of the latter they may be partly due to a slight advantage in location. Here again, we may note that our results with this class of crops are not materially different from those of Emerson at the Nebraska Station, which were published in 1903 and 1906 in their Bulletins 79 and 92. These crops are all frost-killed annuals, though the rape is much more resistant and usually some of its plants survive the winter. As a group, therefore, they offer little or no competition for moisture in the spring, which is apparently much to their credit. Their competition in the fall also, has not been so serious in the present experiment as that of the other frost-killed crops.

As winter covers, the millet is the best of the present three,—chiefly because of its greater ability to hold the snow,—and the rape is the poorest. The latter usually withers away and disappears almost completely during the winter. The buckwheat, also, furnishes but little direct protection to the soil, though it does seem to exert a mysteriously good influence on the physical condition of the latter, making it looser, mellower, and more congenial to moisture. Its general effect, however, is hardly so good as that of millet, and even the latter crop, for the average Pennsylvania conditions, does not yet impress the writer nearly so favorably as hairy vetch, and possibly crimson clover. From present indications, however, and in view of the low cost of their seed, either millet, rape, or buckwheat is likely to prove much more valuable in many cases than many of the plants now sown for orchard covers.

RESULTS IN ORCHARDS OF EARLY BEARING AGE.

The next group of results is obtained from orchards ranging from 6 to 20 years old, if we begin with the age of the youngest at the start and finish with that of the oldest at present. The experiments directly concerned in this group are the first three indicated in Table I, and each involves the entire plan shown in Figure 1. These experiments were started in 1907, in orchards already planted, and hence it was not always possible to get all the conditions as uniform as desired. Such irregularities as are present, however, have been corrected in our calculations so far as possible. Owing to some serious attacks of "collar-rot" and other diseases also, one of these experiments, No. 217, was terminated in 1912 and a similar one was started in another section of the orchard.

The results thus far obtained from these three experiments on the yield, growth, average size and color of apples are shown in Tables V, VI, VII, and VIII, respectively. The yields, color and average size are given for the five-year period from 1908 to 1912, inclusive, thus omitting the yields of 1907, which naturally were affected but slightly, if at all, by the treatments of the first year. In growth, however, the averages are given for the entire six-year period beginning with 1907. The yields are obtained by weighing and recording all the fruit from each tree, and the growth is determined by measuring all the trees practically annually at definite points on their trunks.

The data on average size and color are obtained by the random sample method. This means that as the fruit is picked and weighed, a sample is taken at random from each basket, the samples being of sufficient size to make at least two bushels of fruit of each variety from each plat. This sample is weighed, counted and carefully examined for amount of color, and the average weight and the per cent of color shown by the fruit in each sample are calculated from the data thus obtained. The averages for each year on all characters except growth are brought together and averaged to obtain the present data on each experiment. These mean values in turn are averaged in each of the present tables to obtain the various "table" averages shown in them. In the growth tables, the figures given are the average increases in trunk girth for the whole period covered. The results secured are shown in the following tables.

TABLE V.—INFLUENCE OF CULTURAL METHODS ON YIELD. (YOUNG BEARING ORCHARDS.)

(Average annual yields per acre during last 5 years, 1908-12.)

TREATMENTS.	Expt.	Tillage.	Cover crop.	Mulch.	Sod.
		Bushels.	Bushels.	Bushels.	Bushels.
Without fertilization	217	96.0	121.0	174.3	140.1
	218	129.5	110.4	108.5	110.4
	219	21.9	23.6	55.5	19.9
Average per acre	–	79.1	85.0	112.7	90.1
Rank	–	4	3	1	2
With manure	217	169.1	151.5	213.0	260.5
	218	155.8	145.2	105.9	115.9
	219	52.3	30.2	59.1	35.0
Average per acre	–	125.1	109.0	126.0	137.1
Rank	–	3	4	2	1
With complete fertilizer	217	170.4	195.3	218.2	187.7
	218	182.3	133.3	115.3	126.6
	219	47.5	53.7	44.4	33.5
Average per acre	–	133.4	127.6	129.3	115.9
Rank	–	1	3	2	4

TABLE VI.—INFLUENCE OF CULTURAL METHODS ON GROWTH. (YOUNG BEARING ORCHARDS.)

(Average increases in trunk girth, 6 years, 1907-12.)

TREATMENTS.	Expt.	Tillage.	Cover crop.	Mulch.	Sod.
		Inches.	Inches.	Inches.	Inches.
Without fertilization	217	9.10	9.69	9.05	8.92
	218	9.89	10.09	10.71	8.78
	219	10.01	8.94	10.87	7.65
Average gain	–	9.67	9.57	10.21	8.45
Gain over sod	–	14.4 %	13.3 %	20.8 %	–
Rank	–	2	3	1	4
With manure	217	9.88	9.13	9.19	9.06
	218	11.15	10.32	10.52	10.55
	219	11.65	11.20	11.75	10.06
Average gain	–	10 87	10.22	10.47	9.89
Gain over sod	–	28.6 %	21.0 %	23.9 %	17.0 %
Rank	–	1	3	2	4
With complete fertilizer	217	9.58	10.22	10.29	8.51
	218	9.38	9.63	11.25	9.63
	219	11.19	11.37	11.92	10.08
Average gain	–	10.05	10.41	11.15	9.41
Gain over sod	–	18.9 %	23.2 %	32.0 %	11.4 %
Rank	–	3	2	1	4

TABLE VII.—INFLUENCE OF CULTURAL METHODS ON THE SIZE OF APPLES. (YOUNG BEARING ORCHARDS.)

(Average weights of fruit in ounces, 5 years, 1908-12.)

Treatments.	Expt.	Tillage.	Cover crop.	Mulch.	Sod.
		Ounces.	Ounces.	Ounces.	Ounces.
Without fertilization	217	4.90	4.82	5.22	4.94
	218	5.68	6.01	6.14	5.68
	219	3.81	3.73	4.74	4.30
Average size	-	4.80	4.85	5.37	4.97
Gain over sod	-	-3.4%	-2.6 %	8.04%	-
Rank	-	4	3	1	2
With manure	217	5.53	4.98	5.42	5.42
	218	6.15	6.26	5.91	5.84
	219	4.63	4.43	4.83	4.56
Average size	-	5.44	5.22	5.39	5.27
Gain over sod	-	9.5 %	5.03%	8.44%	6.03%
Rank	-	1	4	2	3
With complete fertilizer	217	4.85	4.99	5.72	5.41
	218	5.48	6.00	6.44	5.83
	219	4.55	4.27	4.52	4.63
Average size	-	4.96	5.09	5.56	5.29
Gain over sod	-	-.2 %	2.4 %	11.9 %	6.44%
Rank	-	4	3	1	2

TABLE VIII.—INFLUENCE OF CULTURAL METHODS ON THE COLOR OF APPLES. (YOUNG BEARING ORCHARDS.)

(Average per cent of fruit colored one-half or more, 5 years, 1908-12.)

Treatments.	Expt.	Tillage.	Cover crop.	Mulch.	Sod.
		Per cent.	Per cent.	Per cent.	Per cent.
Without fertilization	217	71.1	67.5	77.1	81.0
	218	76.4	83.2	74.8	76.0
	219	77.5	72.6	82.9	86.2
Average color	-	75.0	74.4	78.3	81.0
Per cent gain over tillage alone	-	-	-0.7	4.4	8.1
Rank	-	3	4	2	1
With manure	217	64.0	68.8	64.3	68.9
	218	64.5	73.9	69.6	74.7
	219	66.0	74.5	63.3	77.2
Average color	-	64.8	72.4	65.7	73.6
Per cent gain over tillage alone	-	-13.6	-3.5	-12.35	-1.8
Rank	-	4	2	3	1
With complete fertilizer	217	64.6	64.6	69.7	72.7
	218	74.7	75.7	69.6	70.0
	219	70.0	71.6	74.2	77.3
Average color	-	69.8	70.6	71.2	73.3
Per cent gain over tillage alone	-	-6.9	-5.8	-5.1	-2.2
Rank	-	4	3	2	1

These results are naturally much more complicated than those in the recently planted orchards considered above. The differences also are less distinct and much less uniform in their trend in many cases, and the relative values of the several treatments are more variable in the different soils and localities. Part of this variability is doubtless connected with the natural unsteadiness, in yield especially, that is generally characteristic of trees in their early stages of bearing. The extent and importance of the latter influence, however, can only be determined by further results and perhaps by additional experiments.

But notwithstanding the present difficulties, a few points are fairly clear. In the first place, it may be noted that the sod treatment has uniformly resulted in the poorest growth and the best color of any of the treatments. This is doubtless chiefly due to its usual accelerating influence on maturity. On yield thus far, sod has usually exerted a stimulating influence, a fact which is especially noticeable when it occurs in connection with manure. The exceptionally high average in this sod manure treatment, however, can be traced primarily to the unusual yields in Experiment 217, as in the other two experiments it is a notable fact that four out of six of the other treatments with manure are against this average. The same is true of the sod average obtained in the series without fertilization, as shown in Table V.

The present yield benefits from sod, moreover, are evidently being secured primarily as a result of mild injury, as is shown by the fact that the sod trees are making the least growth of any of the treatments, and in the series receiving commercial fertilizer they are also showing the lowest average yield. Grass sod growing over tree roots, therefore, must generally be considered as an objectionable treatment.

THE CROP VALUE OF A MULCH.

In terms of fruit, it will be noted in Table V that our annual mulch applications alone have given an average increase of about 35 bushels of apples in two of the experiments, and have resulted in no gain over sod in the third. These differences might be greater if the trees were larger and in another experiment on older trees, as shown in Tables IX and XII, it will be observed that the mulch has given a maximum annual gain of

76 bushels per acre for the last four years. In the absence of fertilization during three of those years, the average annual gains from the mulch were 22 bushels per acre, which also happens to be the average shown by it for all three of the experiments in Table V.

When fertilization has been added in these "adolescent" orchards, however, the benefits from the mulch have usually been reduced, and in the presence of manure they have disappeared entirely, so far as the average yield is concerned. In other words on these medium sized trees, the three-ton mulch of straw or other extra material has apparently been heavy enough to interfere somewhat with the action of the manure. This interference has been less with the commercial fertilizers, especially in the case of growth, and it does not appear at all in Experiment 221, as shown later.

From the present data, therefore, it appears that such a mulch as we are using can not be relied upon for annual gains of more than 20 to 35 bushels of apples per acre in the younger orchards, and not more than 75 or 80 bushels in those more mature. From this, it is evident that one is restricted to the use of relatively cheap materials in maintaining the mulch, if it is expected to show a definite profit. Where the materials for it can be grown between the rows, or can be obtained in such form as swamp hay, buckwheat straw, or possibly damaged straw of other kinds, its use seems to be practical in many cases, though not in all.

We have grown a great abundance of material for an initial mulch by using rye between the rows of 5-year-old trees. This is followed by a more or less permanent cover of white and red clover, supplemented with hairy vetch. The latter plants are used to maintain the mulch until driven out by grass or less desirable forms, whereupon the interspaces may be re-tilled and reseeded to leguminous plants.

As compared with the other treatments in these experiments, it will be noted that the mulched trees are usually retaining their superiority in everything but color of fruit. Their margin is considerably smaller, however, than that in the recently planted orchards discussed earlier, and in a few cases it disappears entirely in favor of some of the tillage treatments. The latter cases are found chiefly in the heavy soil of Experiment

218, which is rather unexpected because this soil is almost the same as that in our Experiments 331 and 333 above, in which the mulch has proved very satisfactory.

Incidentally it may be noted that thus far the tillage and cover-crop treatment has surpassed the mulch in but a single average and that is the rather surprising one of color when used in connection with manure. In a few other individual cases, especially in Experiment 218, the cover crops have also excelled slightly in certain other characters. In general, however, with the exception of Experiment 218, the mulch treatment has proved very satisfactory for orchards of the early bearing age, when the cost of materials is not too high.

THE VALUE OF COVER CROPS.

Just as in the very young orchards considered above, cover crops here again have largely failed to come up to expectations. In yield, as compared with tillage alone, they have shown a couple of 25-bushel increases,—both in Experiment 217. In practically all other cases, however, their gains either have been very small or totally lacking, with the results favoring the other treatments.

These results again may be connected with local conditions, to some extent, and also with the unsteadiness and youth of the trees, though the exact importance of these influences is not at all certain. In two of the older orchards, particularly in Experiments 221 and 338, the benefits from tillage and cover crops together have seemed to be quite important,—amounting to about 122 bushels per acre annually as compared with sod in the latter case. Just how much of this is due to the cover crop, however, can not be determined from the particular combinations that are under comparison in those experiments.

On the other hand, the present series do contain comparisons bearing directly on the value of cover crops; they give the average annual returns for 5 years from three experiments on three markedly different soil types, and their results are certainly not without significance. These results indicate that many orchards, and especially those in the early stages of bearing, are not likely to be materially benefited by the addition of cover crops. Where the humus is very deficient, however, and perhaps in older and more mature orchards, cover crops may be expected to give better results.

Other matters, such as the relation of cultural methods to fertilizer response or utilization, the influence of fertilization in reducing the differences between the various cultural methods, the relative value of manure and of our commercial fertilizer in connection with the different treatments, and something of the relation between soil type and the response to all these treatments, might also be considered here if space permitted. They can be determined fairly well by examining the tables themselves, however, and some of them will be referred to briefly in connection with certain results that appear later.

RESULTS FROM MATURE ORCHARDS.

One of the following orchards can hardly be considered mature, since it is now only 10 years of age, but it is considered in Table IX along with the 24-year-old trees of Experiment 338 because the experiments are of the same type and they thus admit of briefer treatment. These two experiments, 336 and 338, are what we have called "combination experiments" because they involve two distinct series of questions,—one on fertilizers and the other on cultural methods. Only the latter series is considered in Table IX, and the treatments correspond with Nos. IV, VII and X of the general plan shown in Figure 1. No fertilization has been used on the present plats except once (in 1911), when a commercial fertilizer analyzing about 6-10-6 was applied uniformly over all the treatments at the rate of about 600 pounds per acre. The results from these two experiments on the four characters of yield, growth, size and color, are as follows:

TABLE IX.—INFLUENCE OF CULTURAL METHODS ON YIELD, GROWTH, SIZE AND COLOR IN APPLES.

(Annual yield per acre and total growth increases, 1908-12, and average size and color, 1909-12.)

	Expt. 336.	Expt. 338.	Total yields.	Yield increase over sod.	Inc. in tree girth.	Growth increase over sod.
	Bushels.	Bushels.	Bushels.	Per cent.	Inches.	Per cent.
Cover crop	47.8	312.9	1142.0	72.5	8.33	41.4
Mulch	57.0	266.4	1030.2	55.6	7.30	23.9
Sod	23.1	190.2	662.4	-	5.89	-

	Average size in 336.	Average size in 338.	Average size.	Size increase over sod.	Average color.	Color increase over tillage.
	Ounces.	Ounces.	Ounces.	Per cent.	Per cent.	Per cent.
Cover crop	6.77	4.24	5.50	12.0	62.0	-
Mulch	6.48	4.06	5.27	7.3	69.9	12.7
Sod	6.01	3.82	4.91	-	74.4	20.0

These results show greater benefits from the tillage and cover-crop treatment than any of the experiments thus far considered. In every character except color, this treatment here shows very decided gains over sod alone, and with one additional exception it is also surpassing the mulch by considerable margins. In these cases, as compared with sod, the cover-crop trees are making 41% better growth and are showing 72% better yields, which amounts in the latter case to more than 122 bushels per acre annually in Experiment 338. The fruit also is 12% larger. As against this, the sod fruit is 20% higher in color. The superiorities and deficiencies of the sod in comparison with the mulched trees are similar, but with smaller differences, and as usual, in the younger orchard, the mulched trees are again showing the highest yields of any treatment by about 10 bushels per acre annually.

These results are likely to be considered much more "orthodox" than those in the three earlier experiments, because they are more nearly in line with most of the current opinion. The other results are more extensive, however, and are just as truly the responses of the trees involved. It is evident, therefore, that

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the success or failure of the various cultural methods is also closely dependent upon local conditions, just as already found to hold true with fertilization.

As already noted also, it is not practicable in the present cases to determine just how much of the credit is due to the cover crops and how much to the tillage. But in view of the rather unfavorable results from cover crops in the direct comparisons above, the present benefits can hardly be largely or positively credited to them without more definite evidence.

RELATIVE COMMERCIAL QUALITY OF THE FRUIT.

Assuming that commercial quality in apples is largely determined by the size and color of the fruit, it would seem to be almost a triple tie for the leading place between the various treatments here. This is on account of the fact that the gains in one character are usually offset by deficiencies in the other and vice versa. If there is any material advantage, it is probably with the mulch, since the size of its fruit appears to be satisfactory and its color is distinctly higher than that of the cover-crop fruit. On the same basis and assuming equal soundness and perfection, the mulched fruit in Experiments 217 to 219 would also doubtless be ranked first in commercial quality in about two-thirds of the cases, or in about six of the nine opportunities for comparison. Incidentally, the high average size generally shown by the mulched fruit, when the crops are not excessive, is clear evidence of the excellent moisture-conserving ability of a good mulch and this also has been thoroughly demonstrated experimentally.

Thorough and proper tillage will likewise conserve moisture very satisfactorily, but its action on the color of the fruit is quite similar to that of too much nitrogenous fertilizer,—the result in either case being a gray and unsightly color, instead of a rich red, which greatly detracts from its salable qualities. Other characters, however, such as full development in size and a normal period of ripening, are also very important in securing the best dessert and keeping qualities, and where the tilled fruit can excel distinctly in these respects it may often more than overcome its usual deficiencies in color. In this connection also, the relative keeping quality of the fruit is evidently of much importance and definite and extensive comparisons of average fruit from the different treatments are needed to determine their relative influences on this important character. As yet, however, the facilities have not been sufficient to get this accomplished.

RESULTS FROM THE FASSETT ORCHARD.

This orchard is fully mature, since its age, as shown in Table I, is now 40 years. Its results, therefore, should be typical of orchards in the fully mature class. Our experiment here was started in 1907, and the treatments involved are those numbered IV to IX in the general plan shown in Figure 1. The other treatments in this plan were omitted because of limitations in the experimental area available.

The results of the present treatments in respect to the four characters under consideration are shown in Tables X and XI. The yields are given for four years only, excluding the first two years instead of only the first one in this case, so as to allow the same number of full and off years to each treatment. This is desirable in the present experiment because of the marked alternations in bearing that have developed in some of the plats, with their full crops not all coming on the same years. The trees here are set at the rate of 27 to the acre.

TABLE X.—INFLUENCE OF CULTURAL METHODS ON YIELD AND GROWTH · EXPERIMENT 221.

(Annual yields per acre, 1909-12 and the average growths, 1907-12.)

Treatments.	Average Yields, 4 Years.		Growth, 6 Years.	
	Tillage and cover crop.	Sod mulch.	Tillage and cover crop.	Sod mulch.
	Bushels.	Bushels.	Inches.	Inches.
Without fertilization	345.9	322.8	5.39	3.19
Gain over mulch	23.1	-	2.20	-
Relative gain	7.2%	-	69.00%	-
Rank	1	2	1	2
With manure	382.5	513.5	6.72	4.26
Gain over lowest	-	131.0	2.46	-
Relative gain	-	34.2%	57.70%	-
Rank	2	1	1	2
With fertilizer	372.5	438.9	6.06	4.16
Gain over lowest	-	66.4	1.90	-
Relative gain	-	17.8%	45.60%	-
Rank	2	1	1	2

TABLE XI.—INFLUENCE OF CULTURAL METHODS ON SIZE AND COLOR. EXPERIMENT 221.

(Average weights and color of fruit, 1907-12.)

Experiment 221. Treatments.	Average Size. Tillage and cover crop.	Average Size. Sod mulch.	Average Color. Tillage and cover crop.	Average Color. Sod mulch.
			Per cent.	Per cent.
Without fertilization	4.79 oz.	5.22 oz.	68.0	79.9
Gain over cover crop alone	-	9.0 %	-	11.9
Rank	2	1	2	1
With manure	5.45 oz.	5.33 oz.	65.9	72.6
Gain over cover crop alone	13.8 %	11.3 %	-2.1	4.6
Rank	1	2	2	1
With fertilizer	5.16 oz.	5.37 oz.	68.9	73.1
Gain over cover crop alone	7.7 %	12.1 %	0.9	7.5
Rank	2	1	2	1

Taken as a whole, these results show a rather marked distribution of the honors,—neither method showing a uniform superiority over the other in all characters. The mulched fruit as usual is superior in color. It is also leading in average size, in two cases out of three, and its deficiency in the third is so slight that its general superiority in color would probably entitle it to rank first throughout in respect to commercial quality.

On the other hand, we find that here, as in the other mature orchard, the trees receiving the tillage and cover-crop treatment are making uniformly the largest growth. Whether or not this is also the best growth for trees of this age is less certain. There are some indications that the two plats receiving fertilization in addition to tillage and cover crops, are now making rather too much growth for best results in yield, which is naturally the important item in a mature orchard, and in it unnecessary growth is objectionable.

In the absence of fertilization, the cover-cropped trees are now excelling the mulch in yield by about 23 bushels annually, and this margin would be materially increased if the yields for the entire period were included. This superiority is very decidedly reversed, however, when fertilization is added to both treatments. Under the latter condition, the mulched trees are giving better annual returns than any combination involving tillage and cover crops that we have tested thus far. Their yields also, have been much steadier than those of the other treatments, as shown in the following table, which gives the annual yields from 1907 to 1912, in bushels per plat of about an acre.

TABLE XII.—INFLUENCE OF CULTURAL METHODS, WITH AND WITHOUT FERTILIZATION, ON STEADINESS OF YIELD.

(Yields in bushels per acre annually, in Experiment 221.)

Treatment.	1907.	1908.	1909.	1910.	1911.	1912.	Average last 4 years.
	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.
Mulch and manure..	84	215	493	526	621	413	513.5
Cover crop& manure	117	145	493	216	612	188	382.5
Mulch & fertilizer..	38	199	409	560	370	416	438.9
Cover crop and fertilizer...........	129	122	639	118	573	161	372.5
Cover crop alone...	23	467	195	505	202	481	345.9
Mulch alone.......	29	221	215	391	246	439	322.8

In the presence of fertilization in this orchard the differences in steadiness of yield between the mulched and tilled trees are very striking. The tilled trees on the one hand are showing a regular and distinct off year, while those receiving the mulch have shown steady increases in yield up to about 600 bushels per acre, which is followed by a decrease of only about 200 bushels. The off year, therefore, has not yet been eliminated entirely, but its influence has been greatly reduced. At the present time, the average deficit on the tilled and fertilized trees in this experiment is practically represented by the losses in their off years.

The fundamental cause of this difference is very important. Practically it appears that the chief difference in treatment lies in the fact that the tree roots are materially disturbed in one case and not in the other. Strange to say, this disturbance does not seem to have injured the growth, but it, or some other influence not yet recognized, has evidently reduced the yields very materially. The harmful effect on yield that regularly accompanies too much pruning of the tops of apple trees is now widely recognized. There is therefore reason to believe that similarly harmful effects may be associated with any regular and material pruning of the roots.

These and other relatively unfavorable results with the ordinary methods of orchard tillage suggest the advisability of shallower plowing over tree roots,—not deeper than four inches at the most,—and where the conditions permit, it would seem advisable to displace the plow entirely, either with a double-action disc or cutaway harrow, or with a satisfactory mulch.

IS FERTILIZATION MOST EFFECTIVE ON TILLED OR UNTILLED TREES?

Judging from the Fassett experiment alone, one would answer this question positively in favor of the latter trees. In Table X, for example, the addition of manure to the tillage and cover-crop treatment has resulted in a gain of only 37.6 bushels per acre, while the corresponding gain from its addition to the mulch is 190.7 bushels or over 5 times the gain secured by manuring the tilled trees. With the commercial fertilizer similarly, the gains from its use on the tilled trees are but 27.6 bushels annually, while the corresponding gains are 116.1 bushels on those receiving the mulch. These cases are, therefore, evidently on the side of greater efficiency from the fertilization applied to untilled trees, and incidentally it may be noted that the thinner mulch under these larger trees shows none of the interference with fertilization noted above in the experiments of Table V.

Similar inference may be drawn from the large benefits obtained from fertilization in our untilled fertilizer experiments in the Johnston and Brown orchards,* as compared with the smaller benefits obtained in other similar experiments involving tillage. Such comparisons, however, are naturally much less direct and less exact than those in the Fassett orchard.

In Table V, on the other hand, with the exception of manure on sod, we find that the largest increases in yield have regularly come from the fertilization applied in connection with tillage, and the differences are especially marked in Experiments 217 and 218. In Table VI, similar results are apparent in regard to growth,—the most striking gains from fertilization in this

* The fertilizer experiments in these orchards are discussed in the paper preceding.

case being shown by the tilled trees of Experiment 219. The benefits from fertilization, therefore, are by no means confined to untilled trees, and in some cases its utilization is evidently better when accompanied by some cultivation.

The exact conditions associated with these different kinds of response have not yet been determined, and this is one of the important questions intended for further study, by chemical and physical means, as soon as the necessary facilities are available.

THE RELATIVE IMPORTANCE OF FERTILIZATION AND CULTURAL METHODS.

Throughout these experiments, and especially in the older orchards, the importance of fertilization has been quite apparent. In most of the results from Table V on, it will be observed that the addition of fertilization, either in manure or in commercial form, has largely overcome or neutralized the differences developed by the various cultural methods when used alone. In some cases, also, it has even distinctly reversed the latter differences. Similar, though not exactly analogous data, bearing on the same general question, may be obtained from the Johnston experiment by comparing the yields produced on its cultural-method plats with those obtained on certain of its plats receiving fertilization.

The figures resulting from this comparison are shown in Table XIII. As already noted in connection with Table IX, the cultural-method plats in this experiment have received one uniform application of fertilizer, the application being made in 1911. This has not yet influenced the yields very materially, with the possible exception of the mulched trees in 1912, but the annual differences for the three preceding years are also given, thus permitting any further comparison that may be desired. The sod here is not especially heavy, owing to the practically complete occupation of the ground by the trees.

TABLE XIII.—RELATIVE INFLUENCE OF CULTURAL METHODS AND FERTILIZATION ON YIELD.

(Annual yield per acre, during four years, 1909-12, in Experiment 338.)

Treatment.	Annual yields per acre.	Annual gain over sod.	Annual gain 3 years.
	Bushels.	Bushels.	Bushels.
Sod	190.2	-	-
Sod mulch	266.4	76.2	22.
Tillage and cover crop	312.9	122.7	100.
Sod plus phosphate and potash	277.6	87.4	123.
Sod plus nitrogen and phosphate	542.0	351.8	451.
Sod plus manure	637.0	446.8	390.

In the present table, it will be noted that sod alone has given a four-year average yield of 190 bushels per acre. The addition of the mulch has raised this average by 76 bushels, and the substitution of tillage and cover crops has raised it still further to a gain of nearly 123 bushels per acre, which is the maximum gain obtained thus far in our experiments, from the latter treatment.

In the latter half of the table, however, we find that the addition of phosphate and potash to sod, without any cultivation, has resulted in an average gain of 87 bushels per acre, while the addition of nitrogen and phosphates has given an increase of about 352 bushels, and manure now shows the enormous gain over sod alone of more than 446 bushels per acre annually. These latter increases are thus about 3 or 4 times as great as the best of those obtained from modifications in cultural methods alone.

These and other results already given indicate that in many cases the character of the fertilization is of greater importance than the particular cultural method followed. This is not always true, however, and before doing any extensive fertilizing of orchards, a preliminary local test on the general plan described in the accompanying report on this subject is always recommended. Similarly, before making any radical changes in a cultural method, it is always advisable to give the proposed change a careful trial on a typical portion of the orchard, unless one already has undoubted evidence of the value of the change for his particular conditions.

SUMMARY.

(*a*) *Experiments in Orchards Recently Planted.*

(1) In this group of experiments the untilled and mulched apple trees have uniformly made a better growth during their first five years than any of the trees receiving the usual orchard tillage and cover crops. These results are similar to those reported from the Ohio Station, in their Bulletin 171, page 207.

(2) As compared with clean tillage alone,—followed by weeds or other natural growth,—the addition of cover crops has not yet resulted in any material gain. In certain cases, they have even appeared to check the growth of the trees somewhat. These and the results immediately following are similar to those reported from the Nebraska Station in their Bulletins 79 and 92.

(3) The addition of vegetables or other tilled intercrops, when accompanied by proper fertilization, has not materially reduced the growth of the trees, as compared with other tillage methods. In one case the accompanying growth was slightly better than that of the adjacent trees receiving tillage and the usual midsummer cover crops.

(4) Considerable variation has appeared in the value of cover crops, as measured by their effects on tree growth. Thus far, hairy vetch and crimson clover have proved best among the leguminous covers, and millet, rape and buckwheat have been best among the non-leguminous. Their influence on the moisture supply, in both fall and spring, often seems to be more important than their relations to humus and plant food.

(5) Alfalfa for five years has proved very effective as a mulch producer and as a permanent orchard cover, when its growth is prevented from competing directly with the tree roots. The exact effects of the latter competition and the relative values of alfalfa and certain other plants as permanent orchard covers have not yet been fully determined.

(6) In general, moisture conservation appears to be more important than applications of plant food in the case of young trees, though the latter may also be of value sometimes. For this reason, a good mulch of strawy manure, wherever available, is likely to be one of the best possible treatments for stimulating growth and vigor in trees of this class.

(*b*) *Experiments in Orchards of Early Bearing Age.*

The results in this group of experiments are somewhat less clear and less uniform in their trend than those in the other orchards. In general, however, the following points have been fairly well demonstrated:

(7) In the group of early-bearing or "adolescent" orchards, the treatment involving sod alone has resulted uniformly in the least growth and the most highly colored fruit of any of the treatments. It also has usually exerted some stimulating influence on the yields. The latter effect is apparently secured primarily as a result of mild injury while the former is probably chiefly due to the hastening of maturity. The growth of grass directly over tree roots is usually objectionable because it offers an undesirable competition for soil nitrates and moisture.

(8) This competition can be satisfactorily eliminated by means of a good mulch,—one involving about three tons of vegetation per acre annually, or once in two or three years on the younger trees. The addition of such a mulch to the ordinary sod treatment has increased the average yields by about 20 to 35 bushels per acre annually in the younger orchards, and it has given a maximum annual gain of 76 bushels in one of the older orchards.

(9) Assuming that the above gains represent the approximate crop value of a three-ton mulch, it is evident that relatively cheap materials must be available, if the mulch is to show a definite profit. A rye cover crop grown between the rows will usually give a very satisfactory initial mulch around the trees, and this can then be maintained for a considerable period by growing leguminous or other less active permanent covers in the unmulched areas.

(10) In the "adolescent" orchards, the addition of fertilization, with manure especially, has generally resulted in smaller increases on the mulched areas than on the other treatments. This condition is reversed in the older orchards, however, thus indicating that the apparent interference in the younger orchards may be due to too thick a mulch. In general the mulch treatment has compared very favorably with the other treatments in nearly every point considered, but ample protection against mice must be provided, wherever this treatment is used.

(11) In the present group of orchards, tillage alone and also tillage with leguminous cover crops have usually been surpassed by the mulch treatment, though in one experiment they have excelled in most respects. The addition of cover crops here also has not yet shown any material gain over plain tillage followed by weeds or other natural growth. These results may not apply generally, and cover crops may often be expected to show a profit in more mature orchards or in soils that are especially deficient in humus, but thus far they have shown no important crop value in the present experiments.

(*c*) *Experiments in Mature Orchards.*

(12) In most of the experiments in the more mature orchards, the tillage and cover-crop treatment has proved better than the other methods of soil management, in respect to yield, growth and average size of fruit. Its chief deficiency has been in color of fruit, in which it has been regularly surpassed by the other treatments. It is impracticable from the comparisons available, however, to determine how much of the present benefits are due to tillage and how much to the cover crops.

(13) On the assumption that the relative commercial quality of the fruit is determined chiefly by its average size and color, it appears that the mulched fruit generally ranks highest in this character, with that on the cover crops usually following closely. Full development in size, as well as a normal period of ripening, is also of much importance, especially in securing the best dessert and keeping qualities. Where the tilled fruit can show material advantages in these respects, it may often more than compensate for its customary deficiencies in color.

(14) In the fully matured orchards, the tillage and cover-crop treatment alone has proved superior to sod mulch alone in yield and growth. When fertilization is added to both treatments, however, the situation is reversed as to yield, and probably also as to growth, although the *larger* growth is occurring on the tilled trees. The latter is rated lower because too much growth is undesirable in trees that are fully mature.

(15) In the Fassett orchard especially, the yields on the mulched and fertilized trees have been much *steadier* than those under any other treatment. The results on these plats show a

practical elimination of the off year during a period of five years. The chief difference in treatment between these trees and those receiving tillage, cover crops and fertilization, seems to consist in the fact that the roots are regularly and materially disturbed in the latter case and not in the former. This suggests the general advisability of shallower tillage over tree roots, with the possible displacement of the plow entirely wherever soil conditions will permit.

(16) In these experiments, fertilization has often proved more efficient on untilled trees than on those receiving tillage. There are some notable exceptions to this, however, especially in Experiments 217 and 219. The benefits from fertilization, therefore, are evidently not confined to untilled trees and in some cases the applications are evidently utilized better when accompanied by some cultivation. The exact conditions associated with these different responses have not yet been determined.

(17) In the majority of cases, in these experiments the addition of fertilization has largely neutralized the differences shown by the various cultural methods when used alone. In some cases also it has even reversed the cultural differences. These and other results indicate that proper fertilization is often more important than the cultural method. No important change in local practice should be made, however, until one has clear evidence of the value of the change for the particular conditions involved.

Question. What did you use for the intercrop?

Prof. Stewart: Corn, potatoes, mangel wurzels, peas and beans.

Ques. Then you put a cover crop in afterwards?

Prof. Stewart: Yes, the difference is, this cover crop is seeded quite late, usually along in September, so that its moisture draft is less, and it has been usually a mixture of crimson and red clover; that is, a leguminous cover crop.

Ques. Did you use any phosphate with the intercrop?

Prof. Stewart: We fertilized for the intercrop to a certain extent, just a moderate fertilizer for the crop.

Ques. What kind of soil is that which the experiment is on?

Prof. Stewart: It is a rather heavy limestone clay loam. It is one of those limestone soils in which you would have to go a good many feet to get a well, so that the water table is quite low. It is excellently drained.

Ques. May I ask, Do you maintain the clean tillage during the entire season?

Prof. Stewart: This clean tillage is stopped in the middle or latter part of July, just as the tillage is stopped on the plats receiving cover crops, so that the difference will essentially be that in one case we have merely the natural growth, weeds, and so on, following the cessation of tillage, and in the other case we have a definite cover crop.

Ques. What I learn from this mulch system on your land is that the trees respond to it better than they do to tillage, and that more moisture is conserved by the mulch than by the tillage?

Prof. Stewart: Yes, there isn't the slightest doubt about that point, because we made the moisture determinations this fall very carefully and thoroughly and under almost ideal conditions. We took them about the 10th of September, after one of the most severe drought periods that we have experienced in recent years. It was a severe test on the different cultural methods. It was, however, a comparison of the moisture conditions about six weeks, or even eight weeks, after the tillage had stopped, you understand. In other words, we compared the moisture conditions on the tilled plats at the close of the active season with the moisture conditions under the mulch treatment at the same time. We found that the moisture content under all of the tillage systems ran from about five to eight per cent of moisture in the surface foot of soil. It was almost dust dry. In other words, it contained about five to eight per cent of moisture, but trees can hardly extract moisture from soil below seven or eight per cent, so that most of those trees were existing in a state practically of complete drought. At the very same time we found that under the mulch there was 17 to 18 per cent of moisture. The soil was quite moist to the touch. The optimum, or the best moisture content possible in that soil is 20%. We had 17 to 18%. This means that even at the end of a very trying period we had 85 to 90% of the best possible moisture content surrounding the roots of the mulched trees, while those under tillage were practically in a state of drought.

Ques. How large a surface does your mulch cover?

Prof. Stewart: We attempt to keep it out over the majority of the root area—moving it out as the roots extend.

Ques. Will you tell us again in detail how that mulch is applied and how expensive it is?

Prof. Stewart: In a bearing orchard we attempt to apply about three tons of vegetation annually, to maintain the mulch, besides what is grown naturally in the orchard. Now in some cases that amount of mulch is out of the question, as you simply cannot obtain that amount of vegetation. But any kind of vegetation will do. We use buckwheat straw, swamp hay and any kind of damaged straw we can get hold of. You might use potato tops, or anything of that general sort, or you might grow a lot of mulching material by the use of some of the coarser millets, on relatively moist land that would be of little use for anything else.

Ques. What was the condition of the fertility before the operation?

Prof. Stewart: Well, it was rather poor in this field. The fertility in this soil was quite low. So we expected the addition of fertilization would be of value, but as a matter of fact it was much overshadowed in importance by the moisture. Moisture is of much more importance to young trees than the addition of plant food.

Remark: The tree needs its moisture in the growing season, and probably that cultivated plot had lots of moisture while the cultivation was going on. In September the growing of the apple tree is done. What little growth it makes then is the ripening up of fruit buds.

Prof. Stewart: Yes, but the point was this,—that the growth of the tilled trees has been regularly checked much earlier in the season than the growth of the mulched trees, with the net result that the latter trees are now a fourth to a third larger. In your climate you might have to lighten up the mulch or do something else that would be different, though it is usually the dry tree that is injured by winter, rather than the one that is plentifully supplied with moisture. We want our young trees to continue growing. We want to get a tree in as few years as possible that will be ready to bear fruit. We don't want to get but a half season's growth when we might let it grow the full season.

Remark: In our country where we fertilize very heavily, when the severe winter comes we get lots of winter-killing among the young trees, the bark bursting and the trees dying back. It is not a safe thing at all in Nova Scotia to keep up a late growth.

Prof. Stewart: In that case of course you will have to modify conditions to meet it.

Ques. Are the winters severe in Pennsylvania?

Prof. Stewart: We have had some pretty cold weather there in some instances. Year before last we had weather that ran as low, according to the reports, as 30 below. The actual fact is simply that we had 20 or a little more below zero. But the point is this,—that cold came along in February after we had had a very good preparatory season for the trees to stand it. The suddenness of the coming of the cold makes much more difference than its actual extent. But I will say that we have not had an appreciable bit of winter injury on any of our trees and they are growing in different parts of the state, too.

Mr. Keyser: You get more freezing and thawing than we do?

Prof. Stewart: Yes; last winter there was a certain amount of winter-killing in the state, but we didn't get any on any of our different experiments; it was to that relatively rapid freezing and thawing that I attributed the winter-killing last year, especially of peach trees.

Mr. Morse: What should you say was the average twig growth of those young trees?

Prof. Stewart: Well, we have had as much as three feet twig growth on them this past season, for example. The point is that we can get more growth in a given season, we can conserve moisture better, with certain other methods than we can with tillage, and when you pile those seasons up, one after another, we have bigger trees because of that better moisture conservation.

Mr. Morse: There is no trouble in getting the bigger trees; the trouble is getting them without the winter-killing to pay for that.

Prof. Stewart: In that case you may have to lighten the mulch, or possibly eliminate it entirely.

Ques. I would like to ask if this experiment has been running long enough so that you know the effect on the fruit?

Prof. Stewart: No; this is only the first five years of the growth. We now have six years' results, but we have not the sixth year tabulated yet.

Ques. I understand that you are using alfalfa as a permanent cover crop, using the same crop year after year?

Prof. Stewart: Yes; it is a permanent cover.

Ques. That gives you a heavy mulch?

Prof. Stewart: Yes; we have plenty of mulch. But as the trees grow larger of course this mulch increases in size and the mulch producing area decreases, and there will come a time when it will hardly maintain a satisfactory mulch, and I don't know what is going to happen when these trees reach the bearing stage. If you cannot grow alfalfa you will have to grow some other crop as a permanent cover and use the same principle. You don't have to use the same plant. Alfalfa is a detail. Vetch is second with us. The first cover crop is alfalfa. The vetch, however, is an annual cover; it is the best of them, and I am just now trying vetch and red clover and white clover combined, as an experimental permanent cover, using that triple combination in the same way that I am using the alfalfa below. It is my opinion that the development of the proper plants and the proper handling of permanent covers in an orchard right now is of much more importance than the consideration of annual covers and annual tillage. In other words, if I could say at the present minute what is the best combination for a permanent cover in an orchard to be used as the source of a mulch to place around the trees, why I would be very well satisfied. We are working now on the permanent covers. This alfalfa is a single instance of a permanent cover. I want others.

Ques. Is there anything else that could be a permanent cover except the alsike?

Prof. Stewart: Well, the alsike is not a good plant for this reason: It is a smooth leafed or globose plant and all such plants are severe in their moisture draught. You want a hairy-leafed plant like the hairy vetch. Its moisture draught is extremely low. As a matter of fact the hairy vetch is an ideal cover for an orchard. The soil under the vetch will often be almost too wet to plow, when under alsike, right beside it, it will be in a dry condition. We have plowed crosswise and otherwise to see. The difference was so great that you could show the sharp break on a photograph. Alsike and rye are both severe in their moisture draught, and that is what you don't want as a cover in an orchard. The advantages of the vetch are a slight moisture draught, a sprawling habit of growth so that it covers the ground and checks evaporation from the soil, and the fact that it is a nitrogen gatherer. You have got everything in that plant, but with this defect, that it frequently winter-kills with us. I believe if you have a sprinkling of rye in combination with the vetch that it will winter-kill much less than if you attempt to grow the vetch alone. We are growing it alone in the present experiment because we want to see what its effect is.

Ques. Are these crops all used alike as a mulch?

Prof. Stewart: The alfalfa is the only one used as a mulch. These others are tilled and seeded at the proper season of the year. The cow peas and the soy beans are slight in their influence on tree growth. They grow a beautiful cover crop if we look at them from the view point of the crop. The plants look fine. But in their influence on the tree they are way down in rank. The reason for that I figure as this: These two plants have to be sown early, about the 25th of June, so that the tillage season is short. They then come up and begin drawing moisture from the soil, thus checking the growth of the trees, with the result that the trees on those plots are considerably smaller than those in the other cases. I think it is because of their vigorous growth, coupled with the fact that we have to sow the seed so early, that they don't give us the effects that we expect.

If a person attempts to use a permanent cover it does not mean that he should exclude tillage entirely. He is not absolutely confined to excluding tillage from an orchard, and if he finds, for example, that he can get along better by putting the disc or something into his orchard along in mid season to stir things up and get a new start for his cover, why so much the better. I know one man in Virginia who is maintaining vetch as a permanent cover. He simply lets it grow along until mid season, until a satisfactory amount of seed has developed on the plant, and then he puts in a disc and discs that seed down into the ground, and thus gets his re-seeding. That is all he does and he is getting along very well with it. We have not been able to work it just that way yet. We have not tried it. It may work all right.

Ques. What kind of millet did you use?

Prof. Stewart: This was the German millet. The Hungarian is a little bit larger and longer in its season of growth, but it doesn't make so very much difference. The millet did very well, you will notice. From the view point of the tree itself we have been throwing out some of these cover crops because logic indicated that they were not as good as some others. In other words, we have discarded some plants because they were not nitrogen gatherers and here are nitrogent gatherers that are way down, while millet, a non-nitrogen gatherer, is way up in its influence on the tree.

Ques. Does millet absorb a great amount of moisture?

Prof. Stewart: Apparently not. The moisture draught is not nearly so high as it is in some plants, and there is this about millet,—it stands up erect in the fall and catches the snow winters, thus accumulating a certain amount of moisture, and there is no growth in the spring to furnish any possible moisture competition with the tree at that time.

Ques. In using any of those cover crops, do you recommend continuing the tillage as long as possible, up to the first or the middle of July, before you seed, or would you seed fairly early?

Prof. Stewart: I would continue my cultivation at least to the middle of July before I seeded the majority of my cover crops. I don't know just what you would have to do.

Remark: The point was this: If you seed early you get a growth for mulch.

Prof. Stewart: Well, I wouldn't want that, for the reason that in a case of that sort you would be growing your millet vigorously at a time that the trees needed the moisture very badly themselves. I would want a mulch around those trees at the very time you are growing these plants to get a mulch.

Ques. What was the difference in that experiment No. 218? The mulch effect is less.

Prof. Stewart: Well, that is a heavy soil. It is exactly the same soil type that I was showing you in our young orchards, but it is in quite a different part of the state. That soil type in the southern part of the state seems to show quite an advantage for tillage. It is a heavy soil and on trees of this age tillage has been better uniformly in that heavy soil in the southern part of the state but in the same soil type at the College the mulch has been better for young trees.

Ques. What is the effect on the color of your fruit in these different methods?

Prof. Stewart: We always get our best color on sod, our next best on the mulch, perhaps third on tillage and cover crops and fourth, frequently on tillage alone.

Ques. Do you consider it would be safe to discontinue that mulch system that you have been running five years?

Prof. Stewart: Why, if I needed to discontinue it I certainly would do it, and the way I would discontinue it would be to go in there with a double-action disc or cutaway harrow, and I would simply cut things up at any time I cared to. I feel perfectly free to go in with a disc or cutaway harrow and tear up the soil, sod, or anything, no matter how long the mulch has been running. There is quite an erroneous impression about the relation of cultural methods to the position of roots of apple trees. As a matter of fact you cannot change the position of apple roots in the soil to any great extent by cultural methods. Apple roots have a certain zone that they are adapted to follow in a soil, and they do not go down nearly so deep under any system as many people think. We studied the depth of apple roots on eight or nine different soil types and quite a good many trees, and we found that in all cases by far the majority of the feeding roots were in the surface 12 inches of soil, regardless of the cultural method, regardless of the soil type and regardless of the tree variety. In the case of the mulch system that entire 12 inches is completely filled with roots. In the case of the tillage system, it is only the lower eight or perhaps the lower six of that 12 inches that are entirely fiilled with roots, and in the upper four to six inches the roots are annually cut out. Now of course, if a person goes into an orchard after it has been running for a certain time without tillage he will have to do a tremendous amount of cutting, but he will still have left practically as many roots below as you normally have under the cultural system.

Ques. You would not want to return to permanent sod?

Prof. Stewart: I would not want to return to a permanent sod unless I knew I could get satisfactory results with fertilization, because sod alone as a general proposition is the worst.

Ques. We are just being taught that we should use dynamite for setting trees. What is the advantage if the tree roots run only about 12 inches deep?

Prof. Stewart: We have run three experiments in dynamiting for two years and we have had no appreciable gain from the dynamited trees. I don't want to be misunderstood in all this at all. It may be the right thing here, but I will simply say that in our experiments in two different parts of the state, and one of them on a hard pan subsoil, where dynamiting should do good if at all, for two years on two orchards in that kind of soil and the third one in another sort—young orchards—we have had no appreciable gain, and also on some mature orchards we have had no appreciable benefit from it. I realize that over in New Jersey, Mr. Farley has recently reported dynamiting, in which he obtained some benefit, in the case of peaches. But we have had none and I doubt very much whether you will get a great deal of benefit from the use of dynamite in planting trees. Now that is my opinion. Mr. Farley's experience with peaches seems to be different. But the trees that were planted in comparatively small holes and the trees solidly tramped in are the best trees in our orchard. We don't need especially large holes for them. The roots get around somehow. And furthermore, in Missouri, some 15 years ago, from the experiments in which they tried out subsoiling with special plows and tore up the subsoil at a great expense and planted blocks of trees on that subsoiled area they found no benefit whatever.

Ques. I think a professor here told me of roots that went 17 feet into the soil. Where is that?

Prof. Stewart: We traced apple roots for 46 feet, but they ran out sideways. In certain arid districts, such as New Mexico and Arizona, the roots have to go down in search of water and some unusual depths are reported there.

Ques. How about alfalfa?

Prof. Stewart: It goes down pretty well.

Prof. Wolff: We in New Hampshire, like you, have had some discussions on this question of dynamite. The New Hampshire Experiment Station has one orchard in Manchester, in which I supervised the planting, and where dynamite was used, and for my part, in our state across the border, I have not been able to see any definite results from the use of dynamite.

Prof. Stewart: That corresponds exactly with our results.

Ques. Isn't that mulch of three tons per acre an immense amount?

Prof. Stewart: Yes, that is a pretty good mulch, but when the trees are rather large that is not a bit more than one needs. If you can't get that amount of mulch, get what you can and supplement it with proper fertilization. You can often add manure to plain sod and get a tremendous gain.

Ques. By sod, do you mean that you take the crop, whatever grows on the sod, away?

Prof. Stewart: In our experiments we take the first cutting away and the second cutting is left where it falls.

Ques. What is the market value of that mulch in your place?

Prof. Stewart: Well, it varies, of course. For our experiments we sometimes get baled straw at $8 or $10 a ton, but that would be impracticable for regular orchard operations.

Ques. How would sawdust do?

Prof. Stewart: I haven't tried it. I would be a little bit afraid to recommend it because of possible harm from its leachings.

Ques. You use three tons every five years on the young trees?

Prof. Stewart: No, we have used for those trees only a maximum of about 100 pounds for a tree and put it on about an average of every third year. In case of the alfalfa we have used no outside materials of any sort. We grow it between the trees. On other trees, we are now starting a mulch with a combination of rye and vetch that we grow between the tree rows and swing it around the trees as a mulch, and then we are going to carry it on by means of this white clover, red clover and vetch combination as a permanent cover.

Ques. You think if we have plenty of meadow hay that is not of much value, it would pay in rather a dry orchard to put it on?

Prof. Stewart: We have used swamp hay with excellent results; anything that will help hold the moisture. If you can get three tons of it you are not getting too much; and as the trees get larger you ought to have a little more to give a real good mulch around the roots.

Ques. Does that work well on old trees?

Prof. Stewart: Yes, especially in connection with proper fertilization.

Ques. You would advise to set an orchard in ground well prepared for a natural cover crop of couch?

Prof. Stewart: If the place were satisfactory for an orchard in other respects I would not hesitate to put it in orchard. The couch or quack grass would by no means keep me out.

Ques. What I mean, you would leave the grass right there?

Prof. Stewart: Yes. I would probably have to leave it, if it behaves in the usual fashion.

Ques. Does sod fruit have good keeping qualities?

Prof. Stewart: Yes, unless it hastens the maturity to such an extent that we have to pick apples too early in the fall.

Ques. How much manure do you use?

Prof. Stewart: Twelve tons to the acre, annually, but as I said yesterday, I don't now recommend more than eight tons.

Ques. What do you think of hogs in an orchard?

Prof. Stewart: Well, if I had the hogs and had no place else for them and wanted to continue raising them, I would leave them in the orchard. But we have had some very unfavorable results from hogs in an orchard. I would not have more than two or three hogs to the acre.

Ques. You would not run them late in the orchard?

Prof. Stewart: No, as a general proposition I would not.

Ques. If you were going to use commercial fertilizer and mulch would it be necessary to sift the fertilizer down with a fork?

Prof. Stewart: No; just sow it around over the surface and let the rains carry it down. As a general proposition you can get about as good results, sometimes better, by simply leaving it on the surface and allowing the rains to carry it down as by tilling it in.

Mr. Morse: We have been taught strongly not to sow ground bone on the surface; that it will yield less benefit.

Prof. Stewart: It is possible that you lose the nitrogen there. At the same time there is not much nitrogen in ground bone and we are getting good results from dried blood left on the surface.

Ques. What do you mean by proper fertilization?

Prof. Stewart: I mean the fertilization that is adjusted to your orchard. Until it is adjusted the best guess that I can make is the general fertilizer that I showed you yesterday. My advice always is to take that general fertilizer, use it where you think your orchard needs it and then accompany it with a local testing plan in order to adjust the fertilization to your own orchard.

Ques. The young trees mulched show better results?

Prof. Stewart: Yes.

Ques. The older trees with the cover crops show better results?

Prof. Stewart: Yes.

Ques. Suppose we run our young trees on mulch five or ten years, how about changing that over?

Prof. Stewart: As I said before, we can do that if we go in with a double-action disc or something of that sort that does not injure the roots in the way the ordinary plow does.

Ques. What time of year would you apply the manure?

Prof. Stewart: It can be applied any time from late winter until the buds burst.

Ques. About this time?

Prof. Stewart: You can put the manure on now if it is in the way; but I think that the manure application from late winter, perhaps February, to budding out time is about right. This is for manure. But with a nitrogenous fertilizer, as I said yesterday, you don't want to put that on so early.

Ques. How about adding manure to the tillage and cover crops?

Prof. Stewart: We did that on those young orchards and also on the 36 year old orchard,—we added the manure to tillage and cover crop and didn't get nearly as big a gain as from adding it to the mulch. That simply means that in an orchard that needs fertilization you can get greater gains from the proper fertilizer than from any other scheme. Now that does not apply to all orchards. There are some orchards in which a tillage system seems to be of more influence than the fertilization, and in young orchards, as I pointed out, uniform moisture conservation is of more importance than any type of fertilization. But the whole thing means that you must study your orchard and adjust to it the thing that fits it best. In some cases it will be a certain fertilizer. In other cases it may be proper method of conserving moisture, with a mulch if you can get it, and with proper tillage if you can get it.

Prof. Wolff: I notice yields of 542 bushels and 637 bushels. I feel sure there are not many that could come up anywhere near to that average. I believe, if I remember rightly, that the highest yielding acre in Massachusetts two years ago at the exhibit at the New England Fruit Show was about 220 barrels to the acre. That was said to be the highest yielding acre in Massachustts. If we could do something like this we should be doing a big thing.

Prof. Stewart: Of course that 220 barrels may have been for just a single year, too. You see these are averages for four years. We have had yields running as high as 1300 bushels per acre in single years.

Dr. Twitchell: Isn't that due to the fact that your trees make much larger growth than ours?

Prof. Stewart: I suppose, undoubtedly, a good deal of it is, but it shows the possibilities. Incidentally, that 1300 bushels was grown on untilled trees receiving a nitrogen and phosphate application. Right alongside of them, on both sides, were the same varieties, same age of trees averaging 73 bushels at the same time, the only difference being that the 73 bushel trees were not fertilized; the 1300 bushel trees were—there was not even a mulch there, a proper fertilizer only.

Ques. I would like to inquire whether this was assorted fruit or the fruit as it run from the tree.

Prof. Stewart: These were the total yields.

COOPERATIVE FRUIT HANDLING ASSOCIATIONS OF THE PACIFIC COAST.

PROF. B. S. BROWN, Orono, Maine.

Coöperative fruit handling associations are in no wise a new, untried, or uncertain enterprise. While it is true that their span of successful operation may be included within the past 20 years, yet the success of such endeavors is measured by the volume of the business handled, and by the net cash returns to the coöperator. Many failures have resulted during the evolution of these organizations, but as much was to be expected. Everything was new and strange. No precedent existed to serve as a guide for the leaders. They were groping in the dark, as it were, yet feeling the insidious demands for a means whereby the fruit industry could be given a permanent financial standing. Prices were continually fluctuating, and uncertain. Buyers were compelled to be cautious, watching the movements of their opponents and competitors. No one dared order large quantities, for a fall in prices would mean the loss of months of careful business manipulation. Railroads had adopted the policy of charging "all the traffic could stand," and no one was in position to argue with them. Producers had no means of knowing what to ask for their fruit, and must rely upon the judgment and honesty of the commission men. Times were changing; laborers were asking more for their services; larger orchards were being planted; new sections were being developed, and this vast increase in production was being dumped into the centers of the population with no organization to handle it. Profits were on the decline; the pocket book was being affected. Growers drew together by instinct to talk the situation over, and coöperation was the result.

At first, progress was slow and many failures resulted. The organizations were either too small to make any impression upon the larger markets, or too large to act as a single unit. Farmers hesitated to pay large salaries to men with sufficient business acumen to handle the crop, and disorder followed. New laws had to be made and old ones changed. Railroad managers had to be interviewed and traffic agreements arranged for. Refrigerator cars, icing stations, and pre-cooling plants must be provided. Fruit packages must be reviewed, sorted out, and systematized, to avoid confusion in the general market. Information bureaus must be established, that accurate data could be collected from all the fruit producing sections of the world. Selling agents must be placed in all the largest cities, to see that the fruit was properly cared for when it reached its destination. When all this was done, we had an organization, and one whose volume of business cannot be recorded in less than hundreds of millions of dollars.

Owing to various peculiar conditions, the Pacific Coast led off in the establishing of these coöperative associations, and now they have become a prominent part of the fruit growing industry. The volume of business aggregates 75% of the total output of the coast. One association alone in California does an amount of business twice that of the total aggregate of all the fruit interests of the six New England States.

The number of successful organizations is large. California has about 40; Colorado, 33; Washington, 18; Oregon, 12; Idaho, 4; New Mexico, 3; Montana, 1; British Columbia, 11; and Ontario, as long ago as 1896, had 24 in successful operation. The California Fruit Growers' Exchange is by far the largest, and handles a volume of business exceeding $20,000,000 a year. The income of the state of California, from its varied industries, is about $1,000,000 a day. Of this amount about 1-3, or one hundred and twenty million annually is represented by its fruit products, 25% of this amount being handled by the one exchange.

The California Fruit Growers' Exchange operates over the entire state, but confines its activities mainly to the citrus fruits. This industry is large, and in years of maximum production over 40,000 cars of oranges and lemons have been shipped out of the state. This means in round numbers fifteen million boxes, with a value of thirty million dollars. This vast business is handled by the exchange direct or through subsidiary exchanges which are allied with it.

All of the more successful organizations have been developed from the producer towards the manager rather than the reverse. Each locality that can get together ten or more interested growers forms a local association. These local bodies are further organized into a district group by sending one delegate from each local society. The California Fruit Growers' Exchange now has over 80 local associations and 14 district organizations. The general office is located in Los Angeles, and is governed by a board of directors, composed of one delegate from each of these 14 district associations. They hire the manager and direct the general policy of the exchange.

They operate on such a large scale that they can maintain their own selling force. One or more salesmen are located in each of the largest cities of the east, who see to the selling of the crop and keep the general office informed on the conditions of the market. The daily consumption of each city is carefully tabulated, and a record kept of the supply distributed to smaller cities, tributary to the main centers. Each night during the busy season a telegram goes forward to the general office in Los Angeles, giving the sales for the day of the various eastern cities, the quantity received, and an estimate of the probable quantity that can be properly handled the following day. From this mass of telegrams the general office makes out a bulletin, and forwards a copy to each member of the exchange. By the middle of the afternoon each grower knows the condition of the eastern market for the previous day. From these reports the general office also forecasts the probable consumption for the next few days, and instructs each local association how much to pick or ship.

The average time consumed for a car of fruit to travel from California to New York is 14 days. This means that a car can be six days on its journey before its destination need be decided upon. The California Fruit Growers' Exchange has had as high as 500 cars of fruit rolling eastward without the destination of a single one being determined. The railroads offer a flat freight rate to all cities east of the Mississippi; hence cars may be diverted at any point without extra charges. As the cars near the eastern cities, the general office, by studying the reports of the telegrams, decides which city can best handle the arrival for the day, then wires diversion orders to the different agents. This means that the general manager must have at his finger tips, each morning, accurate information of the market conditions of each of the large cities, the quantity of fruit consumed each day, a forecast of the imports and the probable shipment of competing sections, the whereabouts of every car rolling eastward, how much fruit is in the hands of each local association ready for shipment, and the quantity of fruit that will be ready to pick during the coming week. The manager does all this for $1000 a month, and few envy him his job.

In order to maintain this standard of efficiency, the exchanges must guarantee their product. To do this they have had to supervise the picking and packing of the fruit. They have adopted standard packages, standard packs, standard grades, and even standard cars of loaded fruit. Every package is labelled with the variety of the fruit, the number of fruit in the package, and the number of the packer. On one end of the box is stamped the brand of the local association, and on the other the name of the exchange.

Each local association in the exchange is incorporated under the laws of the state. This binds the members together and permits legal restraint to prevent growers from withdrawing at critical times. Most exchanges are non-profit sharing corporations, the revenues being derived from a flat tax on each box or carton handled. The California Fruit Growers' Exchange charges 5 cents per box for oranges. The California Almond Growers' Exchange charges one cent per pound on almonds, the Cured Fruit Exchange, one-fourth cent per pound on raisins, prunes, etc. The surplus each season is pro-rated among the members, according to the quantity shipped.

As to what the exchanges have been able to do by way of increasing the net returns, the results will speak for themselves. In 1895, oranges were barely bringing the cost of picking and shipping, and many growers despaired of ever making the business pay again. In the 18 years since the reorganization of the exchange the business has developed rapidly from five million to over thirty million dollars. The cost of the orange boxes, and the picking, packing and selling of the fruit has been reduced to 35 cents per box against 80 cents before the time of the exchange.

The Almond Growers' Exchange started in 1911, and the prices were boosted the first year from 9 to 12 cents per pound to 12 to 16 cents; this in spite of the fact that the crop was the largest ever known. This increase in price added over $200,000 to the net profit of the growers. This added income does not materially affect the price of the article to the consumer, the

$200,000 being the result of speculation, and the profits to the middlemen.

In May, 1912, the Almond Growers' association sent out blanks to each member of the exchange, and collected data as to the probable amount of the crop to be harvested, varieties, etc. After these data were all tabulated the directors got together, and from the figures of previous years set a price at which they could offer the crop. Eastern brokers were advised of the price and the quantities offered, and were requested to bid for the amount wanted. The crop was estimated at 2000 tons, or 200 carloads. The next day after these letters reached the East, telegrams began coming in, making reservations, and by the second day the crop was all sold and some 30 carloads over; and this, fully six weeks before the first almond was harvested. This was possible because the buyers knew that the prices would not be changed and they were safe.

The Cured Fruit Exchange was organized last year. This was for the purpose of handling raisins, prunes, dried peaches, etc. For the preceding two years raisins had not returned the cost of production, and prunes were selling on a three and three and one-half cent basis—barely paying expenses. The organizer began incorporating local bodies in September of last year, with no thought of handling that crop, but by the first of January, 1913, over 400 carloads of fruit were tied up in nine local associations. Brokers discovered that dried fruit was getting scarce, and advanced the price one-fourth cent per pound. Soon another advance, in a few weeks another, and so on, until a full two cents a pound advance was reached. This amounts to $40 a ton, and on 400 cars, means a net advance over the old price of $160,000.

The Apple Growers' Exchange, of Hood River, Oregon, is another typical example of the advance of price to the producer. Before the organization was effected apples were bringing the grower about 85c. a box. The first year of the organization the price was boosted to $2.00 a box, and the next year to $2.60.

Another valuable feature of the exchanges, that cannot be overlooked, is their advertising advantages. With every box of apples from Hood River goes forward a large lithographed trade mark, advertising the goods as well as Hood River. Ninety per cent of the fruit growers of the United States know Hood River, yet one county in California ships more apples annually than the whole state of Oregon. Hood River ships from 500 to 600 cars of apples annually. Watsonville, California, ships over 3000 cars annually, yet who of you know Watsonville? Watsonville apple growers have no exchange. Their apples are handled by private companies, and these advertise themselves and not Watsonville. You all know of the Earl Fruit Co., the Pioneer Fruit Co., the Pacific Fruit Co., and these are the companies that the Watsonville apples have made famous. Why should such apples not make Watsonville famous?

You may ask, Are conditions in the West such that exchanges would be desirable there and not in New England? I see no reason why the fruit industry of the East should not be encouraged in every way possible. You are justly proud of your apples, because you know that an impartial judge will select your fruit instead of the more highly colored western stock. Knowing that you have better fruit, and knowing that your cost of production and placing that fruit in the hands of the consumer is less, why not demand the prices that your western neighbors get?

The fruit industry of the New England states amounts to $10,000,000 annually. One per cent of this sum would equal $100,000—more than five times the amount needed to operate a successful New England Exchange. Yet who would not give this one per cent to see the industry put on a sound financial basis, and it is possible that five per cent might be saved with increased selling efficiency of a well organized exchange.

Only 15% of the land area of New England is under improved cultivation, while fully 50% is capable of being so placed. If you bought an apple orchard in Hood River, you would pay from $800 to $1000 an acre, or an orchard in Watsonville would cost even more, yet you can buy land in your own state for one-tenth this amount that will produce just as good fruit as the West. Is this not a just and sufficient cause for encouraging the fruit industry of New England?

Such an organization could be easily effected. Each state would form a district association, and these could be combined into one by electing one delegate each to the general office in Boston. These six delegates would constitute a board of directors, to manage the affairs of the association. Each district could be composed of local bodies made up of the growers of the different fruit sections. Thus a complete chain could be established from producer to consumer, and much of the trouble of the middlemen would be eliminated, and their profits be returned to the grower where it rightfully belongs.

The time is now right to act. Progress is the result of concerted action, and united action may save thousands of dollars which at some distant future may be valueless. Prices are constantly going up, living expenses are increasing, and there is no moral reason why the producer should not have his share of this increase. In union there is increased strength, and in strength, increased efficiency.

THE PEAR-LEAF BLISTER MITE.

By E. H. Siegler, Washington, D. C.

Your president, Mr. Keyser, has asked me to give an account of the pear-leaf blister mite, *Eriophyes pyri* Pgst., which infests the pear and the apple and a few other plants of lesser economic importance. There are other species of mites which attack the pear and the apple, but only this particular species causes very much trouble. I shall therefore confine myself to the discussion of this one species. In presenting this subject, I shall endeavor to treat it in a simple way, avoiding all technical terms, as far as possible. Also, since the apple is the fruit of paramount importance in the state of Maine, I shall consider the blister mite chiefly in its relation to this fruit, although what I may say is in general applicable to the pear.

The blister mite, as the name implies, is not a true insect, but is more nearly related to the spiders, ticks and various other well known mites. A true insect is divided into three distinct parts—the head, the thorax and the abdomen. It also possesses a pair of antennæ and three pairs of legs. The blister mite under discussion has its head and thorax united, has but two pairs of legs and is devoid of antennæ.

The older members of this society will doubtless recall the day when apple trees apparently grew naturally in the state of Maine. That is, those who grew fruit in the past did not experience the same difficulty which the present growers do. Since the time of our forefathers, conditions have materially changed. Many new pests have entered our orchards and hence our methods must correspond in order to eradicate them. Not only do the growers of Maine and other states have to contend with native insects, such as the plum curculio, but also they must combat many foreign pests which have been accidentally introduced. The codling moth, the bud moth, the brown-tail and gypsy moths and the San Jose scale have all been imported into our country. Likewise, the pear-leaf blister mite has been introduced, supposedly upon nursery stock.

The blister mite was first scientifically recognized in America at the office of the U. S. Entomologist, Washington, D. C., in the year 1872. Of course, it may have been present in this country many years before that time, but it did not attract the attention of the entomologists until that year. At first, the blister mite in America was regarded as a pear pest, but within comparatively recent years it has been recognized as a formidable enemy of the apple. Since coming to this meeting, I have been informed that the mite is becoming more abundant in certain orchards, especially during the past season.

The true blister mite is very small in size, being about 1-125th to 1-150th of an inch in length. Owing to its diminutiveness, the fruit grower would seldom detect the mite, but must learn to recognize its presence by means of its work. It is an elongated creature, possessing two pairs of legs. The abdomen or body is divided into many rings, usually about 80 in number. The head is terminated in a snout which contains the mouth parts. The young mites are very similar to the adults, except that they are smaller in size. The eggs are microscopic, slightly oval in shape, with bluntly rounded ends and usually whitish in appearance. I might add that the adults are usually whitish, although there are some individuals which have a pinkish hue.

In order to learn how to control any pest, and this might be applied to fungous diseases as well, the life history must be known. By thoroughly knowing the life history, the vulnerable points may be ascertained. The adult blister mite hibernates over winter beneath the bud scales, usually of the past season's growth. As spring approaches and the weather becomes warmer, the mites become active and they begin to feed at the base of the growing bud scales. Then, as the leaves push out, the mites migrate to the leaves and piercing the lower epidermis, enter and feed upon the succulent tissue within. The irritation caused by the feeding results in the characteristic blister. Within the blister the eggs are laid and these eggs hatch in a period of about seven days, depending upon climatical conditions. In fact, I might say that insect life is largely governed by climate. The young mites, which hatch, continue to burrow around within the blister and when they attain maturity, leave in order to infest other parts of the same leaf, or adjacent leaves. When the mites are especially abundant they will sometimes attack the fruit and fruit stems. I was speaking with Miss Patch for a few minutes yesterday and she informed me that fruit which had been infested with the mite had been submitted to her. The damage to the fruit, however, is usually considered negligible.

Throughout a season, and especially a season favorable to the mite, there are many generations and often every new leaf as it appears is attacked. During the past season I have been living in the vicinity of Winthrop and Monmouth and have found many orchards quite severely infested. During the drought which we experienced, the mite was very active and caused considerable defoliation in some orchards.

I have brought with me some apple leaves which are not badly infested, but which show the characteristic blisters. On the pear, the blisters are usually found along the mid-rib, while on the apple they are distributed as a rule along the margins and toward the base of the leaves. Often the blisters are so close together that they coalesce and form darkened areas. The margins of the leaves often break. The leaves also curl when the blisters are numerous. The blisters upon the pear, especially upon the Kieffer, will often appear reddish, while on the apple they usually turn brownish in color. On examining these blisters on the lower epidermis, it will be seen that they are noticeably elevated above the surrounding surface. One or more small openings will be seen in each blister through which the mites pass in entering or leaving the blister. The blisters vary somewhat in size and shape but are usually about 1-16th to 1-8th of an inch in diameter.

In a general way I have hastily gone over the life history and described the work of the blister mite. The next consideration will be the means of control. There are three materials which may be employed against the blister mite, viz.: Lime-sulphur, kerosene emulsion and the miscible oils.

Lime-sulphur may be obtained from dealers or manufactured at home. The commercial lime-sulphur usually tests 32 or 33 degrees Baumé. At this strength, I would recommend one gallon of lime-sulphur to eight gallons of water. I realize that the blister mite may be controlled by a weaker solution, but since this will be a dormant spray application, I believe the greater strength advisable. If well applied it will eradicate scale insects at the same time and may also be of fungicidal value.

Kerosene emulsion may be secured from insecticide dealers but is usually made at home. It can readily be made in the following proportions: One-half pound laundry soap, one gallon of water and two gallons of kerosene. The soap is chipped up and dissolved in the boiling water. As soon as thoroughly dissolved, it is removed from the fire and the kerosene poured in. It should then be put through a force pump until a creamy white solution results, making certain that there is no free oil. In making this material in large quantities I employ an ordinary barrel pump. By bringing the hose back into the barrel and then pumping vigorously for about ten minutes, a good emulsion is usually obtained. This is known as a stock solution, containing about 66% of oil. To control the blister mite this should be used at the rate of one part of the stock kerosene emulsion to five parts of water.

The miscible oils are manufactured by several dealers. Usually they are employed at the rate of one gallon to 12 or 15 of water. However, these manufacturers may vary the material and I would advise that you follow their recommendations.

There are two times during the year when growers may spray against the mite. Most recommendations favor the fall application, that is, spraying in the fall as soon as possible after all the leaves have dropped. At this period, some of the mites are to be found exposed in the pubescence of the new wood and hence the spray material will more readily come in contact with them. The spray application may also be made in the spring as soon as the buds are swelling and the tips of the new leaves just appear.

I believe that, owing to the weather conditions and insect fauna of Maine, the spring application would usually be preferable. For example, this year the leaves have been very tenacious and on healthy trees such is usually the case. The presence of these leaves would not only take up much of the spray material, but would also break the force of the spray. An early winter might also interfere with the fall application. In the spring, on the other hand, there will be no leaves to interfere and further, the pruning will have been done. The annual pruning will remove many of the mites. Burn the pruned wood. Again, if lime-sulphur is employed in the spring as the buds are swelling, arsenate of lead might be combined so as to aid in destroying the larvae of the bud moth, if this insect has been troublesome.

Question: Would "Black Leaf 40" take the place of kerosene?

Mr. Siegler: I have never seen this insecticide recommended.

In actually applying the spray material special care should be exercised to see that the buds of all the new wood are thoroughly sprayed, since the mites hibernate beneath their bud scales. If lime-sulphur is employed the buds should be thoroughly drenched so as to insure its penetration. The oils need not be applied so heavily since they naturally spread more readily, although the work should be thorough.

There is just one other consideration which I would like to mention. This concerns an angle nozzle or the use of a crook so as to throw the spray at an angle of about 45 degrees from the spray rod. We have had a very good discussion on spraying but this point was not brought out. I find that many growers in Maine have not adopted any means to change the angle of the spray material as it comes from the spray rod. I have here a pair of nozzles which illustrate a good type. It is very important, especially in spraying for the codling moth at the time the petals fall, to drive the insecticide from above downward, so as to fill every calyx cup. I also find that some growers, even though in possession of power sprayers, employ but one nozzle per rod. If a grower has sufficient pressure, it would be economy to employ two nozzles which may be attached to the spray rod by means of a Y.

I have eliminated some of the smaller details, but have covered some of the more essential points. If there are any questions I would be glad to consider them at this time. I might add that the Baldwin seems to be the variety chiefly affected by the blister mite, so far as my observations go, although there have been over 250 varieties recorded.

Question: What is your formula for kerosene emulsion?

Mr. Siegler: One-half pound laundry soap, one gallon water, two gallons kerosene. This gives a stock solution of 66% oil.

Question: Then one in five of water?

Mr. Siegler: Yes.

Question: What is the comparative value of these insecticides?

Mr. Siegler: Lime-sulphur would be the cheapest of the insecticides if it could be purchased at a reasonable figure, followed by the kerosene emulsion and then the miscible oils. However, in Maine lime-sulphur costs considerable,—$8.50 to $10 per 50 gallon barrel. If you figure up the cost of the ingredients of lime-sulphur you can see what it is worth. Prof. Stewart recommends a very good formula which is as follows: Fifty pounds good stone lime containing 90% or over of calcium oxide; 100 pounds sulphur; commercial ground or flour or flowers of sulphur might be used, but the latter two are more expensive; 50 gallons water.

Question: Is the lime-sulphur as effective as the other insecticides?

Mr. Siegler: There are different points to be considered. If the lime-sulphur is of benefit as a fungicide we have to take that into account. Also lime-sulphur is a good scalecide. The oils, however, spread more readily. With lime-sulphur, however, very satisfactory results may be obtained.

Question: You have the oyster-shell bark louse the same as we have?

Mr. Siegler: Yes.

Question: Will lime-sulphur cure that?

Mr. Siegler: Trees sprayed with lime-sulphur, one to eight, every year, will soon be rid of the oyster-shell scale and all other scale insects.

Question: What percentage of the blister mite can you destroy by the use of either lime-sulphur or kerosene emulsion?

Mr. Siegler: In some New York orchards they have almost controlled bad cases by the use of a single application of either of these materials. Arsenate of lead may be combined with the lime-sulphur and applied just as the tips of the new leaves appear. This will aid in controlling the bud moth.

Question: In spraying for the bud moth, wouldn't you have to spray before the buds opened at all?

Mr. Siegler: If you have the bud moth and not the blister mite that would be advisable. If the spray application is made before the buds swell, it would not be so effective against the blister mite. On the other hand, if the spray is applied after the buds have swollen and the tips of the new leaves are just appearing, some of the bud moth larvæ may have done a little injury, but the mite would be well controlled by a thorough application.

Question: What is the formula for the home made lime-sulphur?

Mr. Siegler: Fifty pounds of stone lime, this lime to contain over ninety per cent of calcium oxide. We want a lime as free from magnesia as possible, because the more magnesia you have the higher will be the sludge content, and you want to eliminate that. One hundred pounds of sulphur, preferably commercial, ground. This should be very pure, 98 to 99 per cent. Fifty gallons of water.

Boil this material about fifty or sixty minutes, as a rule. In order to determine when it is done, take a little out and pour it so as to see if all the sulphur granules have been dissolved. Of course small growers cannot well afford to make their lime-sulphur, but it might be made by communities. There is considerable difference in the price in Maine between the commercial lime-sulphur and what it would cost to manufacture it at home.

Question: Have you had any experience with the Rockland lime?

Mr. Siegler: I have not made lime-sulphur in this state. You should ascertain the analysis of this lime. The higher the calcium oxide content, above 90%, the better. If you get a lime that doesn't contain so much calcium oxide, you would need to use more lime, but this is undesirable.

Question: How much water does this quantity of lime-sulphur take in mixing?

Mr. Siegler: A final volume of about 50 to 55 gallons. In cooking by fire there is, of course, some water evaporated. Therefore, after boiling has well commenced you would want to have about 60 gallons so as to compensate for the evaporation. Then boil it down until all the sulphur is dissolved, which will require 50 or 60 minutes of vigorous boiling. It should be well stirred from time to time, especially at first. In testing the strength of the lime-sulphur, employ a hydrometer and test in the clear solution after it has cooled.

Question: Does all lime that is sold on the market have a certain percentage of magnesia?

Mr. Siegler: No, the lime would vary somewhat in its chemical composition.

Question: Is there lime in the market that is free from magnesia?

Mr. Siegler: Commercial lime usually contains magnesium oxide.

Question: In this dust application they use simply sulphur?

Mr. Siegler: Yes, but I would prefer not to discuss the dust method of spraying. Sulphur is a fungicide and has also been used against certain mites. The dust method, however, might not prove effective against the blister mite under discussion.

OUR SUCCESSES AND FAILURES.

By W. H. Woodworth, Berwick, N. S.

It is constantly remarked, and perhaps with a certain amount of truth, that farmers as a class are so set in their ideas that it is impossible for a body of them to work together to accomplish any particular purpose.

This movement of which I am to speak to you, was organized in 1907 by a few of the best fruit growers in Berwick, a pretty village in the heart of this fruitful valley.

The method of handling the fruit products of the valley prior to this date was very easy, and eminently satisfactory to a certain few individuals, but far too easy and satisfactory to be much appreciated by the fruit grower.

The European commission houses handling Nova Scotian fruit had their agents over here. During the shipping season these agents had sub-agents at nearly all railway stations from which any quantity of fruit was shipped. The farmer would pack his apples at home and haul them to the station on an appointed day, where the sub-agent would make up carload lots and forward on his immediate superior's orders. These apples were then left to the tender mercies of the consignees who when they eventually sold them would commence piling up an account of charges that were really startling in their ingenuity. A charge was made for every conceivable thing under the sun, including commission for every one who had anything to do with the apples, and when all was deducted that the consignee's conscience would allow, the farmer received an account of sales and sometimes a check representing what remnant of the wreck remained for him.

The farmers chafed under this system of disposing of their products, but individually could do nothing.

An attempt was made about ten years ago to organize some kind of a coöperative movement, but owing to the fact that it was on too comprehensive a scale and lacked the necessary business application, it was a failure.

In 1907 a few of the most up-to-date and energetic farmers in Berwick made up their minds, however, that in coöperation alone was to be found a cure for the state of affairs that then existed. The product from their orchards was increasing year by year and they realized that there were only two ways in which they could give proper attention to the packing and grading of their fruit. One way was to individually build apple houses on their farms large enough to permit of fruit being stored and packed; another was to get together and build or buy a large warehouse on the line of railway where the apples of all could be stored and packed.

The latter was the scheme that appeared the most attractive and these men formed the first coöperative fruit company in Nova Scotia.

This company was called the Berwick Fruit Company and was incorporated under the Nova Scotia Joint Stock Companies' Act, with an authorized capital of $10,000.00. Warehouse accommodation was secured and during the first season some 7000 barrels of apples were handled. This company did not limit its sphere of usefulness to the mere handling of apples. It aimed also at being an educational power. The leaders of the movement soon found that one of the most important factors in successful coöperative fruit packing was the production of good fruit. The company therefore used its best influence to educate its members and also farmers generally in the matter of careful cultivation, spraying, etc.

At the beginning of the second season the membership of this company was doubled and a new warehouse was purchased.

In 1908 the output of this company was 15,000 barrels, which increased the following year to 22,000.

The early history of this company is a splendid demonstration of what can be done by a body of men associated together for the common benefit.

The superiority of the pack put out secured splendid prices. While farmers outside the company had to be content with $1.25 per barrel, tree run, for their apples, the members of the coöperative company were receiving $2.65 for No. 1 grade of fruit, $1.90 for No. 2 and $1.22 for No. 3.

News of the phenomenal success soon spread and in 1909 five more companies were incorporated under a new act specially passed to facilitate the incorporation of such companies. The following year saw that number increased.

The apples of all members of coöperative companies are packed at the warehouses by experts. No farmer being a member of a company is permitted to pack any standard variety at home, neither is he allowed to sell except through his company. Thus the companies are able to put up a uniform pack which they can guarantee.

A farmer joining a company agrees to pool his apples and is paid the average price realized for each variety in the three grades. Thus there is a direct incentive to raise good fruit, for the member receives the average prices for the grades into which his fruit packs.

It was realized, however, by the leader of this movement that while much could be accomplished by individual companies, it needed concerted action on the part of all the companies to carry this coöperative idea to its logical conclusion.

The companies were valuable factors in educating their members in the matter of cultivation, spraying, etc., also in the matter of improving the pack of their products, but as individual companies working entirely independently of one another they rather defeated the very idea of coöperation, inasmuch as they became competitors of one another, and speculators were wont to play one company against another, so that the superior pack did not make that extra money that its quality merited.

It was also realized that if the companies could work together large savings could be effected in the purchasing of supplies, such as fertilizer, nails, pulp heads, spray materials, etc. The matter of transportation could also be better and more economically handled.

A conference was held and it was determined that some form of centralization was necessary. At this point, however, the Nova Scotia farmers showed that while they were ready to consider new ideas and act on them if their judgment pronounced them good, yet they would not "buy a pig in a poke."

They decided, therefore, that they would give this centralization scheme a trial for a year and see just what could be accomplished before floating the Central as an incorporate body. An executive of three members was elected from the leaders of these companies, some twenty-two in number, who decided to participate in the movement. The farmers were fortunate in their choice.

As I stated before the companies did not tie themselves to the Central Association in any way. They contributed nothing to found or start it and were under no legal obligation to support it.

The work of the Central was to attend to the matter of transportation, make what sales it would for the companies, buy supplies and generally assist all affiliated companies. Companies wishing to affiliate paid an entrance fee of $5.00.

To maintain itself the Central charged the companies a small percentage on what apples it sold and earned certain money as will be explained later. This Central Association came into existence in July, 1911. The whole scheme was an experiment and no company was compelled to supply a single barrel of apples to fill orders taken by the Central if it thought it could do better elsewhere. Under these circumstances it is little short of wonderful that at the end of the season the manager was able to report an unqualified success. Great credit is due to the companies, the majority of which, I am glad to say, stood by their Central. There were a few weak-kneed companies but these dropped out early in the game.

A brief resumé of the work accomplished by this experimental Central Association may prove of interest to you.

In the first place, Nova Scotia had that year a record crop of apples.

The very magnitude of the crop gave the Central its first opportunity to demonstrate its usefulness. With such a large crop there was naturally a lack of laborers to harvest it. The Central advertised for help and in response to their appeal a small army of laborers invaded the valley and were distributed by the Central to the various companies who had previously made their requirements known. These companies in turn passed the help on to such of their members as required it. Previous to this action by the Central Association the valley laborers were demanding an unreasonable remuneration for picking. The advent of the additional help, however, knocked the bottom out of this "hold up" and the growers, even those altogether outside of the movement, were able to harvest their crop at a reasonable rate.

It had long been thought that a good market for the farmers' Nova Scotia Gravensteins could be found in the Canadian West. This splendid apple never had a real chance on the European markets on account of the large quantities of English fruit always available on those markets early in the season and the lack of fast boats to place it on that market in prime condition. The Central engaged a man of marked ability as a salesman, to go west and see what could be done. As a result of his short trip some 12,000 barrels were shipped to the Northwest Provinces by the Central Association. The opening up of this market has proved a great boon to the Nova Scotian apple trade, for, as is ever the case when a new market is found, the old markets were relieved and thereby steadied, resulting in better prices all around. Verily, in this initial year, the Central Association did not lack opportunities.

Take the matter of transportation, for instance. The supply of steamships, usually all sufficient to carry the apple crop to European markets, proved totally inadequate to cope with the tremendous quantities of early fruit sent forward. The end of September saw the Halifax terminal blocked, its cars of fruit sweltering in the sun and no boats to carry it to market. The Central Association quickly grasped the situation and dispatched four train loads to Montreal, connecting there with fast boats to England. This, however, was only done as a temporary relief. In the meantime they chartered four boats which carried some 40,000 barrels out of Halifax, and so effectually relieved the situation at that port that a similar congestion did not occur again throughout the entire season. I claim that the farmers of the valley were saved thousands of dollars by that action. Not only did the members of the companies benefit, but the entire body of fruit growers. That action alone justified the existence of the Central and should have earned for it the support of all fair-minded and clear-thinking men.

The Central Association proved also a great selling factor. During the season it sold for the companies 102,000 barrels of apples, and what is quite as important, made good prices.

Another very useful work accomplished was the securing of space on steamers and attending to the shipping of the companies' apples. During the season 400,000 barrels of apples were shipped on its bills of lading.

In the matter of marine insurance a great saving was effected. The fact that the Central had some 400,000 barrels to insure, secured for the companies an exceptionally close rate and cut out that little item seen on most account of sales which in the aggregate amounts to a startling figure.

Insurance of the warehouses and contents was also effected at a very close rate, the Central earning the commission usually going to the agents.

Supplies were bought at very low figures. An order for 1,250,000 pulp heads and 500 kegs of nails naturally secured inside prices. The largest saving, however, was made in the purchase of fertilizers. Many companies who had stood loyally by their Central throughout the apple deals backed out when it came to buying fertilizers. Only a few companies, therefore, were working with the Central on this deal, but even then 2,283 tons were handled. This fertilizer was bought at a saving, compared with the lowest price quoted by any agent, of about $3.00 per ton. Fertilizer agents assured the companies that they would guarantee them as low a price as the Central could get them, and others advertised openly in the press that they would supply fertilizer at even lower prices than could be obtained through the Central.

Thanks, however, to the business acumen of the managers, the fertilizer agents were soon glad to withdraw those advertisements and the companies who stood by the Central were able to divide a net saving of $6,800.00 on their fertilizer deal.

I know some companies whose lack of faith in their Central cost them $4.00 per ton on their fertilizer supplies. One should not be too ready, however, to blame those companies; after all, it was only an experimental year and it is not strange that some should look askance at the idea of giving their order blindly without knowing how much their goods would cost them. At the same time all the more credit is due to those who were sufficiently imbued with the right spirit of coöperation to do this.

The great thing for the individual to remember, however, in a coöperative movement, is that after all it is not a Central Association selling you material; it is you yourself buying material at first cost through your own buyer, that is, your Central Association. The Central did not work to make any profit out of the affiliated companies. Supplies were distributed at cost and apples were sold at cost. A small levy was made on all apples sold to cover the expenses of the Central, but owing to the economical manner in which things were worked out, money being earned by the Central in various ways already indicated, the entire business of the companies was handled at the ridiculously low cost of three-eighths of a cent per barrel.

Thus did the leaders of this movement demonstrate to the farmers what could be done by coöperation.

During the winter months a special bill had been prepared to enable the Central Association to be incorporated. This bill, with certain modifications, was passed by the House of Assembly at Halifax.

Steps were taken in June, 1912, to complete the organization of this movement and to incorporate as many companies as possible into one central body.

The speculators who had so long made a very lucrative living out of the farmers did not allow this organization to be effected without a determined opposition, but thanks to the zeal and untiring energy which was put into it, twenty-four of the twenty-seven coöperative companies signed the Memorandum of Association, which gave birth to the United Fruit Companies of Nova Scotia, Limited.

The company is incorporated with an authorized capital of $50,000.00, of which $42,000.00 is subscribed, each subsidiary company subscribing 20% of its authorized capital.

The organization meeting was held at Kentville on July 8, 1912, the companies being represented by seventy-two delegates. By-laws were adopted and directors and officers were appointed, each company being represented on the directorate by one representative.

Three other companies have been formed and have come into the Central Association since organization, so that there are now twenty-seven companies.

All the companies agreed to come in under a by-law which gives the Central Association complete control of all their fruit. All apples are pooled and average prices are returned to the companies according to the class and grade of fruit packed out.

These companies collectively have a membership of about 1500 of the most up-to-date and progressive farmers of the valley. The United Fruit Companies can therefore claim to have control of the best fruit produced in the finest fruit producing district in Canada.

There are thirty warehouses belonging to the companies, having a total frost proof storage capacity for 420,000 barrels of apples. These warehouses are turning out on an average 20,000 barrels of apples a week. Three of the companies have erected evaporators where the cull apples are used up, thus reducing waste to a minimum. It is the aim of the United Fruit Companies to establish and maintain a uniform high standard of pack which they guarantee. It is considered that in this way a demand will be created for coöperative packed fruit which will naturally mean higher returns. Already the superiority of this pack has been noticed. Fruit inspectors have reported on it to Ottawa, and Ottawa in turn has congratulated the companies. Uninterested persons in various parts of Canada have commented on it in the press. And above all it is reported that the European buyers have caught on to it and now look for and demand the coöperative mark. Thus it can fairly be said that the aim of the companies has been accomplished.

Great importance is attached to this matter of good pack, and to maintain uniformity the chief inspector visits every warehouse constantly, spending a little time at each, inspecting barrels packed, and instructing. His reports concerning conditions prevailing at each warehouse are carefully noted and filed.

New markets are constantly being sought and in this connection much valuable work has been accomplished. Markets on the continent of Europe hitherto supplied through a series of middlemen are now being supplied direct and trial shipments are being made to other hemispheres where the Nova Scotia apples, the apples with the flavor, have never previously been tasted, but where it is hoped a demand will be created.

As the shipping season is only in its early stage it would be premature to talk about what has been accomplished this year. Suffice it to say that up to October 31st, 155,000 barrels and 16,000 boxes had been shipped and quite a fair proportion of this quantity had been shipped to fill orders.

The worst feature of the Nova Scotia crop this year was the enormous quantity of black spot. To a great extent this was due to carelessness on the part of the farmer. Last year there was an entire absence of spot which lulled the grower into a sense of false security. Indeed, he has had a rude awakening, for this year climatic conditions were particularly favorable to the growth of fungus and in orchards where little or no precautions were taken Kings' Fungus reigned supreme while in neighboring orchards where better sense had prevailed Kings' Dollars reigned instead.

The wonderful success that has attended the coöperative movement is having a telling effect and applications are being constantly received from responsible farmers asking for assistance in forming companies in their neighborhoods. Seven such companies are now in course of organization and at the end of the apple shipping season a vigorous compaign will be conducted to still further extend the scope of this movement.

It is not proposed that the shipping of apples and furnishing of fertilizer shall be the sum and substance of this movement. A more ambitious program is mapped out.

It is proposed that in time everything that a farmer requires on his farm or in his home can be purchased through the coöperative companies. Advertisements are seen daily, setting forth the advantage of buying direct from the makers. Through the coöperative movement the farmer will get his supplies direct from the makers, minus even the advertising expenses, and with all the saving in cost which is always effected when a large quantity of any material is bought.

Through coöperation the farmer buys his supplies direct from the producer and sells his product direct to the consumer. The small army of middlemen who have been making a comfortable living out of him on both sides has to retire and he, the producer, gets the full value for his money on the one hand, and gets all the money that his produce makes on the other.

As I stated before, the United Fruit Companies have a very ambitious program on. It figures such items as the erection of cold storage plants, the running of a line of refrigerator cars, erecting or purchasing large departmental stores, erecting sawmills and cooperage and box-making shops, and even banking and insurance. Indeed, the possibilities are unlimited. See what has been done in Europe. Who will say that what Denmark has accomplished is not possible in Canada?

One doesn't expect all this in a year, or two years, or even five years, but given judicious management and capable officials in all departments and in ten years I look to see the United Fruit Companies of Nova Scotia the most powerful organization in Eastern Canada.

The Central Association has an efficient office staff working on an organized system initiated by the writer.

Instructions are sent out from the Central office constantly to all the subsidiary companies, directing as to varieties to be packed and how, when and where to be shipped. Space on the various boats is alloted to the companies and directions issued as to method of shipping, etc.

Statistics are compiled showing quantity and condition of crop throughout the American continent and Europe. Constant telegraphic advices are received and recorded, giving total estimated shipments of apples from all ports to all ports. Prevailing conditions on all markets are recorded daily and reports received from our representatives and agents from all markets touched by the North American fruits.

All these reports are carefully studied and instructions are issued as a result.

THE PRESENT AND FUTURE OF APPLE GROWING.

Address by S. H. FULTON, Sleepy Creek, W. Va.

Within the past twenty-five years apple growing has become one of the great branches of agriculture in this country, eclipsing, in area of orchards planted and in quantity of fruit produced, all other fruits common to the temperate zone. The attractiveness of this fruit, its palatability and its health giving properties, together with the fact that it is in season practically the year around, all combine to make the apple the greatest single asset of American horticulture. When the census of 1910 was taken, there were 151,323,000 apple trees of bearing age in the United States. Among the states of the Union, Missouri ranks first, having in round numbers, 20,000,000 bearing trees; New York stands next, with 15,000,000; Illinois third, with 13,000,000 bearing trees, and so on down the list. With such vast interests in apple growing, it is not surprising that anything pertaining to the culture of this fruit is of keen interest not alone to rural horticultural circles but even to town and city people with money to invest. Within the past decade, hundreds of people unacquainted with the orchard business, but allured by tales of great profit in orcharding, have invested large sums of money in apple orchards. This is particularly true with reference to orchards located in sections where large areas of cheap undeveloped land can be secured, as in the Virginias, western Maryland, southwest Pennsylvania and sections of other states which might be mentioned. In Maryland, within forty miles of the home of the writer, one company is developing in apple orchards an immense tract of 40,000 acres and selling in ten-acre units to investors all over this country and abroad. The published circulars of this company are so alluring and the salesmen so enthusiastic over the orchard business that sales have been made much faster than the land can be cleared and planted. Plantings by practical individual growers and close corporation companies with good managers have also been very extensive within the past ten years. In the sections above mentioned, young well-cared-for orchards of from 200 to 500 acres are not uncommon. In addition to these heavy eastern plantings, the middle west and the Pacific northwest must also be taken into consideration. In these latter sections there has been unprecedented activity in the planting and development of apple orchards within the past few years.

This brief review of existing conditions serves to bring practical apple growers face to face with the fact that competition will shortly become keener and marketing problems will become more difficult. Of course not all these vast plantings will ever come into bearing, but the next few years will witness a great increase in the number of bearing trees of the country and we must prepare to meet the conditions. In the coming era of close competition, certain essential points in orcharding should be kept fixed in the grower's mind. There will not be space in this brief paper to enter into the details of the many problems surrounding the apple business from the time the ground is prepared and trees planted until the orchard is brought into bearing and the fruit placed in the hands of the consumer, so the writer will touch only upon a few vital points relating to the apple industry.

One important question is that of varieties. Advertising schemes and plans to educate the people to eat more apples are beginning to bring results. But in addition to consuming more fruit, the public is beginning to recognize the fact that all apples are not Baldwins, Northern Spies or even Ben Davis. They begin to realize that some apples are better than others and they demand the better varieties. Ten years ago when we made our largest planting of apples, we in common with other growers of the eastern Pan Handle of West Virginia, planted heavily with York Imperial and Ben Davis. We also planted in a more limited way, Grimes Golden and three varieties of summer and fall apples. Grimes Golden was then considered rather a doubtful variety for profit. At that time York Imperial and Ben Davis sold on a par, while buyers took Grimes Golden reluctantly at about twenty-five cents less per barrel than was paid for other varieties. This past season the prevailing price for Ben Davis was $2.75, for York Imperial $3.25, and for Grimes Golden $4.00 per barrel. In other words, York Imperial brought fifty cents and Grimes Golden $1.25 more per barrel than Ben Davis. It should be stated, however, with reference to varieties, that many apples of high quality are poor bearers and some possess constitutional weakness in the tree. On the other hand, many of the medium and low quality varieties are strong and hearty in tree and abundant bearers. Under these circumstances, it may pay the commercial grower better to raise large quantities of medium quality apples at a fair price than to produce a limited quantity of high class fruit at a high price. Whether the crop is to be sold on the open market or to the retail trade should also be taken into consideration. Low quality apples can often be sold to advantage on the open market but would be rejected by the retail trade. This season in shipping on orders to mountain towns in West Virginia and Maryland, we found it very difficult to dispose of Ben Davis, while other varieties sold readily. Were we to be dependent upon the retail trade, we would commence next spring to graft over all our Ben Davis trees. It is possible that changing conditions of the general market may yet bring us to this point.

In a good many fruit growing sections apples which are in season during late fall and early winter are not receiving as much attention as they should. After peaches, pears, plums and other summer fruits are gone, there is a demand, poorly supplied in most markets, for good eating apples. It is a mistake to try to meet this demand with hard fleshed winter apples unfit for immediate use. Rambo, Wealthy, Maiden Blush, McIntosh and other excellent varieties of this season furnish a list from which the grower may select.

In the eastern fruit belt of West Virginia pruning is one of our big problems. This very important operation in the upkeep of an orchard is apt to be neglected outright or at least receive little attention. Doubtless the pruning problem also is, or should be, a serious consideration with Maine apple growers. The style of pruning, that is, whether the tree shall be trained with open head, closed head with central shaft or leader, two story, or to some other recognized form does not matter greatly, provided the style once adopted is adhered to year after year. However, the extent to which apple trees are pruned does matter greatly. Unless the tops are kept sufficiently thinned and open to admit plenty of light and air, the fruit will be poorly colored, unattractive in appearance and in the case of certain varieties, very much inclined to scald in cold storage. Personally, the writer likes low, open centered trees because of the increased area of the top exposed to light and air and because of convenience in pruning, spraying and harvesting the crop.

Spraying, cultivating and fertilizing are all operations demanding careful attention on the part of apple growers but these topics have been discussed by other speakers and will be passed over by the writer of this paper. It might be stated, however, in passing, relative to cultivation, that a practical orchard tractor should prove a valuable acquisition to the grower whose orchards are extensive enough to justify the necessary outlay. A number of manufacturers, at the present time, have gasoline and oil tractors on the market designed for farm and orchard work, but most of these outfits are not fully adapted to the needs of the practical grower and furthermore the price is so high, in most instances, as to be considered prohibitive by most orchardists. A few hours' work with a tractor in low headed, closely planted trees will convince any one that under such conditions, a tractor to work successfully must be low and compact with short wheel base, capable of turning in a short space. The wheels should be broad and well cleated for work on soft ground, and the engine should not develop less than 15 horse power at the draw bar. Some makes of tractors approach these specifications, but most of them are built too high and require too much space for turning. The usual price, of from two to three thousand dollars, is beyond the reach of the great majority of apple growers. A practical working outfit, at a cost not to exceed ten or twelve hundred dollars, would appeal to growers generally throughout the country, to supplement and to a certain extent take the place of horses and mules. The automobile and motor truck are practical where roads are good, and prices are no longer excessive. These modern inventions are in use by a good many fruit growers in various parts of the country. It is to be hoped that the orchard tractor will shortly be gotten down to a practical working basis and the price materially reduced. In the rush of spring work, it is often impossible to get the orchard land worked over in good time with horses and mules, and, furthermore, teams are necessarily idle a good share of the year on the average fruit farm while expenses for feed and care go on just the same.

In harvesting, winter apples should be allowed to hang upon the trees until well colored and fully developed. This will insure attractive appearance and good keeping quality. Practically all of the decay which occurs in stored apples in the early part of the winter, is due to injuries in handling. The unbroken skin of a sound winter apple is very resistant to rot, but once the skin is broken or punctured, rot spores gain entrance and decay results. Careful handling is particularly essential in box packing as the box is designed for fancy fruit and freedom from punctures or bruises is very necessary.

Ordinary barrel packing is usually done in the orchard just as the fruit is picked. Occasionally the apples are hauled to some central point or to a packing shed and there packed in barrels but this practice is not common. For box packing, however, a packing shed of some kind is very necessary. Facilities must be at hand for convenience in grading and wrapping and all needed supplies such as box materials, wrapping paper, box liners, labels, etc., must be kept under cover. This means hauling the fruit to the packing shed and the wagons used for the purpose should be low down and equipped with bolster springs. Round, drop handle, half bushel picking baskets are very convenient for use in picking and hauling to the packing shed.

Careful, systematic work is essential in packing both barrels and boxes. In facing apple barrels the selection of specimens of uniform size so that it will require just so many apples of a certain grade to face a barrel, will facilitate the work and add to the attractiveness of the package. In box packing systematic work is the only kind that will be worth considering. A certain number of apples in each layer and in each row of the layer is absolutely necessary so that the box when completed will contain a fixed number, depending upon the size of fruit adapted to any one of the standard packs in common use. This means careful grading. Box packing tables can be obtained through a number of the experiment stations and once the style of pack for a given size of fruit is learned, the work becomes fairly easy and is a pleasure to the packers. Home help can soon be broken in to the work, though it will require considerable practice to acquire speed in handling the wrappers. In West Virginia, we have found expert Florida packers who come to our section to pack peaches very efficient for box apple packing. Being skilled in the wrapping and packing of tomatoes and oranges, they quickly learn the various apple packs and acquire good speed with a single day's practice. These packers work their way northward after the tomato season is over in late spring in Florida. The usual wages paid these packers is two dollars per day with board and lodging and railroad fare one way from the point at which they last worked.

Box packing calls for wrappers, box lining paper, layer paper, labels, a convenient packing table and a box press. It will not pay one to attempt box packing on any extended scale without all necessary supplies and equipment.

Within recent years there has been considerable agitation in eastern apple growing sections relative to the box versus the barrel for apple packing. In reality there should be no controversy. Tender fleshed varieties of high quality are better adapted to box packing than to barrel packing. On the other hand, firm fleshed apples of only fair quality are best suited for barrel packing. Whether to use boxes or barrels is a question for the individual grower to decide. If he finds he can realize more for his apples packed in boxes than in barrels, then the box is the package for him to use. This past season we packed our Wealthy, Jonathan and Grimes Golden in boxes to very good advantage. When it came to York Imperial and Ben Davis we dropped the box and used the barrel as these varieties did not go well in boxes. The barrel commends itself highly to the man who has large quantities of medium grade fruit to handle and who must depend upon inexperienced help for packers. Doubtless the barrel will continue to be the package generally used for the great bulk of eastern grown apples.

Marketing is one of the greatest problems which confront the average apple grower. Growers not infrequently produce good crops of well grown fruit and yet fail to realize profitable returns because of unfavorable conditions at marketing time or because of improper methods of handling. Usually the apple crop is sold on the trees on the basis of so much per barrel delivered at the railroad station, the grower to furnish the barrel and do the picking and packing under the supervision of the buyer or his representative. This simplifies marketing very much and the fact that this method has become a general practice is an indication that it has been found at least a fairly satisfactory system. Winter apples at harvesting time are not in condition to be put on the market for immediate use. The grower must either store his fruit and hold it until ready for consumption or sell to some buyer who stores for later marketing. Usually the grower needs the money for paying his package and labor bills and prefers to realize at once by selling his crop at harvesting time. He generally feels also that he does not wish to take chances on a rise in the market during the winter months and does not like to face cold storage and repacking charges incidental to storing the crop. However, if prices are low at harvesting time or if for other reasons the grower concludes to handle and market his own crop his problems are greatly multiplied. He must pack for the needs of a retail trade, he must be prepared to meet competition, he must advertise, he must know when to sell, he must collect his bills from a number of individuals and firms instead of from one firm. This system of marketing, while it is more taxing on the grower, usually secures wider distribution of the crop and better prices and if practiced to any considerable extent redounds to the benefit of the whole apple industry. Wider distribution and the supplying of small towns not accustomed to securing a regular supply of apples will aid in solving the problem of over production in full crop years.

The future of apple growing is a matter of no small concern at the present time to practical orchardists in this country. Overproduction, the ghost which at times haunts the minds of many fruit growers, looms up big in the hazy future. With thousands of acres recently planted in all parts of the country and millions of young apple trees developing, it would at first thought seem impossible ever to market at a profit to the grower, the great quantities of apples which seem likely to be produced within the next ten years. However, it should be borne in mind that not all the orchards conceived in enthusiasm and planted with dreams of great profits in the near future will ever come into bearing. Apple growing has been boomed too much both for the good of the orchardist and the man with money to invest. The idea of large profits has been exploited with little or nothing said of the failures in the business, thereby bringing about, in many instances, blasted hopes and an extravagant waste of money. Already reaction is beginning to set in and fewer orchards are being planted than were set out from three to five years ago. Inexperienced companies and individuals are beginning to learn that it takes money to plant and develop an apple orchard. The writer has in mind a young orchard of two hundred acres finely situated in his vicinity which was entirely abandoned this past summer because the company owning this property ran out of funds and were unable to secure more money. From the vast unit system plantings of promotion companies, we have little to fear. Usually the management is very poor so far as the upkeep of the orchard is concerned and the whole scheme is impracticable so far as raising fruit is concerned. However, the increased planting of experienced individuals and well financed companies with efficient management will doubtless swell the production of apples in this country within the next few years. We shall probably see some years of low prices, but the practical conservative grower will weather the storm. Low prices will cause the neglect and abandonment of many orchards which are being run on a narrow financial basis. Low prices also will bring about wider distribution and increased consumption. The population of this country is steadily increasing, which means greater home consumption, and the foreign market for apples is being gradually extended. There came to our shores during the last fiscal year immigrants to the number of 1,197,892. While it is true these immigrants do not eat many Hood River Jonathans or Maine Northern Spies, still they do consume a good many low grade apples, canned and dried fruit and other cheap products of the apple. Advertising the apple will help to increase the demand. In this movement the grower can lend his aid and influence. Apple shippers and handlers having designated October 21 as National Apple Day are doing a good work in exploiting the merits of the apple and increasing the demand for this fruit. When apple day came around last month it was quite generally observed in most of the large eastern cities. Commission houses, restaurants and retail stores made a special effort to center attention on this particular fruit. Many schools in apple growing regions devoted a portion of the day to specially written articles on the apple and in the cities many samples were given to the poor, to orphan asylums and to hospitals. The Chicago papers participated in the celebration, telling the people about the abundance of the fruit and its beneficial effect. In Baltimore about 35,000 apples were distributed among the children in the orphan asylums. In New York, restaurants in the produce district made a special display of apples cooked in various styles.

Referring again to the heavy planting of apples made within the past few years, it should be stated that this great increase is offset to a considerable extent by the decline of hundreds of small orchards scattered over the country. Only a few years ago from many small railroad stations in the older apple producing states such as Maryland, Ohio and Michigan, from one to five or more carloads of apples were shipped each fall to the city markets. Now the small farm orchards are gone and no fruit is shipped. This decline has been due to neglect, ravages of the San Jose scale, etc. In the ten years intervening from 1900 to 1910 the United States census showed a decline in bearing apple trees in the United States of from 201,794,000 to 151,323,000 or 33.4 per cent. It will take a considerable share of the newly set trees to offset this decline. The apple business is falling more and more into the hands of the specialist and the man who makes apple growing the dominant feature of his farm operations rather than a side issue.

It rarely happens that we get anything like a full crop of apples in all sections of the country in any one year. This fact also tends to relieve, to a considerable extent, the tenseness of the situation so far as over prdouction is concerned. In 1896 we had the largest apple crop this country has ever produced. In 1910 the next largest yield occurred. Here was an interval of 14 years between the two big crops. The well established grower can withstand an occasional year of big crops and low prices.

High transportation rates and expensive methods of distributing in the large cities militate against the apple business. The grower can unite with the apple shippers and handlers to secure better transportation rates. When the fruit reaches the city on consignment, commission men, jobbers and retailers all take a liberal share of the dollar paid by the consumer, leaving the grower a much smaller fraction than that to which he is entitled. How to eliminate these middlemen is not so apparent. In some instances the grower is in position to deal directly with the retailer or consumer, thereby securing a larger share of the dollar. But usually he must let his fruit go through the ordinary channels of trade. If the parcel post weight limit is raised and the rate decreased, this will help the grower who is in position to retail some portion of his crop.

On the whole there can be little question but that the apple grower who continues to give his trees good attention through both good and bad years, who produces high class fruit and who grades and packs carefully will continue to find apple growing profitable. If he is situated within easy reach of the large eastern city markets his chances for success will be greater. With reference to nearness to market, Maine growers are particularly fortunate and may be able to produce apples at a profit in those years when more distant sections ship at a loss on account of heavier freight charges.

BEES INDISPENSABLE IN MODERN HORTICULTURE.

Dr. Burton N. Gates, Massachusetts Agricultural College, Amherst, Mass.

Ladies and Gentlemen:—I observe that I have a varied audience. Some are young folks who would know of life of bees; doubtless, too, I have some bee keepers who would hear something of the technicalities of the industry; and I know I have horticulturists. I am quite accustomed to speaking to bee keepers of specialized bee keeping procedures, but to a mixed audience it is frequently necessary to vary the subject. I will try to present three or four different themes for your consideration. I will tell you something of the importance of bees in horticulture; something of the natural history of the bee, how it behaves, the wonderful and almost mystic activity of the bee which may be closely compared to the activity of the human race; something of the fundamentals in handling bees; finally, I will show you sôme pictures.

BEES FOR HORTICULTURE.

First of all, I will consider the intimate and important relation of bees to horticulture. The Chairman has already given the key to the situation. I will further make a presumption. If, for instance, by a command, all the bees, both wild and those under domestication, could be wiped out, say from a given district or locality, it is a safe prophecy that but few fruits and vegetables would set during the following season. In a word, so important in the setting of fruits and vegetables are the honeybees that the supposition might include merely this race of bee life. It is common experience and even the result of experimentation that honeybees do the major part of the work in pollinizing orchard fruits, small fruits and many vegetables. Illustrative of this recognized importance, colonies of bees are now being kept in orchards purposely for their services as carriers of pollen, the male element of the flower, which is so essentially necessary in the maturation of fruits. Later, when the slides are thrown on the screen, I will show you some of these apiaries in commercial orchards. I will also illustrate what happens to an apple, for instance, if the pollen is not satisfactorily deposited on the stamen. It will be seen that the resulting fruit is either malformed, one-sided, lopsided, or otherwise unmarketable. In this connection, fruit growers are recognizing more and more that cross pollinization especially, results in larger fruit, with better texture and quality, for it is known that many and perhaps most of our fruits and vegetables require cross pollinization and cross fertilization for their maximum and most satisfactory development. An exception to this is the Baldwin apple, which is, in a measure, self-fertile.

In Massachusetts, within two or three years, an industry which is worth a million dollars and probably a million and a half dollars to the state, cranberry growing, has demonstrated that this crop is set essentially by the agency of the honeybee. Some other insects, as solitary bees, it is true, play a part, but the honeybee is the important agent.

Bees have become quite indispensable in greenhouse growing of fruits and vegetables, which in Maine is probably not as large an industry as in some other states. In Massachusetts, however, the growing of cucumbers under glass is a peculiar specialty. In these cucumber greenhouses, from 2,000 to 2,500 colonies of bees are used annually for the purpose of setting the cucumbers. It is likewise found that bees are equally important in melon houses; for melons grown out-of-doors as well, bees are being utilized.

In the Connecticut Valley of Massachusetts, as elsewhere, there are large market gardens growing nothing but cucumbers for pickling purposes. It is being recognized that the services of bees are also of vital importance in this industry. Cucumber growing out-of-doors is closely associated with squash growing and with melon growing. A melon grower, for instance, in the vicinity of Springfield, told the speaker that he attributed his successes in large crops of muskmelons and cantaloupes which he sends to the finest hotels in the country, to an investment of perhaps $2.50 a year paid a neighbor bee keeper for the rent or services of a single hive of bees which he maintains in his melon plantation. Doubtless this one colony may mean all the difference between success and failure. To summarize, it is being demonstrated that all cucurbitaceous vegetables require the services of bees and the crops benefit in proportion.

A specific instance of the importance of bees to the practical orchardist, is shown in an observation on two orchards of about equal acreage in a western "pocket" in the foothills of an admirable fruit land, well drained and protected from frost. One grower secured large crops, while his neighbor secured none, though his fruit trees were of the same age and blossomed heavily each spring. The owner, in despair of financial ruin, called for assistance upon the State Experiment Station. A specialist, who was a pomologist and entomologist, investigated the two entirely comparable orchards, but was about to return without solving the problem when the question of bees arose. Upon inquiry it was asserted that no bees had been maintained for either orchard. Going over the ground more carefully, however, the specialist found in a neglected corner of the fruiting orchard, a fallen log partially sunken in the damp land. This sheltered a very large colony of bees; to it is attributed the success of the orchard. The following season bees were provided in the orchard which had previously failed, with the result that the owner netted $3,800 on his crop.

It is well to stop a moment and inquire why the services of bees are so indispensable. You horticulturists doubtless know the key to the situation, or at least you know one key, namely, that bees are the carriers of pollen from the stamen of one flower perhaps to the pistil or female organ of another flower. Pollen thus transmitted from stamen to pistil is spoken of as cross pollination. When this minute pollen grain reaches the sensitive stigma, a "pollen tube," or the outgrowth of the pollen grain, penetrates down through the pistil to the embryo seed or ovule where there is a union of the contents of the pollen grain and the ovule. This is spoken of as fertilization. This very common phenomenon is widely understood and it is recognized that bees function in its accomplishment. But it is in a deeper sense that the honeybee is important in the fruit and vegetable industries.

It is well known that the prevalence of all wild life, plant or animal, is subject to fluctuations due to favorable and unfavorable environmental conditions. Some years in a locality there is a pest of mosquitoes or house flies. In succeeding years they may be few. It is so with the game birds and the fish of the sea; they are plenty or scarce from time to time. It may therefore be expressed as a biological law, that the prevalence of all life is subject to fluctuation; bees have their periods of ups and downs. When favored they rise to the crest of prosperity and prevalence. It may be that disease enters a locality and reduces their numbers. Hard winters may also depreciate them so that in a year when they are needed for their service as pollen-bearers, they are at a low ebb.

When the horticulturist realizes that he is depending on this fluctuating service of wild bees, he asks what he can do to overcome the unreliability and assure himself of a maximum crop or a more even crop. The recommendation would be to establish an apiary in proportion to the size of the orchard or garden. This eliminates any dependency upon wild bees or honeybees from neighboring apiaries. Yet their additional service will do no harm. It is far better to flood an orchard with bees during the blooming period than to have a scarcity. Furthermore, the cost of the small apiary is infinitesimal as compared with the possible benefits and returns.

It should also be remembered that during fruit bloom, particularly, weather conditions often prohibit free flight of bees, hence they should be near at hand to perform their service. Numerous observations are on record in which orchards were successfully fertilized when the bees had less than a quarter of a mile to fly, while more distant orchards bore no crops. Thus the apiary in or adjacent to an orchard will safeguard failure.

A question which is frequently asked is, how many colonies of bees are necessary for a given number of mature apple trees or for so many acres of cucumbers, cranberries, raspberries, etc. With respect to the apple, two ratios have been advised. I used to say that for each 50 bearing apple trees, the services of one colony of bees is recommended. Within a year, I have talked with large fruit growers in Ontario and elsewhere, who assure me that I am quite wrong, and who recommend the provision of one colony of bees for every 25 fruiting apple trees. This recommendation is made with the idea of keeping up that efficiency curve already spoken of, so that in the blooming period of the fruit orchard there will be available a sufficiency of bees to successfully pollinize the blossoms. As is said above, it is far better to flood the orchard with bees during the blooming period than to have a scarcity.

In summarizing, an horticulturist or orchardist may fertilize soil, cultivate, prune, thin, spray and do all those things which modern practice advocates, yet, without this agent, the honeybee, to transfer the pollen from stamen to pistil, the results may be nothing. It is a matter of assurance or insurance and protection. It is a slight expenditure in comparison to the possible and probable returns.

THE MANIPULATION OF BEES.

It is not possible in a few moments to make bee keepers of each of you, but it is possible to throw out a few suggestions for manipulation and procedure which are so fundamental that they apply not only to the one who is a prospective bee keeper, but to the bee keeper of experience as well. People sometimes regard the bee man who seemingly handles his bees with perfect impunity, as a trifle abnormal or perhaps as one who possesses some supernatural power which it would seem he exerts over the bees, enabling him to handle them at will. The operator may pick them up by the handfuls, and as I have seen one demonstrator do, may place a handful in his mouth, afterwards allowing the bees to fly forth one at a time. Such manipulations seem supernatural to the uninitiated who habitually regard bees as vicious and untamable; but as a matter of fact, it is quite simple and I assure you that it will be quite possible to teach any and all of you to handle bees with a similar proficiency.

There are a few fundamental features. In the first place, move slowly when operating a colony of bees or when moving about the bee yard. Quick movements invariably attract bees. They fly quicker than the eye; you cannot dodge them. Another key to the situation is the use of a little smoke, not necessarily tobacco smoke, but a smudge made from punky wood, excelsior or old burlap sacking. Such a smudge is easily made in this instrument which his called a bee smoker. Every bee keeper should have one. It is almost as requisite in handling bees as knives and forks are in eating. This is merely one type of a smoker and illustrates a strong type. It is known as the Standard Root Smoker. In this tin can a smudge is built; before opening a colony puff a few jets of smoke in at the entrance; two or three will be sufficient and will materially quiet the inmates. Occasionally an obstreperous colony requires more smoke. In handling Cyprian bees, smoke should be avoided, but in place of it the colony should be jolted or jarred. This procedure is quite the reverse of that recommended in handling all other races of bees. Pounding on the hive, jars or jolts will usually excite races other than the Cyprian, and sometimes cause them to be cross. The use of smoke or in case of the Cyprian bee, the purpose of this jarring, is to cause the bees to gorge with honey. In this condition it is known that they are less prone to sting, which of course explains the procedure.

The majority of bee keepers prefer to protect their faces from possible stings by the wearing of the veil which is put over a broad brimmed hat, like a straw hat, and which comes down over the face, fastening under the coat, or drawing tightly around the chest. Professional bee keepers, however, do not wear gloves, but prefer to take a sting occasionally rather than to be inconvenienced by them. The beginner, however, may gain confidence by using them, yet he will soon discard them.

I think there are those here who would like to see the practical and advantageous features of the modern hive illustrated. This one here, which is from the exhibit, may be demonstrated. It is called the ten frame Langstroth hive. The parts of this hive, beginning at the bottom, are the "$\frac{7}{8}$" bottom board, the body or brood chamber in which all the young bees are reared, and the part above the brood chamber which is called the super and is the place where the honey is stored. Over all there is the cover. The type of cover which is preferred consists of two parts, namely, the inside thin cover, and the outside metal roof telescoping cover. Opening this super, you will see that it consists of numerous boxes which bee keepers call section boxes. In this it is that the honey is stored which, when sealed, weighs approximately a pound. These section boxes fit four in a row in what are called section carriers. They are separated, which prevents the bees from building crosswise from box to box by a partition, known as a separator. There are two kinds of sections, square sections and oblong sections.

Analyzing the brood chamber, it will be seen that it consists of ten frames in which the brood combs are built. This particular frame, as the name of the hive would denote, is called the Langstroth. To keep these frames separated, they are spaced by what bee keepers call the Hoffman self-spacing devise. In each of these frames, bee keepers stretch wire which they imbed into this sheet of foundation. Foundation is merely pure bees wax run out between rollers bearing the impression of the cells. It is the basis or septum of the comb and while some have spoken of it erroneously, as artificial comb, this name is not in any way applicable. If there is any one thing which I would impress upon you, it is that there is no such thing as artificial comb. There has been for years a premium offered of a thousand dollars to anybody who will produce one pound of artificial comb honey. This premium has never been claimed nor is it likely to be. Bee labor is cheaper than human labor. Humans cannot compete. Foundation is, as the name implies, the base on which comb is built.

It is used merely to save the bees labor and to supply them additional material on which to work.

In the cells which the bees would normally build on this foundation in this frame, would be laid the eggs by the queen which would develop into grubs and finally mature as worker bees. The adult bees would deposit in some of these cells the pollen, the very thing which the fruit growers want transmitted from tree to tree or blossom to blossom. There would also be a certain amount of honey stored in some of these cells. It would be in this part of the hive that the colony would pass its winter. The discovery and invention of these frames were made by the Rev. L. L. Langstroth, whose name marks an epoch beginning about 1850, in the advancement and progress of apiculture. Langstroth is furthermore said to be the father of modern bee keeping. Without his discovery, it probably would not have been possible to have made bee keeping commercial.

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