PUBLIC DOCUMENTS OF MAINE:

1903

BEING THE

ANNUAL REPORTS

OF THE VARIOUS

DEPARTMENTS AND INSTITUTIONS

For the Year 1902.

VOLUME I.

AUGUSTA
KENNEBEC JOURNAL PRINT
1903

GUERNSEY HERD OF JOHN F. BUKER, BOWDOIN.

AGRICULTURE OF MAINE.

FIRST ANNUAL REPORT

OF THE

COMMISSIONER OF AGRICULTURE

OF THE

STATE OF MAINE.

1902

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STATE OF MAINE.

DEPARTMENT OF AGRICULTURE.

To the Honorable Governor and Executive Council of Maine:

In compliance with chapter 204 of the Public Laws of 1901, I herewith submit my first report as Commissioner of Agriculture of the State of Maine for the year 1902.

A. W. GILMAN, *Commissioner.*

AUGUSTA, January 1, 1903.

ANNUAL REPORT OF THE COMMISSIONER OF AGRICULTURE.

In presenting my first report as Commissioner of Agriculture of the State of Maine, I wish to express my appreciation of the active co-operation and valuable assistance rendered me by the various agricultural organizations of the State: the University of Maine and Agricultural Experiment Station, which have always been ready to assist the department by solving difficult problems, furnishing information desired, in any line, and supplying speakers, whenever practicable, for institute work; the Maine Dairymen's Association and Pomological Society, which have been ready to co-operate with us in any work for the promotion of agriculture; and the granges of the State, which have been of much assistance in the farmers' institute work, opening their halls for these meetings and in every way possible contributing to their success. Every department of the State government has also manifested a deep interest in the success of the agricultural department, and been ready to extend a helping hand.

We are under obligations to the press of this State and the agricultural press of other states, for extended notices and reports of our meetings and for publications which are sent free to this office.

I would also acknowledge my indebtedness to my predecessors for the excellent equipment found in the office of the department, and the efficient system which prevailed there. This office is one of the most cheerful and attractive in the State House. The walls are adorned with pictures representing different phases of the agricultural industry, and most appropriate of all, with the crayon portraits of Dr. Ezekiel Holmes and Dr. S. L. Goodale, the first two secretaries of the board of agriculture. An invitation has been extended to the other secretaries to add to these their portraits.

The publications of the experiment stations of the different states and of the United States Department of Agriculture are so well arranged, and the subject index, by the card system, not only of these but of the reports of the Maine Board of Agriculture from its organization, is so complete, that any part of the large amount of valuable information contained in these reports and bulletins is readily available.

The work of the past year has been carried on along the same general lines that were pursued by the board of agriculture. The year has been a prosperous one for the farmers of the State. The excessive rain and cool weather during the growing season were unfavorable for some crops, particularly the corn crop, which in many sections was almost a failure; the potato crop also suffered severely in some localities. But with the high prices of farm products, and the general encouraging outlook for agriculture in the state, farmers will begin the season of 1903 with good courage, and the acreage of land tilled will be somewhat increased. We believe that the possibilities of Maine as an agricultural state are becoming more fully realized; that there has been an advancement in methods pursued in all lines of farm work; that farmers are awakening to the fact, not only that their occupation presents large opportunities for success, but that the highest and most remunerative type of farming requires a wider range of knowledge, a more general intelligence, than is required in any other profession; and in many instances they are endeavoring to make use of all the means at their command to extend their knowledge and keep in touch with the best methods of the times.

OUR LIVE STOCK AND DAIRY INTERESTS.

We are able to report an increase in the number of cows, sheep and swine in the State, also a considerable increase in the number of oxen. Owing to the high price of beef, farmers in some sections are turning their attention to the line of beef raising more than formerly, and we think this industry might be still further pursued with profit, if animals of the right type were used, economical methods pursued, and the beef matured at an early age. We also think there is an opportunity in our State for the raising of good family horses at a fair remuneration. There is a demand for good working and driving horses which would seem to justify the farmers in paying more attention to this branch of stock husbandry. The poultry industry also offers inducements to the Maine farmer. It is said that Maine consumes between five and six million dollars worth of dressed poultry and eggs annually, and we raise not quite three million dollars worth. We believe that with close attention to details, the profits in this industry would compare well with those in other branches of farming, and that a larger proportion of these products should be raised within our own state.

Dairying is the leading agricultural pursuit in the State. As Maine produces nearly ten million dollars worth of dairy products annually, this branch of our agriculture is of sufficient importance to demand our careful attention. This state has all the requisites of a good dairy state, and there is no reason why as good butter should not be produced here as in any state in the Union. We regard the step taken by the Maine Dairymen's Association at their annual meeting in Waterville, December 5th, in relation to a dairy instructor, as one of special importance. At that meeting the following resolution was adopted:

"*Resolved*, That the welfare of the dairy and creamery interests of Maine requires the appointment of a dairy instructor, whose duties shall be, first, to familiarize himself with the dairy industry in all sections of the State, and by personal work seek to harmonize and make common the interests of all dairymen and creamery men for their mutual benefit; second, to give instruction to butter and cheese makers, at the creameries and the farms, and to instruct in and urge better methods in the production and handling of milk and cream, said officer to be under the direction and control of the Commissioner of Agriculture."

The dairymen at this meeting pledged their special efforts towards making their representatives in the coming legislature understand the needs of the dairy interests of the State, and we are of the opinion that the legislature will see that these interests are well protected. This resolve is in the line of education. If better methods in caring for the product of the dairy cow were adopted, so as to advance the price of the butter produced even one cent a pound, this would mean a very large increase to the dairymen of the State. There are about 60 creameries in the State and if the quality of the product of these creameries could be advanced, every patron would be largely benefited.

The most successful dairymen advocate that the waste products of the dairy can be utilized in no way so profitably as in connection with the raising of pork. Pork has been so high during the entire year that farmers who have given this branch of husbandry proper attention have classed it with the most remunerative branches of farming. Dairying and pork raising combined tend to largely increase the fertility of the farm and thereby increase its output. The largest profits from dairying are realized only when the waste products are utilized in the raising of pork.

FARMER'S INSTITUTES.

Farmers' institutes have been held during the past year in every county, as the law directs. In the majority of cases these have been largely attended and much interest has been manifested. The principal subjects which have been discussed are Dairying, Orcharding, Swine Raising, Sheep Husbandry, Beef Production, Poultry Growing, Hay Production, Potato Culture, Horse Breeding and General Farming. The speakers from outside the State have been Prof. J. L. Hills, director of the Vermont Experiment Station, Burlington, Vt.; Prof. J. W. Sanborn, Gilmanton, N. H.; W. A. Shaw, Northfield, Vt.; Forest Henry, Dover, Minn.; John W. Clark, North Hadley, Mass.; Dana H. Morse, Randolph, Vt.; L. B. Harris, Lyndonville, Vt., and T. L. Kinney, South Hero, Vt. The institutes have been largely advanced by the speakers within our own State. Our practical farm workers and writers have taken a large part in these meetings, giving them the benefit of their personal knowledge and successful experience.

Some one has said, "The institute is the farmers' college." During the past year we have endeavored to secure for our institute workers men who are thoroughly informed on the subjects which they treat, who have devoted a long time to institute work and are able to discuss these questions in all their phases. And, believing that the institutes are intended not only to disseminate information but to inspire courage and hope, we have also kept in mind the idea that these speakers should be practical men, men who have been successful in their farming, and who can present these questions with such force and energy as to awaken enthusiasm in the farmers to a larger degree than ever before. It is our opinion that much good has been accomplished through these meetings. They have stimulated thought and discussion. An intellectual apathy too often is the condition of the farmer. He should be stirred to greater activity of thought. From these meetings the farmers gather knowledge which they would derive, or could derive, from no other source. Questions over which they have been pondering are here asked and answered by experts in a manner clearly and easily understood. We believe these institutes will be a great factor in teaching the farmers the use of modern labor-saving machinery, and inducing them to broaden out and adopt new methods of farming, and thereby revolutionize the agriculture of this State. There is no expenditure of money that will give more satisfactory returns. One of the most pleasing features is that the farmers' wives are becoming more and more interested in these institutes. When the dairy and poultry questions are discussed, there are no more interested listeners than the farmers' wives. Our institutes have been characterized, during the past year, by an increased number of young men who are interesting themselves in farm work. It is an encouraging sign for our agriculture that young men are more largely turning their attention to agricultural subjects.

AGRICULTURAL SOCIETIES.

The agricultural societies the past season have had a good degree of success. The weather during the fall was very favorable, for the most part, for the holding of their exhibitions. We believe the character of the work done by these societies is advancing. Special attractions are being dropped out of the fairs, and more attention is being paid to the educative features. We hope there may be further progress in these lines. The fairs should be educative and stimulating. When a farmer has compared his herd of cows or his stock with his neighbor's, and sees wherein his neighbor excels, he resolves that he will use every effort between that time and the next agricultural exhibition to so improve his stock that they shall be entitled to the blue ribbon.

Early in the season a circular letter was sent to the various agricultural societies of the State, suggesting that no premiums be awarded to males kept for breeding purposes unless they were pure bred registered or standard animals, that animals which had in previous fairs won the blue ribbon should be classified by themselves and special premiums or medals offered for this class, which should be known as the sweepstakes blue ribbon class, and that the judging of all stock should be made more educative, the work being done in a public and conspicuous place and by intelligent, practical men, who should clearly and distinctly state in every case the reason why an animal wins over its competitors. We were pleased to note that in many instances these suggestions were followed.

The following figures show the business of these societies:

Number of horses and colts exhibited.............	1,592
Number of neat cattle exhibited.................	7,299
Number of sheep exhibited......................	1,571
Number of swine exhibited.....................	702
Number of poultry (coops) exhibited.............	2,311
Amount of premiums and gratuities awarded......	$23,193 25
Per cent of increase in awards, from 1901.........	5
Amount of trotting purses......................	22,664 56
Amount of entry fees for trotting purses..........	7,814 42
Actual cost of trotting purses....................	14,850 14
Per cent of premiums and gratuities to total awards,	51
Per cent of stipend to societies not otherwise provided for by law............................	33
Number of societies receiving stipend............	43

AGRICULTURAL LAWS.

All complaints of the violation of the laws in relation to the sale and analysis of concentrated commercial feeding stuffs, or the illegal sale of oleomargarine have been fully and promptly investigated. We find, upon investigation, that the law in relation to feeding stuffs is defective, and the object for which it was designed cannot be accomplished. The attention of the committee on agriculture of the coming legislature will be called to the defects, and we trust they will see to it that such amendments are made as will render it effective.

BULLETINS.

Bulletins have been issued from the office quarterly. These contain reports in relation to the crops of the State, and articles upon some subject of importance to the farmers by eminent men, as well as remarks by our correspondents from every county in relation to their experience on the subject treated. A great deal of pains has been taken to make these bulletins instructive and valuable to the farmers, and that they are much appreciated by some of the readers, at least, is manifest from the letters received at the office. Our mailing list at present contains about nine thousand names, and additions are continually being made, upon special requests.

CORRESPONDENCE.

The correspondence of the office is large and varied. Inquiries covering a wide range of subjects and embracing all branches of farm work are continually being received, and it is our intention to answer all of these as promptly and fully as possible.

THE AGRICULTURAL OUTLOOK.

The improved agricultural conditions of the past few years are suggestive of the possibilities of future improvement in this pursuit. Nature's storehouse is vast, and as we learn how to avail ourselves of her resources and make use of the material she has in store for us, we shall see that there are still greater opportunities for the farmer. The Department of Agriculture at Washington and the various agricultural experiment stations of the country are doing a great work for agriculture, in developing new resources, introducing new methods, and furnishing information in many lines which will aid the farmer in his work. The farmers have every reason to extend their farming. By the use of the new labor-saving machinery, the output of the farms of the State can be doubled with comparatively little added expense. The outlook for agriculture in Maine at the present time is bright.

FARMERS' INSTITUTE AT TURNER CENTER.

The first farmers' institute under the auspices of the Commissioner of Agriculture was held with the Pomona Grange at Turner Center, March 5, 1902. A large and enthusiastic audience was in attendance. It was the intention that this meeting should be a representative meeting, a general gathering together of all the organizations in the State that have for their object and purpose the advancement of agriculture. Every organization of this character was largely represented, and the members assured us that they were willing, and anxious, to join with us in the common cause, the promotion of the agricultural interests of the State. The general feeling of harmony and interest in the cause which prevailed was very gratifying. We were pleased to have with us at this meeting Dr. Geo. E. Fellows, the new president of the University of Maine, who addressed the meeting for a short time in both the afternoon and evening sessions, and was cordially received; Hon. D. H. Knowlton, secretary of the State Pomological Society, who discussed briefly a few of the problems for Maine fruit growers, and Hon. Rutillus Alden, president of the Maine Dairymen's Association.

Lectures were given by Mr. John W. Clark, North Hadley, Mass., on Orcharding, Prof. J. L. Hills, director of the Vermont Experiment Station, on Dairying, and Dana H. Morse, Randolph, Vt., on Hay Production. Brief remarks were made by Solon Chase, and others.

Some of the addresses at this meeting will be presented in the following pages, under Institute Papers.

INSTITUTE PAPERS.

DAIRYING.

By Jos. L. Hills, Director Vermont Experiment Station.

I am asked to discuss dairying before you today. It is a large subject to be handled in the short time which can be devoted to it this afternoon. But few things can be said, and these have been better said by better men than I to Maine dairymen for lo! these many years. Since farming today is essentially a manufacturing vocation, let us view it from the standpoint of the manufacturer. Let us consider the machine (the cow), the force she uses (food), the machine-made product (milk), and the "man behind the cow."

I. THE MACHINE—THE COW.

It may be an inhuman or one-sided way of looking at the matter to think of the cow as a machine; yet there is a pretty close analogy, if you will only draw it, between the locomotive and the cow. They are both machines, the one living and the other inanimate, but the results are much the same, production of work as a result of the expenditure of energy. A poorly constructed mechanism, or one ill fitted to its purpose, is run at a disadvantage and perhaps at a financial loss, whether it be a loom or a cow.

The sage of Chase's Mills said this afternoon that he thought there were more cows in the town of Turner than in any other town in the State. I fear that the dairymen of this and every other town in this and every other state have too many cows—of the wrong kind, poorly constructed machines, mechanisms ill fitted for dairy work. Undoubtedly you ought to have as many cows as you have today, or more; but a good many of the individuals you milk today ought to be discarded and other and better ones put in their places.

Some few years ago the secretary of the Vermont State Board of Agriculture wrote me at the beginning of the institute season, asking what matter I wished to discuss at the institutes that year. Among other topics I gave him a somewhat novel one,—Proverbs 27, 23: "Be thou diligent to know the state of thy flocks and look well to thy herds." In the Book of Books the proposition is laid down that it is worth while to know the character of the machines that the dairymen and herdsmen use. There is no record in the Bible, so far as I have been able to observe, of Solomon or Job weighing milk or testing it, and there was excuse for those old time Israelitic dairymen keeping poor cows. Our forefathers may be forgiven that sin, but we can plead no valid excuse today if we milk inferior animals. We read of Pharaoh's lean and Pharaoh's fat kine, and we know what happened to them and what would have been the result had not Pharaoh had Egypt's purse to draw upon for deficiencies. Now there are lean kine in Maine, as there are in every state and country the world over, and lean pocketbooks because of lean kine. If I, or others before me or after me, can show how unprofitable animals may be detected with surety and without excessive cost or labor, the scheme is surely well worthy consideration. At least one-fourth of the cows in the state of Vermont do not pay their way. Such cows are "cow boarders." We hear the relative merits of the Jersey, the Guernsey, the Ayrshire and the Holstein discussed, each having its advocates. More important, however, than the choice between breeds is the choice to be made between cows that eat more than they make and cows that make more than they eat. Too many farmers keep the former class, and a long pedigree is no insurance policy against a cow's belonging to it. The question for every dairyman to ask himself is, Have I any cows of this first named class, cows that eat more than they make? If he has, let him dispose of them to the butcher or to his enemy. Any price is a good price for them, and they are expensive luxuries for him to keep even though he got them for nothing.

What means may be taken to weed out these cow boarders? Three pieces of testimony needed are

1. The amount of milk the cow gives.
2. The quality of milk the cow gives.

3. The amount of food, roughly estimated, the cow uses to make that milk.

This does not mean weighing the milk every day in the year, frequently testing the milk and weighing the food; but it means occasionally weighing the milk, making two tests a year, and keeping an observant eye on the eating habits of each cow. If the milk is weighed two or three days in a month (say the 14th, 15th and 16th, any three days will do) and the necessary calculations made, adding a zero to the result, one will get a close idea, close enough for farmers' purposes, as to the amount of milk each cow has given during the year. If two composite samples are taken during the year, one about six or eight weeks after calving, and another five to seven months after calving, and the results averaged, the quality of the milk will be ascertained closely enough to serve farmers' purposes. Multiplying the pounds of milk by the per cent of fat and adding one-sixth to the result, gives within reasonable limits the pounds of butter which could be made from the milk. An intelligent farmer, milking twenty cows, can in this way tell closely the amount of butter each cow makes each year and he need not spend more than one and one-half days total time in gaining this information.

We have some 60 or more animals in our Station herd. One cow made 533 pounds of butter last year, and another 116 pounds. The first cow, Eva, we bought three years ago from a man who allowed us to go into his herd and take our pick for $45. Her records in successive years are 462, 441 and 533 pounds. Sadie made 116 pounds. Even without weights and tests we could have told that Eva was a better cow than Sadie, but how poor the latter was would perhaps not have been detected had it not been for these safeguards. I do not mean to imply that every dairyman should own or use a Babcock test, but I believe most emphatically that every grange, farmers' club, dairy community, etc., ought to own or have access to a Babcock tester. In our state it is not infrequent for some young man or woman to own a Babcock machine and to use it for the farmers of the community. Some three summers ago the very charming daughter of Mr. Dana H. Morse—who accompanies me at these meetings—spent three or four days at our University in order to learn to operate the Babcock test. Our chemist found his task of teaching a most pleasant one; and I have no doubt that any of the Orono professors would gladly welcome the young ladies of Maine for similar instruction. Miss Morse has picked up quite a number of pennies testing milk in her vicinity, and has helped many farmers to learn the capabilities of their several cows. Undoubtedly several Randolph bovines have felt the butcher's axe as a result of her verdicts; and more important, but a logical result, undoubtedly some Randolph savings bank accounts are the fatter because of their death.

If you cannot get the samples tested in your vicinity send them to Orono. Many hundreds of samples of milk and cream are sent to the Vermont Station yearly for analysis, a good many of them coming from farmers who are looking up the merits of their cows. Not as many are sent as should be sent. The dairyman who is dissatisfied with his creamery returns is far more apt to curse the creamery man than to look at home in his own herd for the source of the trouble. The Biblical adage touching the mote and the beam obtains here with full force.

One of my former associates on the Vermont Board of Agriculture, driving by a large cotton cloth mill one day observed machinery being removed. Reining in his horse he questioned the superintendent: "What are you doing? Are you not taking out machinery which I saw go in there less than three years ago? Is it worn out?" The man replied, "It is doing good work yet, but we are taking it out and putting in new machinery, costing us heavily, because these new machines, invented and perfected during the last few years, will enable us to reduce the cost of manufacture a few hundredths of a cent a yard. We cannot compete in the manufacture of cloth with our competitors using better machinery."

Too many farmers are manufacturing butter or cream with out of date or imperfect cow machines. Since such ready means are at hand for detecting these animals, it seems to me that it is worth while to weed them out.

I heard a man say only a few days ago that he believed he should breed Durhams rather than Jerseys, because when he was through with them they would sell for more for beef. I believe he was penny wise and pound foolish. Take our Jersey grade cow Eva, making 533 pounds of butter last year. She will be good for little for beef when we are done with her. When doing her best she looks like a hat rack. But last year she made over

$140 worth of butter; and when she dies we can afford to bury her, and, perhaps, to put up a monument over her remains. She will have paid her way even though nothing be realized for her carcass. It is better to grow a special purpose animal, one bred for one particular thing and doing that one thing particularly well, than to attempt to produce milk and beef from the same animal. Gov. Hoard illustrates this notion well when he asks what dairyman there is who ever dreams of hunting for foxes with a bird dog, or for birds with a fox hound, or for either with a bulldog. The bird dog was built for one specific thing, the fox hound for another and the bulldog for a third. Yet the man who believes in special breeding as applied to dogs all too frequently goes hunting for butter with a beef animal.

II. THE FUEL—THE FOOD.

We must now pass to the consideration of the food which is the fuel which produces the force, the energy in our cow machine. The locomotive is driven by the burning of coal in the fire box, its combustion producing heat, which changes water into steam, which, passing into the cylinder, moves the piston rod. Thus heat, one form of energy, is transformed into motion, another form of energy. Food contains much energy, which entering into the cow's being is in part made into or stored in milk. The many things fed cows—hay, silage, roots, soiling crops, cottonseed meal and the like, are simply nature's combinations or man's reworkings of three or four nutrients. We need concern ourselves today with but two, those forming flesh and those producing heat, the protein and the carbohydrates, as the chemist calls them.

We have heard a good deal of late years of what is known as the balanced ration, that is to say, that ration, if there be such, which contains the correct proportions of the flesh and milk making nutrients and the heat producing nutrients. It is a moot point what are the best proportions. I do not, myself, credit the notion that there is any one, fixed, absolute, standard, balanced ration to which cow feeding should be adjusted. The balanced ration as it is understood today is a fluctuating thing, varying according to altering conditions, a matter into which judgment must enter to a very large extent. Physiological chemists lay down rules and formulate recipes calculated to produce maximum results, omitting considerations of cost and other important items. Practical feeders include these. Hence have arisen two distinct kinds of feeding standards, the physiological and the practicable; the one built to produce the most at any cost, with due regard to animal health; the other formulated to produce the most for the unit of food and expenditure. The one ignores, the other considers the cost of the ration. The former is a fairly definite, the latter an indefinite thing. The physiological standards represent the results of experiments and present knowledge as to the physiological needs of farm animals. The practical standards are essentially home made, are based upon and usually are profoundly affected by physiological standards, but are the product of the experience, observation and study of the individual feeder. The latter are in many ways more important. Such as may be interested in this particular branch of "cowology" may, if they will, get for the asking our Bulletin 81 on the principles and practice of stock feeding. Address Experiment Station, Burlington, Vt.

Those who have done the closest thinking on this matter are nearly a unit in the opinion that it is difficult to grow all the needed protein in Northern New England, but easy to grow all the necessary carbohydrates. The great American carbohydrate crop is corn; such protein as we can produce is best grown in clover or early cut hay. When a dairyman goes to the feed stores which does he buy, protein or carbohydrates? I do not know how it is in Maine, but four times out of five in Vermont he buys carbohydrates rather than protein, buys that which he has or should have in abundance and does not buy the nutrient which his cows need for milk production, and in which his ration is usually lacking. As has been well said, the farmer in these northern states should make his dairy farm a carbohydrate factory and when he buys, if he buys at all, should buy protein.

One word about the silo. Some people having silos still think it the best practice to pluck the ears from the corn and to put the stover into the silo. The plucking of the ears and grinding them for the hog, or getting the kernel for the horse and the hen, is all right; but so far as the cow is concerned, were she given speech, she would beg of you to leave the ears on the stalk and put them into the silo. The testimony of the experiments at several stations is a unit. The cows, when they have had an opportunity, have declared without a dissenting vote for "ears and all" in the silo. The grinding of an ear of corn makes it not one whit better cow feed. To be sure if the silage is well matured some of the kernels will pass through the animal and go into the manure; but the loss in this way is not so large as the miller's toll.

QUES. In what state should the corn be cut for the silo?

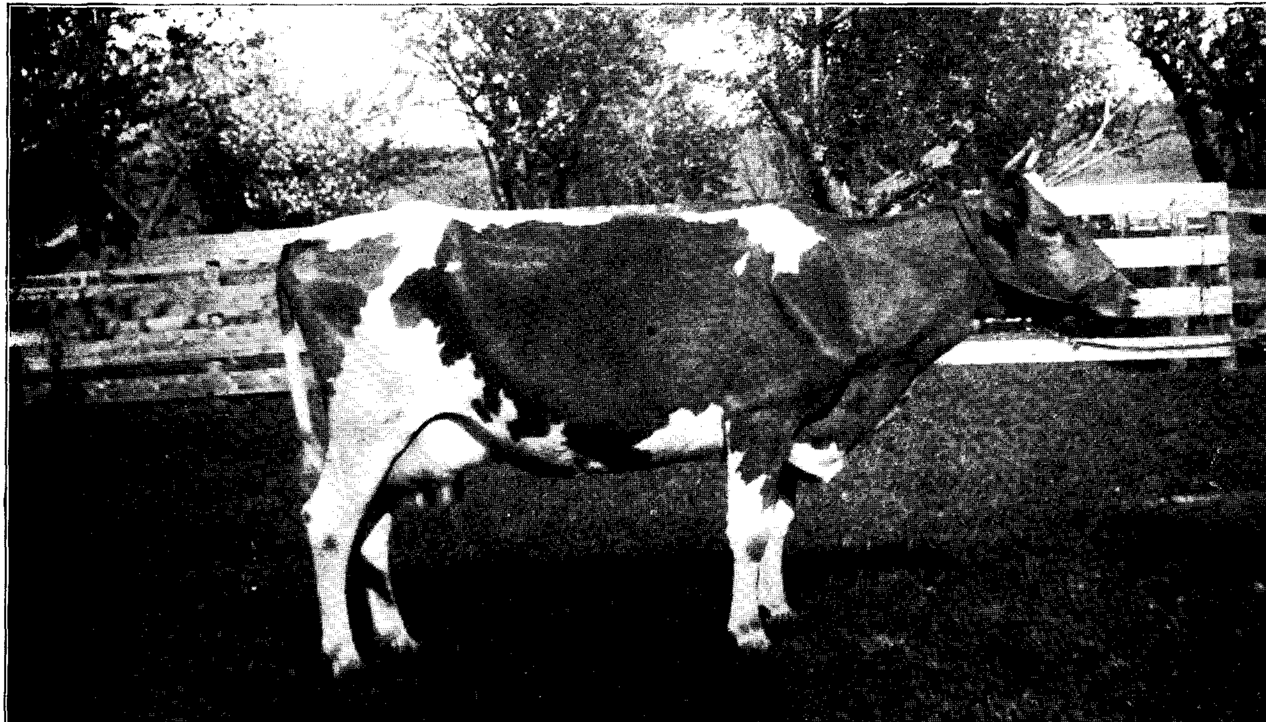
ANS. Corn is best cut when the ears are quite well glazed. The plant nearly or quite doubles its food value in the last month of its life, and he who ensiles an immature corn loses a large amount of potential food and makes an inferior silage. Two years ago we grew experimentally a very large variety of corn from Virginia, the stalks 12 or 14 feet high. Passers by the field would say, "What a magnificent growth of corn you have! I want to get some of that seed." From the same area on which we cut 100 pounds of Sanford corn we cut 160 pounds of this large corn. There was just as much food in the 100 pounds of Sanford as in the 160 pounds of the larger corn. We had to handle the extra 60 pounds which was all water and give it silo room and the silage was poorer than the Sanford silage. You should grow such varieties of corn as will come to maturity in your latitude.

A large share of the grain purchased in Vermont is corn meal. Three million five hundred thousand dollars a year, more than ten dollars for every man, woman and child resident in that state, is paid for grain, and nearly $2,000,000 of that sum is paid for Western corn meal. That is an economic sin. Northern New England grows more bushels of corn to the acre than is grown in the West, and yet our farmers go out there and import it. You ought to grow more corn here, not necessarily more to the acre but more acres. Grow all the corn you may, but do not buy it. When you buy, buy bran, cottonseed, linseed or gluten, some of those products that are rich in protein.

How much grain shall we feed to our cow machine? We have had twenty or more cows under experiment at Burlington for three years with a view of determining how much grain it was economical to feed them. We have not depended on chemists except to tell us what the food was, but have asked the cows themselves. We have found that with our cows, which averaged about 350 pounds of butter a year, in years of normal prices from six to eight pounds of grain a day (amounts depending on age and capacity) has been the most economical ration, more so than four pounds and more so than twelve pounds, particularly when we take into account the fertilizing value of that grain. In this year of abnormal prices for feed, we have been inclined to advise shading that, making it from five to six instead of from six to eight. Some of our farmers are endeavoring to get through the year without feeding any grain, but I believe this is an unwise thing to do. While we might not get more than just our money back, yet if no grain is fed we shall shrink those cows in value and impair their future usefulness. My judgment is that even in this year of high prices it is better to buy some grain, of the right kind, the protein kind, and feed from five to six pounds daily, if one has a good grade of cows.

III. THE PRODUCT—MILK.

It is still a moot point in many minds as to what is the most economical method of raising cream. In Vermont, where the cow population to the square mile and to the number of human inhabitants is denser than here, a large part of the trade in dairy products is with the creamery where the whole milk is taken and separated centrifugally. But there is an increasing use all through the state of the farm centrifugal separator. Comparatively few of the deep setting systems are being sold today. Many, indeed, are discarding deep setting and introducing centrifugal separators. It is unquestionably true that a good centrifugal separator, properly run, will get a larger proportion of the fat than will any other system. The Cooley, which is a good type of the deep setting system, will get most of it, indeed almost all for a considerable part of the year; but if the cows are stripping, or if they are of the Ayrshire or Holstein breeds, giving milk containing small globules of fat, there is inevitably a loss in milk creamed by the deep setting system. Even the centrifugal separator does not get it all under these circumstances, but it more nearly gets it all than does the deep setting. I have no particular interest in any of the separators, though I have tested nearly all of the different makes, but I am emphatic in my belief that a man who has ten cows or more can hardly afford, if he is in the dairy business for his living, to use anything but the best class of mechanism. Certain it is that all through the dairy districts



GUERNSEY COW, LADY OLGA, No. 12366, A. G. C. C.
A seven days' record of 20.05 pounds butter fator 23.59 pounds finished butter. Bred and owned by Dr. E. P. Turner, New Vineyard, Me.

the centrifugal separators are working in more and more rapidly; and that, unless some other and better mechanism supersedes them, their use is bound to increase in a geometrical ratio.

I want to say a word concerning the "dilution separators" so called, better called the "delusion separators," which have been sold largely, I am sorry to say, through our state and through Northern New York. The device consists of a tin can, with some more or less useless internal fixture, into which the dairyman is invited to pour his milk and as much water. The cream quickly separates, and the diluted skim milk may be removed. Many experiment stations have tested them, and seldom if ever have they been found to skim better than does the old fashioned shallow pan. The very advertisements, often ill spelled, ill worded, couched in wretched grammar and worse taste, do not claim for the "separators" that they will skim closer than 0.40 per cent. The wording of the statements often carefully conceals this fact, but it is there nevertheless.

Again, the advertisements say that the diluted skim-milk is better for the pigs than is the undiluted product. If half water and half skim-milk is to be preferred to straight skim-milk, then all water and no skim-milk ought to be better yet. The dilution separator cans may do nicely as wash boilers, or in some such way, but they are inefficient milk separators.

Dairymen commonly believe that they can alter the quality, or per cent of fat in the milk, by feeding. There do not lack good reasons for this delusion (for it is a delusion) since it often happens that changes in feeding do bring about temporary alterations in the quality of milk, and these temporary changes have deceived the farmers. Let us again refer to the Bible. You all remember the statement which tells us that no one can by taking thought add one cubit to his stature. In other words, one can by no method of human ingenuity charge certain of the effects of heredity. The quality of milk a cow gives is born into her, is bred in her by the work of the men who have for generations bred along certain lines. On the islands of Guernsey or Jersey, on the highlands of Scotland, and down among the lowlands of Holland are bred specific kinds of cows which have been raised with specific things in mind. The Dutch have been breeding large, heavy eaters, giving large amounts of milk, breeding for quantity regardless of quality. In the Channel Islands are found three breeds of cows where quantity has been the secondary consideration, and quality the main thing. No one can take a Jersey cow and make her give Holstein milk except by extreme ill treatment, starvation, or something of that kind; and per contra, no one can take a Holstein, giving 100 pounds of milk a day, and cause her to put five per cent of fat therein. She was not bred that way. Slight temporary changes following a change in ration do occur at one time or another, but great changes do not. Now I do not wish you to infer, by any manner of means, that you should not feed well. Food makes milk, but so also does the cow. Food alters the quantity of milk tremendously, but it does not materially and permanently alter its quality.

But you can alter the quality of milk through changes in the environment of the animal and in her treatment. Let me again borrow an illustration from the apostle of the cow, Governor Hoard. He had a pet heifer which for some weeks he had had under close observation as regards the quality of her milk. One day, when the milking was half finished, he raked her across the flank with a hat pin. She was naturally highly excited and it took some time to calm her down. Then the milking was finished. Just before this act of intentional cruelty—done, however, with the kindliest intent and with a view of showing to the dairymen of the world that such things hurt the pocketbook—he took one quart separately, and immediately after it another quart. That stroke of the pin eliminated a sixth of the fat. Other experiments of a like nature have given a similar result. It does not pay to ill treat cows. Viewing the matter purely from the standpoint of dollars and cents, every time the milking stool is used for anything except its legitimate purpose the user pays for the privilege.

Again, an animal kept under unhealthy conditions is not likely to be a thoroughly successful animal, nor is her product likely to be up to grade. Just what healthy conditions are is not always entirely clear. At the Vermont Dairymen's Meeting, held at Montpelier last January, two of our distinguished guests and speakers, Hon. H. C. Adams, dairy commissioner of Wisconsin, and Prof. G. M. Gowell from your own State, got into a mild controversy as to the proper winter temperature of the cow stable. Prof. Gowell advocated a somewhat low temperature with a view of hardening the animals. Mr. Adams advocated relatively comfortable quarters, with a view to benefiting the pocketbook. I believe that the middle ground is the safest there. We do not like to harden our cows with extreme exposure. Yet, on the other hand, we let them out every day in the winter, good or bad, barring blizzards, that they may have air and exercise. Ventilation is sadly lacking in many of our stables. A bill introduced by request in the Vermont legislature some years ago, it may have been in the mock session, relates to this matter. There had been much argument over tuberculosis and much excitement. It required that on and after the first day of January, 1900, all cows stables should be so remodeled that the cows' heads should protrude outside while their bodies remained inside. The introducer of this bill was not such a fool as he seemed. In an ill ventilated stable the opportunities for the spread of disease are greater, and the chances of the cattle becoming contaminated from the effluvia from the breath and excretions are increased. There need not be cracks in the sides or holes in every corner, but the entrance of pure air and the exit of foul air ought to be as well and as intelligently provided for as are the tieups, the mangers or the manure gutters. I cannot tell you how to ventilate your stables. Every stable has "troubles of its own." Every farmer, however, ought to study the Wisconsin Station system. Prof. King's bulletin (free for the asking, Experiment Station, Madison, Wis.) ought to be in the hands of every dairyman who has a cow stable that is not thoroughly well ventilated.

Let us take up one other phase of the product problem, which has to do with the cleanliness of the product. I am a great stickler for definitions. I prefer that our college students in reciting tell me why a thing is done rather than tell me how it is carried out. With few exceptions they come from the farm and know fairly well already many of the hows. They come to the University particularly to learn why, and "why" is the constant question asked them.

Now what is dirt? Lord Palmerston defined it once in four words; and, unless some of you have thought this definition out, I do not believe you can match it. Dirt is simply "matter out of place." Now milk, as it is ordinarily produced, has a lot of dirt in it, visible and invisible. It is said that over 500 pounds of dirt in the shape of manure, hair, scales, etc., enters New York City daily in the milk. It is not that kind of dirt of which I wish to speak, but the living dirt in the milk, that is bacteria. Some people have the notion that bacteria are little worms or bugs. They are plants as truly as onions, oaks or apple trees are plants. They are usually thought to be disease producing organisms. Some are, but the most of them are not. Some are extremely helpful in milk, others extremely harmful, and a large share of them, so far as we know, are without effect one way or another. They are omnipresent. They come from the air, from the hands, from the body of the animal, from the clothes of the milkers, from the fodder. It is almost impossible to keep them out, but one can lessen their numbers. There are means of killing them, means of keeping them out, and means of checking their growth.

And now for five minutes I want to plead with those who are making milk, cream or butter, in the interests of a good cream and butter trade, to endeavor to keep out, to kill and to check the growth of bacteria so far as is practicable. How may these policies of exclusion, slaughter and repression be enforced? Whitewash in the stables; sunlight in the barn; scalding water and steam on the utensils; seams in the tin pails that are flush or filled with solder; sawdust, shavings or straw for bedding; plaster in the gutters; all of these help to kill out and keep out bacteria. To do these, however, means some work, means some expense, means some thought, but it means every time a better product for butter making and for the cream trade. There is one other way of killing these germs out that is easier than any of the others, and that is by the use of a poison which will kill the bacteria, and may imperil human life. Whenever I can I sound this note of warning, for this infernal poison is being talked and vaunted all through the country, is advertised shamefully by some of our dairy papers, and, I fear, dairymen and creamerymen are using it widely. I say this here so that those who use it may know what they are doing. They should be answerable to the laws of the State, and certainly will be, if they act knowingly, to the laws of God. This material, which is called preservaline, formaldehyde, formalin, milk sweet, freezine, iceline, etc., will keep milk sweet, will serve in lieu of care, of cleanliness and of ice, does away with the need of pasteurization and covers up the traces of all filth, no matter how vile. But its use entails the poisoning of human beings. I would not be understood as claiming that all who drink embalmed milk will die; but their digestion suffers, and in particular infants and invalids have been seriously injured if not killed by its use. In one case which came under my personal observation an infant, fed on formalin dosed milk, a child in rugged health, began at once to go down hill, to pass undigested curds from the bowels and to lose in weight. She was on the road to literal starvation. The milk she was given kept five days without souring in a hot room and was heavily dosed with this poisonous material.

IV. THE DAIRYMEN.

Now a word in relation to the dairymen. We sometimes think that some of our cows are poor machines. Had the cows a voice I wonder what they would say about us. For ten years I have gone up and down the hills and valleys of Vermont, and to some extent of some other New England states, I have looked into the eyes of dairymen and talked to them, I have seen as the years have gone on interest grow and intelligence increase, evidenced not only inside the hall but outside in the fields and in the barns. Every day and every year there is an increasing appreciation on the part of the farmer of the fact that somebody else knows something about his life vocation besides himself. He realizes better than ever before that others can help him, that press, grange, institute, college and station workers may do him good. There is said to be one day set aside in the Catholic calendar in the Azores when a special prayer is uttered by the inhabitants that they may be saved from being so impious as to desire to know more than their fathers. That is not the American notion. I do not begin to measure up to my father's standard—to my shame be it said—but I want my boy and my girl to know more, to be better workers in the world than I am. The very best thing in agriculture today is this increasing earnestness on the part of the people for more knowledge. A meeting like this is an earnest of it. The plea which I want to leave last with you, on which I want to lay the greatest stress, the remembrance of which I would have you carry home with you, is a plea for the children. Let us give them every possible chance to learn the vocation that they are to follow. I was talking with a farmer today who said that he wished that his boy was his girl and his girl his boy. The boy is all machinery, while the girl likes farming. He is wisely letting the boy follow his natural bent, and is educating him in a technical way. If the farm-born child can only have an opportunity to see what is going on; if he can only understand "why;" if he can have the chance to study agriculture—and that does not necessarily mean the State College or Station, it means the grange, agricultural books and newspapers, any one or more of the multitude of ways which exist today whereby one may get agricultural light; if he has given him every chance possible to broaden his horizon, there is a far greater likelihood, in my judgment, that he will stay on the farm, and aid in the renovation, the making new again of New England agriculture.

QUES. Will you tell us about pasteurization?

ANS. Pasteurization is a process whereby bacteria may be killed by the means of heat. If milk be heated for varying lengths of time and temperatures ranging from 140 to 155 degrees and then rapidly cooled, from 99 to 99½ per cent of the bacteria may be killed, including all of the disease producing germs. If the process be properly carried out, the keeping quality of the milk will be materially enhanced. This does not injure the milk for butter making, and in most cases does not injure it for other uses. It is a question whether pasteurized milk is good as a regular diet for infants for a number of months continuously.

QUES. How do you proportion your grain feed?

ANS. My judgment is that bran should make up at least one-half by weight of a cow's ration. I like it, not because it is particularly rich, but because of its light, flaky character and because it helps lighten the ration. It is less digestible than the heavier feeds, yet seems to aid digestion. The remainder may be made up of cottonseed and linseed or cottonseed and gluten. One of the best rations we have used contained five pounds of bran, one and one-half pounds of cottonseed and one and one-half pounds of linseed meals.

QUES. Is milk made on a cottonseed ration injurious to infants?

ANS. I do not know that it is. I have heard the notion advanced, but I have never, myself, known of any bad effects.

My two children, while between one and two years of age, were fed for a year on the milk of a herd to which cottonseed was largely fed, and it did not seem to hurt them.

QUES. What breed was the cow which you mentioned as making 116 pounds of butter in a year?

ANS. She was a grade Jersey. The fact that a cow has the name Jersey tacked on to her is not a certificate of her ability as a butter maker. Each individual should be tested as to her dairy worth regardless of her breed, pedigree or beauty. The general tendencies of the Shorthorn are towards beef, but there are a few strains of Shorthorn blood that make good dairy animals. If one is in the milk business and selling milk only, regardless of quality, the Holstein or the Ayrshire would be the breed to keep. But they are not apt to be as economical butter cows as are the Guernseys or Jerseys. Our Holstein butter has proved to be the most costly butter we make, the Ayrshire butter ranks next, the Jersey butter has been made cheaper than either.

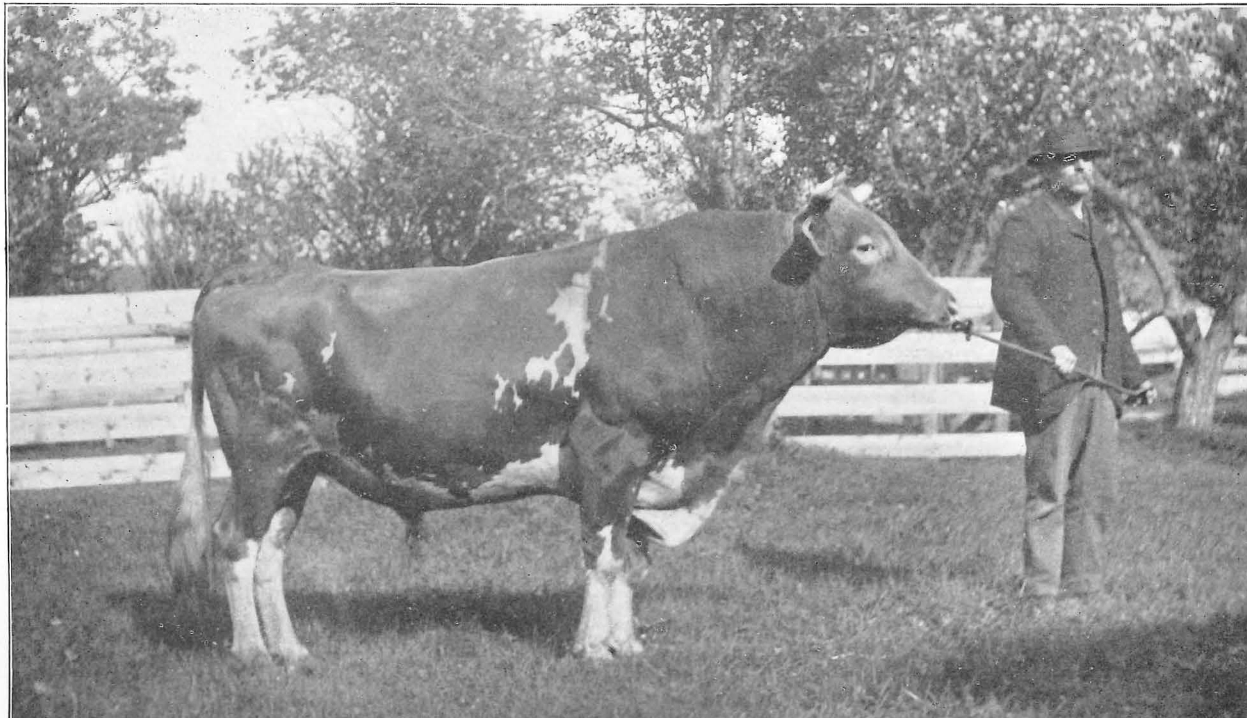
EXTENSIVE, INTENSIVE FARMING.

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

(Stenographic Copy.)

Young says, "All nature is but art unknown to thee, All chance direction which thou canst not see." If nature is art or law, as agriculture deals with nature and comes the nearest to art of all the industries, then agriculture is governed by law. He who works in harmony with law works to the best advantage; and he who works in harmony with law must be the man who understands the laws of his industry, must be the man who thinks. If our occupation is one of intellectual activity, then by the very laws of industrial evolution it is an industry in which the greatest intellectual activity, other things being equal, will give the largest income. If intellect is the measure of the industrial output of a people, then the people that put the largest amount of intellect into their industry will have the largest output. This is true of individuals in a community, it is true of communities against communities, and states against states. If my interpretation of the power of intellect in determining the fruits of agriculture is correct, then the returns of agriculture to us are measured by our intellectual activity, and the relative returns of Maine or of New England as against other sections of the country or of the world will be determined by the relative mental activity they put into their industry.

We say that farming does not pay in New England, because our soil is sterile. The measure of the productions of the soil handled by people of intelligence is nowhere on the face of the earth the fertility of the soil, but the fertility of the intellects of those who farm those soils. New England has poorer lands than the Middle States, but more of her people read and write, and she raises more per acre. Michigan has more people who read and write than Ohio, but a poorer soil, yet her farm products are larger. Indiana has several per cent less of her people who can read and write than Ohio, and less agricultural productions,



GUERNSEY BULL, JOHN MARSHALL, No. 4043 A. G. C. C. Property of Dr. E. P. Turner, New Vineyard, Me.

and Missouri has a still smaller per cent, and she has less crops than either. North Carolina has more people who can read and write than South Carolina and her crops exceed those of the latter state. Compare Louisiana with Georgia, and you will find that Georgia in her crops far transcends the other state, although her lands are poorer. Place Portugal against Spain, Spain against France, and France against Germany, and the same results are seen. France produces only 18 bushels per acre of staple crops, while Germany produces 22 bushels. Germany is by nature the poorer state, but all of her farmers read and write, while in France not two-thirds of them are able to do this. And the poorest returns of all the sections of the world come the most fertile soils on the globe,—that is, the black soils of Russia, where a miserable peasantry starve out a miserable existence through the cycles of years as they go by.

The reason for the decline of our farms and the disappearance of our boys from the farms is not the sterility of the soils. If they are a little stubborn, it is the whetstone upon which our intellects are sharpened. Give a people ambition and purpose in life and the fact of a little stubbornness in the soil is the means to a greater intellectual activity. Instead of being a misfortune, it is in a broad sense a fortune, and never in the history of New England agriculture have the people failed, nor will they fail, because of the infertility of their soils. We have felt that the large and cheap crops of the West have submerged our markets, and have been the true reason for the decline of our agriculture. But, my friends, it will cost you ten dollars to transport fifty bushels of corn from the West to the East, or from the center of its growth, back in Nebraska or Kansas, and eight dollars worth of chemicals will grow the fifty bushels right on your own soils, and leave you two and one-half tons of stalks, worth five to seven dollars a ton, in addition. As between corn growing in the East and in the West, the man right on this spot has the supremest opportunity, because the price he receives is so much greater than the necessary cost of the chemicals to grow the plant. If our agriculture has failed to maintain its position, it is not because we could not, when measuring ourselves beside the Western farmer, prove that we were his peer. We must seek some other reason for the retrogression of New England agriculture, in public opinion, in the price of its lands, and in social status. I find the solution for myself in the great fact that the rapid development of steam power made the fertile plains of the West tributary to the markets of the East and of Europe almost in an economic moment of time, and a dazzling prize was held up in the rich homesteads where a man could accumulate wealth by the very solidifying of population, the rise of land making his fortune. The doctor, the lawyer, the minister, the school teacher, the statesman went West to win wealth and fame through the founding and developing of empire states, the greatness and splendor of whose development surpass that of any other world's epoch. Such prizes were never hung up before any people in any period of history. It is not surprising that our boys went so rapidly and our money so fast after them. It is rather a surprise that they all did not migrate to those regions and possess themselves of these most glittering prizes of the ages. The little northeast corner of the United States, in area not equal to a single one of these mighty empire states, was the one potent source of men and money fitted for and equal to the founding of these states. They determined their institutional life, dedicating them to the civil, religious and industrial freedom of our fathers. They determined that the polity of the Puritan Fathers should be the polity of this mighty country, and fixed forever the destiny of the American Nation as a nation of freedom in all the spheres of life. By the union of East and West the South was compelled into a course of freedom and the American continent was forever dedicated to the civil and religious liberty founded by the Puritans. The influence of the united nation has leaped the Pacific, is lifting the lives of Japan, is permeating the Philippines, and in its subtle influence is acting on China as a ferment. Industrial liberty follows civil and religious liberty, and lifts a people into a new horizon of view and purpose. It fell to no other people of history to do so mighty a work, and our liberty, culture and greatness is to become that of the world. While we regret our temporary loss, yet you and I are glad that the Yankee influence is permeating the whole globe, and now that we have boys enough and money enough to repeople and reinvigorate New England, can feel a satisfaction in the fact that we have done this great work. It was the pause for this work, rather than the fact that we could not have made farming pay, which caused the decline in New England agriculture. A parallel movement, the founding of the new industries based upon modern sciences, drew our boys and money to develop our cities, to develop new industries and to reorganize old industries on broader lines, and to handle these gigantic consolidations of capital that characterize our times. No such exhaustive demands, as I have already stated, ever confronted any people, and no people in any age of the world have been capable of the mighty work for the human family that New England has accomplished. The work is over, and there no longer is a movement from our farms West. Consumption is overtaking production. The best lands are occupied and in the West have reached such prices as to forbid production at low prices. A quarter section anywhere in the West where we would care to settle is worth ten thousand dollars and it will require several thousand dollars more for a working capital. Prices have risen, never to recede again, giving us a chance to compete with the Western farmer. It has gone to that point where reaction is occurring, and men from the West are settling on some of these farms because they are the cheapest farms in the world. Capital also is flowing back upon every New England state. In my own state it is coming back by millions a year. We have markets unequalled by those of Europe or anywhere else at our very doors, making this today the most desirable opening for a young man with a small capital of any place that I know of. I do not speak sentimentally, but just as I feel about the matter.

Now, my friends, the question arises as to the influence, the far reaching influence, of this Western boom. I wish to note, first, that with the migration of our strong young men and women there was taken from the farm that surplus labor and capital essential to keep up the old, broad lines of farming. Tillage was narrowed; fields were put from tillage into grass and some into pasturage. There was a contraction of effort. The motto of "small farms well tilled" arose in the land and every orator voiced it on the platform and every paper in its columns, until it became a stable and proverbial system of farming in New England. To what has it brought us? It has brought us to a capitalization of personal property on the farm of not more than six or seven dollars, the smallest capitalization of any intelligent yeomanry in the world; less than in the Western states with their virgin fertility, where farming is the skimming of the cream from the soil. Eleven per cent of our lands are tilled, 85 to 89 per cent in the Western states, and 50 to 100 per cent in the European states are under the plow. Less of capital, less of tillage, less of tools, less of crops, less of everything that makes agriculture broad, rich and great, characterizes New England farming as compared with that of any other people; and we who peopled a nation and determined the policy of the world, through the false carrying of a motto good for twenty-five years ago into a new age, moved by new impulses, have placed ourselves, after all this gigantic work for all the world, in the attitude of pursuing the lowest type of farming to be found in the civilized world. This is an age of captains of industry, of mighty consolidations of capital, of the production of each unit at an exceedingly small margin, making a great total of profit out of the multitude of units produced. In such an age we draw within ourselves and say that "small areas well tilled" is the clarion or bugle call that we shall follow. And what is the result? You say there ought to be great crops if we have narrowed our farming down to a focus, on a few acres. We have arrived at the result of a ton of hay per acre, and on the twenty-five or thirty acres that we actually handle on the farm we get hay enough to keep seven to ten cows, from which we work out an income of perhaps four or five or six hundred dollars, up to the salary of the ordinary fourth-class clerk. Not enough, my friends, to live the life of the twentieth century, and measured by this a failure. If along this line we have forged our way for a quarter of a century, with no better results than a ton of hay per acre, we have arrived at that historic moment in Maine farming when we should cut loose from the old methods and try something more vigorous and effective.

I am here this afternoon to ask you to adopt the motto of the age, to invigorate your agriculture by more tillage, by more capital, by more hired men, by more chemicals, by all of those factors that enlarge the productions of agriculture and accompany greater culture of the farm. You say that labor does not pay; in that you pronounce in funereal tones the death of your business as a profit seeking one; if hired labor does not pay then you are not well paid. You say it does not pay to capitalize farming. As your farms are not worth on an average more than about a couple thousand dollars, and personal capital is but about one thousand more, involving at savings banks' rates of dividend ninety dollars annual interest charge, and as your labor goes in for three hundred to four hundred dollars annually, you announce that your income is from muscular labor, that you are not capitalists and that you propose to remain where all labor remains, the recipient of the fruits of men's muscular effort. Did you ever know any man by muscular labor to get wealthy, or to achieve more than a low measure of success? Never will you and I achieve anything noteworthy so long as the measure of our effort is our own, unaided muscular labor. Men achieve success by operating with other people's muscle, by increasing their business, and you will have to make your business larger and employ labor and capital both if you succeed beyond unambitious labor. You say, We cannot make machinery work on our farms in a degree adequate for competition with the West. If you tell me that you must depend alone on muscular labor on these hills you announce to my mind that you ought to get off the farm very soon, for in an age of metal, of machinery, no farmer should content himself with muscular labor in which the muscles are hardened at the expense of mental force and activity. You tell me you cannot afford to till, but there is no high farming without tillage. Grass farming is nature farming; grass farming is necessarily low farming. Tillage must come. It requires more labor, more capital, more mechanism and more of plant food. By broadening your farming, capitalizing it, you broaden yourself and your social and intellectual horizon. In an age distinguished by great enterprises and great captains of industry, you must broaden out your farming and make it as large as your mental resources and the possibilities of your soil will permit.

While engaged in professional work in the West, my father became eighty odd years of age and the time came when the ancestral acres must go upon the market at a mere song or I must drop my work there and pick up the threads of life where eighteen years before I had laid them down, on the old homestead where four generations had preceded me. Could I afford to drop a good salary and take up life on a rocky farm four or five miles from railroads and fifteen from markets? What was to be the future of New England? What could be done in New England? Would labor pay? Would capital pay? Could machinery be freely used? Could I find plant food adequate for large operations? Those problems were all reviewed most carefully, and after reflection, life's work was begun there again, where it was hoped, through the family descent, it would continue through other generations of Wilson-Sanborns, for I believe that man will never make the best farmer who sees in his best days the end of the family on his land, the growth of the farm then mattering but little to him. He who looks upon the farm as an inheritance of the family, affording really the best investment of one's money, (for I believe that solid, permanent farm improvements are a better inheritance than money in the bank that often destroys the character and chances of young men), alone is the man who will build most deeply and broadly farm improvements.

I adopted the reverse of all that is traditional in your farming, to wit,—extensive intensive farming, a broad acreage well tilled. Our average of a ton of hay per acre for a small acreage must be carried for all the acres of the farm tillable to the equivalent of three tons or more of hay per acre. It must not be confined to the now occupied field lands. All the pasture lands on the farm capable of it must be put to work. The good God never determined that one piece of land which you choose to name pasture should require five acres to keep a cow for five months, and another acre called field should keep a cow the entire year. My farming, extensive intensive agriculture, was to mean that every acre should be put to its utmost use. Carlisle once said, "Up, young man, the utmost that is in thee." The utmost that is in thee and the utmost that is in each acre of the farm must be brought out. I am not asking you to swing loose from democracy and to hold vast areas, but to make every acre you possess do its utmost.

I am here, then, to advise you to put at work every acre of ground you possess, in its fullest and broadest sense, and make the most of those acres. We will say that on your 100-acre farm there are thirty or forty acres in tillage, from which you are now getting an average of ten or twelve dollars per acre, making an income of four or five hundred dollars. When you have handled it through one rotation I want it to do in the second round several fold what it is now doing. Let us estimate the possibilities of extensive intensive farming. I will assume a system like my own for illustration of what we should expect from the new method. I have an eight years' rotation, in which we till four years out of the eight. One half of the entire area that can be plowed is plowed every year and every acre fertilized. We will suppose that we are starting on the second round, and that the whole farm has had good tillage, with the best of implements, and every acre fertilized every year and everything done at the right moment. We ought to get the following results per acre: The first year, one acre of corn, equivalent to five tons of hay; the next year, one acre of oat and pea hay, equivalent to three tons; the third year, one acre of clover, in two crops, equivalent to three or four tons; the fourth year, an acre of potatoes, 200 bushels, $100; next an acre of hungarian, three tons; the sixth year, an acre of timothy, three tons for sale, and the seventh year an acre of timothy, three tons, making six tons for sale, which will bring $90. The next year it is pasture good for two or three tons to the acre, on which the cow can go out and fill herself in a short time, and lie down and make milk, filling the pails. We have $175 in cash and an equivalent of sixteen or seventeen tons of hay. Allowing for shrinkage of hay and keeping of teams we still can feed seven cows that ought, in intensive farming, to give $60 cash, or a total of $420 plus $190 from this acre in eight years, or $76 per acre per year. Now as the new farming has pressed all the pasture land into fields possible, I assume that the average 100-acre farm has 50 acres of fields. This gives a total return of $3,800 aside from house, garden, orchard and team. This picture may need some shading, yet it is not extravagant. It sets hope where hopelessness was enthroned. As the old way has failed, we turn to the new for inspiration.

It may profit you if I give my method of fertilizing. For corn I use six loads of manure and 500 pounds of chemicals; for oats and peas, 500 pounds chemicals; for clover, 350 pounds; for potatoes, six loads or ten tons of manure and 1,200 pounds chemicals; for hungarian, ten tons of manure; for the hay, six or seven of manure for the first year and chemicals for the second year. We never use large amounts of yard manure to the acre, but distribute it in small amounts over large areas and apply it frequently. When you apply 50 tons of yard manure to the acre, giving 600 pounds of nitrogen that costs 18 cents a pound in chemicals, you have over a hundred dollars worth of fertilizing material for leaching in the spring and fall rains.

You may tell me that is all pretty as a picture, that perhaps my experience has not taught me and that I theorize on these things, as an office farmer, with gloves on, sporting a gold-headed cane; that it is one thing to make a pretty newspaper article, a fancy sketch of agricultural success, and another thing to gain it. I will only say this much,—that for eight years, on money which I have earned or borrowed, with limited capital, I have been able to carry the farm from 112 tons to 600 tons by using the factors named: capital, labor, tools, chemicals, extensive tillage, and other modern factors, and placed the balance sheet on the right side. Chemicals are used at the rate of fifty or more tons a year, and would, if not successful, overload the enterprise. So I believe I can say with authority to you here today that extensive intensive farming, the use of capital, of hired labor, of tools, of chemical manures, of the agencies and knowledge of the twentieth century, is profitable on a New England farm.

You may apologize for yourselves by saying, we have seen no way to feed these lands and have narrowed our operations because of that fact, and would be glad to farm broader if we could secure the plant food. Having laid out a system that requires several fold increase of plant food, and regarding this as one of the most important factors to settle, I shall dwell upon it, though briefly.

I fertilize my farm from the following sources: First, tillage. This is by divine command. Adam was ordered to "till" the ground and to "keep" it. Job said, "If my land cry against me, or that the furrows likewise thereof complain." To him good tillage was virtue, a moral force. Columello when asked to state the best ways of manuring said, "First of all, thorough tillage, second, good tillage, third, tillage in the ordinary manner, and fourth, the laying on of manure." Jethro Full for more than thirty-four years raised thirty-four bushels of wheat per acre by tillage alone, and Rev. S. Smith repeated the operation.

Grass here, though in a northern country, is infrequently plowed. It stands straight and close, holding the air between its spires and forming dead air spaces which prevent the circulation of air in the soil. When it is plowed the soil is opened to the movement of the air and the oxygen and carbonic acid gases enter it and set in play bacterial and chemical actions which decomposes the soil and forms from it soluble plant food. Were it all soluble now the hills would melt beneath our feet and we would soon be swimming in a lake. Sturtevant found that a grass sward had decomposed in it but three-tenths of a pound of nitrogen annually, while a tilled section had 210 pounds made soluble in the same time. Prof. Snyder showed that a virgin prairie soil contained 16,000 pounds of nitrogen in the first foot, while after nineteen years of tillage it contained but 8,400 pounds. Admitted air had done the work. Tillage is manuring, and in this country of coarse granite soil, with practically six months of winter and less sun than in other parts of the country, we should make the most of tillage, and get these coarse soils decomposed by nature, and secure much of our plant food from the soil rather than from the yard and manufactory. This is why I till the land so much. I want to form the nitrogen by disintegration and then put a cover crop over it and take it up before it is wasted, as in continuous tillage.

The second method of fertilizing is through irrigation. My father fifty years ago formed a reservoir of forty acres, running his canals a mile through the woods, and irrigated quite large areas. Whenever water carrying materials in solution touches the soil, it yields them up at once. Irrigation waters that come to my soil part with the materials in them taken from drenching the fields of others, and in that way we carry on two or three hundred dollars worth of plant food every year. You have places where you can dam back a little stream, or where you can spread over the land waters of brooks that will bring you fertility, and in times of drought double your crop, for irrigation waters are an antidote to drought.

The third method is by the use of muck. Your fathers, and the fathers of New England and of the Middle States, for a period of twenty or twenty-five years sought a solution of the problem of soil fertility in the use of muck. They knew that it was rich in nitrogen, and in accordance with this knowledge put it in the yards as an absorbent, also under the cows and in hog pens, and mixed manure and various substances with it. But they recovered from the fever and abandoned its use. Muck is formed under water in shallow places. Its potash and phosphoric acid have drifted out to the ocean and the nitrogen only is left. You cannot grow a crop without potash and phosphoric acid, and the muck could not have been successful in any of the combinations because it did not afford the minerals named. The users but added one nitrogenous fertilizer to another. I believe this to be the secret of the difficulty. I began to use potash and phosphoric acid with my muck, and found that when I added fourteen pounds of potash and thirty-five pounds of acid phosphate, or twenty-five pounds plain phosphate, to a ton, I received, on every crop but one, a little more from ten tons of muck than from ten tons of yard manure. I entertain a hopeful view of the continued use of muck. I am convinced that it is worthy of your study. If you succeed with it, you probably have all the nitrogen you will want for a century, in the muck beds around you.

Fourth, I rely heavily upon rotations as a means of crop increase. It is nature's method, and has been pursued by man far back in history, and is with intelligent peoples pursued in varied forms and often elaborately. At the Missouri State Experiment Station I received in a four years rotation trial, when wheat followed wheat in the fifth crop, when the rotation started its second round:

Wheat after wheat unmanured, per acre......	13.91	bushels.
Wheat after wheat, ten tons manure yearly....	24.28	"
Wheat in rotation, unmanured..............	30.16	"
Wheat in rotation, manured................	38.08	"

An unmanured rotation gave better results than a manured non-rotation. At Utah, with several types of rotation, I received a large advantage in rotation. I will state a few of the reasons, economic and scientific, for the adoption of my eight years' rotation. By a proper management of crops, team work is in such succession as to employ horses continuously. By this arrangement I have handled forty acres per pair of horses, a far larger ratio of tillage ground per acre than is common or can be in the present system of our farming. The same truth holds as to men, and I employ the same number the year around. This aids in settling the labor problem and as it involves properly the cottage home it relieves the household of the farmer of a burden.

The scientific basis on which I found my rotation, if elaborated, would require more than my full time, and I shall merely review the matter dogmatically. Crops should be rotated with roots feeding at unlike depths, that the several areas of soil may be successively occupied. Unlike crops should follow each other, to baffle the insect and fungus enemies that prey on roots, stem and leaves of their several favorite crops. Crops have unlike vaporizing powers, and between two crops there may be a variation of moisture under them amounting to often 200,000 or 300,000 pounds of water, and the difference, even the following spring, is adequate to make a marked reduction of crop as between land occupied by two crops in the preceding year, as trial has shown. Crops take varying amounts of the elements of plant food,—potatoes thirty-five pounds potash to eleven of phosphoric acid, while wheat takes more of the latter than of the former. Crops secrete different acids, or have power by the acids of their roots of dissolving from the soil and of appropriating the several elements of plant food in different degrees. The weight of the roots of crops varies from 1,500 pounds per acre up to 8,000 pounds in the case of clover. The latter crop has a special power residing in nodular growths on its roots of gaining its nitrogen from natural sources, from the air mainly. The decay of this heavy weight of roots and stubble will supply nitrogen enough to grow two to three crops of the class of plants like wheat, that have a low power to gain nitrogen. Crops should be alternated that tillage and cover crops may follow each other; an open soil to favor oxidization, and cover crops to take up the soluble material before it is leached out.

Other reasons make it very desirable that the laws of rotation be observed. New England farmers, of all farmers, have most neglected a proper rotation. In it they will find strong assistance in securing an increase of crops.

The purchase of foods for stock is also a source of nutrition to the farm, especially when the right kinds of food are purchased. I buy the so-called protein food. A ton of cottonseed meal contains forty-three per cent protein, about seven pounds of nitrogen. A ton of bran does not contain half that amount, and a ton of corn meal not half of that; or a ton of cottonseed meal has four times the manurial value of a ton of corn meal. A ton of gluten meal contains nearly as much protein as a ton of cottonseed. I buy these products because I get from them nitrogen for my farm for nothing. My cows pay the full price of the food, taking out twenty per cent and leaving eighty per cent to be returned to the soil. I have bought cottonseed meal and used it as a direct source of nitrogen. When I first returned from the West I used a car that way because I came in the spring when it was too late to feed it. Now all protein foods are first fed. I advise you to buy this class of foods because you get the nitrogen, and get it for nothing, as good breeders and feeders make the cow pay the full bill.

Lastly, in this direction, I urge upon you the use of chemical manures. You say they are stimulants, forcing the soil to great results and then leaving it in a collapse, like a man who takes whiskey. If anything is demonstrated in the realm of agriculture it is that chemicals are plant food. Out of barren sand you can grow a fine crop that will mature its seed and grow another crop by the use of these materials. It has been done again and again. For twenty-eight years I have grown a trial acre of grass with no other fertilizer but chemicals and the past year it gave me two tons to the acre, after twenty-eight years without barnyard manure and twenty-four years in succession in the application of chemical manures. John B. Laws for sixty years has grown crops of wheat which yielded about forty bushels to the acre, by the use of chemicals, a little larger yield than where he used fourteen tons of barnyard manure annually. Chemicals are plant food. Accept that as one of the conclusions of the latter part of the nineteenth century. Are they profitable plant foods? I purchase mine in the form of phosphate, muriate of potash and nitrate of soda, by the carload, and in that way they do not cost me within about forty per cent of what they cost you in the form of mixed fertilizers. I tried an experiment on the N. H. state farm with these three materials on many plots of corn. On the first plot I put potash, phosphoric acid and nitrogen, and obtained sixty-two bushels to the acre. On the second I put potash and phosphoric acid, leaving out the nitrogen, and the result was a small decrease in the crop. On the third plot I left out the phosphoric acid, with almost no decrease of crop, and on the fourth the potash was left out and the crop utterly collapsed, falling to the ground and yielding twenty-one bushels per acre. It was a river-made soil out of which the potash had been largely washed. It was a limestone soil in origin which had never contained much potash. Being possessed of that fact we poured the potash into the soil, and were soon able to raise four tons of clover to the acre, seventy-six bushels of oats and ninety tons of hay on thirty acres. The key to the situation had been found.

On my own farm it is phosphoric acid that is wanted, and by buying and using it aright, I have been able to largely increase production. I have to say to you this afternoon that chemical manures are profitable plant food. Were it not for them I should not attempt farming in New England. The fact that they are plant food cuts the chain that binds you to narrow farming, and prevents expansion of farm operations. It has emancipated you from littleness of operations and opened up to you a wider field; it enables you to farm as many acres as you have the ambition to farm and are capable of farming, I do not care whether it is 50, 100 or 5,000 acres. There is no limit to the acreage you may till, so far as plant food is concerned. When we arrive at such a point in New England agriculture, tell me if the business is not worthy the attention of the boys and girls on the farm? Tell me if there is an industry that develops so many sided a man? It involves outdoor exercise, in which every muscle is operated; it is a thinking business, developing the mind; an executive business, employing labor; it is a capitalist's business instead of a laborer's business, giving a new social status; it is a fascinating business, as it brings a man in contact with life in its varied forms; it is the world's greatest industry, and the agriculture of the future is the business that will develop the highest type of citizenship and the life that, after all, will give the most repose, while giving the largest culture. The only lion in the way is the habit of narrow operation which we have fixed. You know that habit is second nature and hard to throw off. It takes great strength to train to modern service our ancestral brain, to throw off the burden of the unnumbered years of dead men's habits, methods and ideas."

HAY PRODUCTION.

By Dana H. Morse, Randolph, Vt.

In the successful growing of hay, two things are indispensable, namely, thorough cultivation and intelligent fertilization. If there is to be a shortage in either cultivation or fertility, I should prefer that it be in the last named element.

While attempting to discuss some of the important, and I trust practical, methods of cultivation, I wish it understood that this talk applies to tillage land, that is, to soil which is not so moist, rough and rocky but that it can be well plowed. Farms are too cheap, and tillable acres too plenty in these New England States to justify one in the attempt to cultivate land which cannot be comfortably and thoroughly plowed. And it may not be considered a wide departure from my subject to add right here, that fewer acres well cultivated are vastly more profitable than a large acreage poorly tilled.

While in a paper of this kind there will doubtless be some personal theory, and while every idea presented will not coincide with the practice and theory of every other man, as a rule the basis taken has been carefully chosen and the endeavor has been to present such ideas as have specific value to the hay-producing farmer and are sufficiently well established to furnish reliable information and guidance.

MOIST LAND.

There is much moist and heavy land that can be plowed well which is capable of bearing heavy crops of a fine quality of hay on many farms in Vermont, and I dare say in Maine. One of the best methods of raising heavy grass, on either wet or dry land, is found in returning sod lands to grass at the earliest possible time after plowing that the soil can be well fitted for the purpose. Heavy soil plowed in July and August and fertilized with ten or fifteen two-horse loads of fine stable manure, spread evenly upon the inverted sod-land, thoroughly harrowed and pulverized (made as fine as a flower bed), can be seeded to redtop as late as the fifteenth of September, with good results. About six pounds of redtop to the acre, sowed any time when the land is ready, with an addition of the same quantity of alsike clover, sowed in the early spring following the redtop sowing, will make quite a heavy stand at first cutting and will come to full blossom at the second cutting in September. Alsike clover will thrive on very wet soil, and the combination makes an excellent feed for all kinds of stock, while the quantity will be entirely satisfactory as two crops a year for two successive years will be produced.

FALL PLOWING PREFERRED ON DRY SOD LAND.

Many reasons can be given for this, but I will name three only, in the following order: 1st, the preservation of moisture; 2nd, the advantage gained in rendering soil fertility available; 3rd, economy in labor and avoiding the rush of spring's work. I am aware that as to fall and spring plowing there is a difference in opinion. In some cases it may be best to wait until spring but in most cases land can be best plowed in the fall.

Land that suffers from drought can be much benefitted by fall plowing. It has been found that the difference in the loss of moisture between fall and spring plowing is greatly in favor of the former, amounting to nearly two hundred tons to the acre. The water from the snow and spring rains will be more readily absorbed by reason of fall plowing, and hence will be brought back by capillary action, when the summer months set in. The plowing prevents waste of moisture before it is needed by the crops, as the loose soil will serve as a mulch. Too much stress can hardly be laid upon the preservation of moisture, as it rarely occurs that a quantity of water falls adequate for plant growth during the growing period. It has been found that it requires three hundred pounds of water to grow a single pound of dried corn-fodder, and many more to produce some of the other farm crops.

Sod land to be used for spring crops will be in much better condition if plowed in the fall. The freezing and thawing of the land during the winter and spring tends to slacken the soil, and renders pulverization much easier. The resources and possibilities of our lands will never be unfolded to us until thorough cultivation takes place and the best methods of fining the soil are employed.

Scientists tell us that there remains in the first eight inches of New England soil, fertility enough to grow good crops for the next thirty years, and if liberated by cultivation it can be made available for profitable plant growth. So, inasmuch as fall plowing helps to prepare land for growing crops and lessons the work of making an ideal seed-bed, I see no good reason why farmers should not plow in the fall.

The last reason for fall plowing is because it economizes labor and promotes better work. "Time is money" some one has truthfully said, and upon its economy success or failure may hang in a balance. Help is more plenty and cheaper in the fall than almost any other time in the year. Besides, good work cannot be done in a hurry. The rush of spring often causes high wages. and consequently hurried and poor work is the result. Fall plowing also gives the farmer an opportunity of hauling the heavy manure of the stable on to his plowed fields in winter when his help and team might otherwise be idle.

KIND OF HAY TO PRODUCE.

In growing hay, conditions should be considered. Producing hay for commercial purposes, timothy finds the most ready market, but for feeding value, except possibly for horses, it is among the poorest grasses grown upon the farm, as analysis has frequently proven. Besides, it is purely a surface grass, depending almost wholly upon soil fertility for its growth and production.

The successful growing of red clover is no longer an experiment upon our farms. Methods of raising it differ as localities, notions and conditions vary. One of the most successful ways now practiced in Vermont for seeding lands to clover is to seed in a well prepared corn-field. Clover seed sown in the first days of July, with corn standing a foot or more high, will be well protected from the parching sun and will make sufficient growth to stand our winters. On rich and heavy soil twelve pounds to the acre, with three or four quarts of timothy, is sufficient, but upon lighter and dryer land sixteen pounds, with about the same amount of Timothy, will generally give better results.

Clover sod should be plowed every two years and I am not quite sure but plowing every alternate year would be the better practice; although if the corn land is fertilized with twenty loads of stable manure to the acre and thorough preparation and tillage follows until the field is seeded to clover, it will produce two heavy crops a year for two successive years. The advantage of frequent plowing of clover sod is poorly understood. It has been ascertained that clover turf has nearly the same tonnage in roots that it has in hay and that these roots are of great value as a fertilizer, adding humus to the soil—a necessary element to plant growth.

Truly, the soil is replenished by the growing of red clover upon it, for this is one of the plants that feed upon the free and inexhaustible source of air.

Recently it has been discovered that the so-called leguminous plants, as clover, peas, beans, etc., can take up nitrogen from the air, and can grow without being manured with nitrogen, if the soil contains phosphoric acid and potash. The manner in which this nitrogen assimilation takes place has been carefully and patiently studied by scientists and it is sufficient for practical purposes to know that nitrogen is taken from the air by the growing clover plant, directly or indirectly, and that this nitrogen assimilation takes place as the result of the life of bacteria.

Since nitrogen costs the farmer from fifteen to twenty cents a pound if purchased, and it is clearly established that the red clover plant gathers it from the air, is it not important that the farmer "should make the best use of the means which the God of nature has placed within his reach" and secure this costly fertilizer by growing clover? Potash and phosphoric acid are quite abundant in our soils, and hence the price per pound rarely exceeds four or six cents.

Another and no less important reason for growing clover is derived from its feeding value as compared with other grasses. It is said on good authority that one hundred pounds of clover hay contains about twice as much protein as one hundred pounds of hay from the common grasses; that clover hay can be safely estimated as worth from one-fourth to one-third more for feeding than common hay. This is true in spite of the fact that it does not usually command a higher price in the markets, owing to certain prejudices against its use.

Assuming that common grasses yield two tons of hay to the acre, and clover three tons of hay, the amounts of food materials and fertilizing materials are approximately as follows:

Hay from	Assumed yield per acre.	Food Materials in Crop per Acre.			Fertilizing Materials in Crop per Acre.		
		Protein.	Carbo-hydrates.	Fat.	Nitrogen.	Phosphoric acid.	Potash.
	Tons.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.
Redtop........	1	158	1,520	38	23.0	7.2	20.4
Timothy....	2	118	1,480	50	25.2	10.6	18.0
Red clover.........	3	369	1,887	99	62.1	11.4	66.0

It will be seen that on the above basis, which is believed to be a fair one, the clover crop furnishes from two to four times as much protein per acre as common grasses, together with much more fat and rather more carbohydrates. It also contains nearly three times as much nitrogen and about twice as much potash. It should be remembered, too, that clover draws a large proportion of this nitrogen from the air instead of depleting the soil, and that the long roots enable it to feed upon the potash deep down in the soil beyond the reach of surface feeding plants.

CUTTING HAY.

One short plea to the farmers of Maine for early cutting of hay. Practice, science, observation and good sense all combine their testimony in favor of the superiority of early cut hay to late cut hay, in regard to its composition and digestibility. All scientists tell us that young grasses while rapidly growing contain more protein—the most costly food element to buy—and less fibre than mature ones. The stock in our June pastures confirm these claims.

We are also advisedly admonished that grass, in ripening, transmits a large part of its protein and starch from the leaves and stems to the seeds, which are seldom, if ever, digested. Generally they are lost in curing, together with the over-ripened leaves. In the language of the scientist, "The hay made from fully ripe grass is essentially straw."

When the good time shall come in which our farmers shall have their acres covered with red clover, cut early and cured with as little handling as possible, put in their barns rapidly and as compactly as may be, with every leaf and blossom upon it, then they will have secured for their herds and flocks the nearest to a perfect food and balanced ration that the farm is capable of producing in any crop which can be raised upon it.

Remember also, that in growing clover you are raising the best food for your stock and the richest fertilizer for your farm. It is well to remember that if clover is allowed to ripen its seed it not only deteriorates in food value but in most instances the plant itself will be destroyed. Cut in early blossom, clover will make a good stand for two years on Vermont soil.

More and better hay is but another step toward better profits, brighter visions and happier days. Will you take the step?

THE RELATIONS OF THE WORK OF THE WEATHER BUREAU TO AGRICULTURE.

By W. A. SHAW, Observer, U. S. Weather Bureau, Northfield, Vt.

It has been said that "We dwell on the surface of the land; we sail across the surface of the sea; but we live at the bottom of the atmosphere. Its changes pass over our heads; its continued fluctuations control our labors. Whether our occupation is indoors or out, on land or at sea, we are all more or less influenced by changes from the clear sunshine of blue skies to the dark shadows under clouds; from the dusty weather of drought to the rains of passing storms; from the enervating southerly winds to the bracing currents from the north.

Few persons fail to raise some question now and then concerning the causes and processes of these changes; some inquire more earnestly, desiring to inform themselves carefully on the subject. No school study suggests more frequent questions from scholars or allows more educative replies from teachers than meteorology, the science of the atmosphere."

Since man's labor and pleasure are so much affected by weather and climate, it is passing strange that no systematic effort was made to discover the laws of atmospheric phenomena until within 150 years; indeed, it may be said that the modern science of meteorology has been developed within the past 100 years. Therefore I say that it seems strange that man in his strenuous efforts in the development of other branches of science should have so long neglected the study of the atmosphere.

Meteorology may be defined as that branch of natural philosophy which deals with weather and climate; it includes the study of the physical properties of the atmosphere, a description of the instruments employed in that study and the application of the laws and principles discovered. Notwithstanding the fact that we are able to trace the discovery of some of the first principles of meteorology back two thousand years, that which now constitutes the science has been developed within the past two hundred years and a larger part of it within the past seventy-five. And yet meteorology as a science is still in its elementary stage of growth, and there is much to be discovered concerning the laws controlling the atmosphere.

From the beginning of time the alteration of the seasons and the irregular recurrence of weather conditions must have interested man and engaged his attention. The book of Job, believed to be one of the earliest of the Biblical Canon, contains some sound meteorological knowledge as true now as it was some three thousand years ago. The term meteorology is more than two thousand years old. It was first used by the philosopher Plato, four hundred years before Christ, when he described Socrates as "a sage, both a thinker on supra-terrestrial things, and an investigator of all things upon the earth beneath." Fifty years later the philosopher Aristotle wrote a treatise in which he discussed the subject of air, water and earthquakes, in this way approaching the modern signification of the word. Originally applied to appearances in the sky, whether atmospheric or astronomical in their character, the term meteorology is at present used in a much stricter and more scientific sense, to denote that branch of natural philosophy which deals with weather and climate, and the application of the knowledge so obtained to the elucidation of the problems of physics, geography, the advancement of agriculture and the promotion of health.

Notwithstanding the antiquity of the term meteorology, no practical advancement was made in the science until the barometer was invented by Torricelli, in the year 1643, a year after the death of Galileo who had shown that the air had appreciable weight. The thermometer is believed to have been invented about this time by the same school of philosophers, although the exact date of its origin is a matter of doubt.

Although advancement was made in other branches of the arts and sciences, the next milestone in the progress of meteorology we find in 1747, when Benjamin Franklin discovered the identity between lightning and electricity, and also about this time discovered that northeast storms move from the southwest.

Less than two hundred years ago the first accounts were published of ships which had scudded in a hurricane for a day or more, and yet found themselves in nearly the same place as when the gale began. This fact is clear to us to-day but then was regarded as most unexplainable.

There are a thousand who can note a fact for one who can draw any inference from it. Many generations had noted the ebb and flow of the tides before anybody noted a connection between these facts and the daily passage of the moon across the meridian. It is likely that a good many fishermen and sailors had talked over the curious fact that the first sign of the coming northeaster seemed to be from the southwest. And so Dr. Franklin must have the credit of first propounding the doctrine of American storms. The observations we make of the physical state of the air are affected to such a degree by local accidence such as the elevation, contour of the ground, its nearness to the sea, and even the character of the soil, that we meet with considerable variations in the condition of the atmosphere, even within the limits of a single county.

In this respect meteorology offers a strong contrast to astronomy. The objects of observation and study in the latter science are at such a distance from the earth that it is practically of minor importance whether they should be observed at Washington, Greenwich or Hong Kong; the phenomena themselves are identical, and other things being equal the difficulties of making the observation depend mainly upon the meteorological conditions of the locality. In fact, under favorable conditions the range of phenomena observable by an astronomer is limited solely by the horizon of the station and the power of his telescope.

But in meteorology itself the case is widely different. The phenomena are not the same at two different points of observation. A marked difference in temperature may exist in places one mile apart, hence we see the necessity of covering the country with a network of stations, as the observer at each place can not do much more than record the phenomena exhibited by the portion of the atmosphere actually in contact with his instruments.

Meteorology may be considered from many different points of view. In the first instance, observations taken systematically at one place give eventually information as to the climate of that place, and when the results obtained from one such station are combined with those of other stations and compared with those of stations of other countries, deductions may be drawn bearing on the relative fitness of different localities for the support of animal and vegetable life, physical geography and sanitary science.

Secondly, meteorology may be treated as the science of weather; that is, the changes which are from time to time taking place in the physical condition of the atmosphere, and the effects produced by such changes.

These effects find expression in the temperature of the air, its direction and motion, the amount of moisture it contains and the balancing of the antagonistic forces of evaporation and condensation.

Thirdly, we have the highest object of meteorology if we consider it as a department of cosmical physics; the investigation of the physical conditions of the atmosphere and their relation to the forces of light, heat, electricity and magnetism. All conditions and phenomena of the atmosphere are illustrations of the principles of physics. The properties of gases and vapors, and the laws of heat and motion are here exemplified on a scale vastly larger than that usually considered in laboratory experiments, but the difference of the scale does not in any way affect the application of physical law.

The atmosphere is a gaseous envelope which surrounds the earth; it profoundly influences animal and vegetable life; modifies and retains the heat derived from the sun; facilitates the transmission of sound; causes twilight, or the gradual shading of night into day, and is intimately connected in the production of weather phenomena and geological changes of all kinds. It is endowed with the qualities of elasticity, and great sensitiveness to the effects of heat. The height of the atmosphere is variously computed to be from forty-five to sixty miles, but investigations upon the duration of twilight show that its refractory power extends possibly two hundred miles; yet it is quite probable that the weather conditions of rain and storms and cloudiness all occur within eight miles of the surface of the earth. Indeed, some of our more recent investigators hold that all these disturbances in the atmosphere do not reach an elevation exceeding two miles.

The United States was the fourth government to establish a permanent weather service, although its scientists were pioneers in discovering the progressive character of storms and in demonstrating the practical utility of weather forecasts. Previous to 1870 meteorological observations in the United States were carried on by a corps of voluntary observers under the direction of the Smithsonian Institution. The results of those investigations finally led to the establishment of the present government weather service, under the direction of the signal corps of the army in 1870, and which was transferred to the Department of Agriculture in 1891. It has developed from a force of 200 men in 1870 to 1,600 carefully trained officials; from an appropriation of $20,000 per annum to more than one million. The duties of the service are defined by act of Congress as follows: "The Chief of the Weather Bureau shall have charge of forecasting the weather; to issue storm warnings, the display of weather and flood signals for the benefit of agriculture, commerce and navigation; the gauging and reporting of rivers; the maintenance and operation of seacoast telegraph lines, and the collection and transmission of marine intelligence for the benefit of commerce and navigation; the reporting of temperature and rainfall conditions for the cotton interests; the display of frost and cold wave signals; the distribution of meteorological information in the interests of agriculture and commerce, and the taking of such meteorological observations as may be necessary to establish and record the climatic conditions of the United States or are essential for the proper execution of the foregoing duties."

To the general public the Weather Bureau is best known through the medium of its daily forecasts and weather map. These forecasts are based upon simultaneous observations of local weather conditions taken daily at 8.00 A. M. and 8.00 P. M., 75th meridian time, at about 180 regular observing stations scattered throughout the United States and the West Indies. Each of these stations is operated by one or more trained observers and is equipped with mercurial barometers, thermometers, wind vanes, rain and snow gauges, anemometers, sunsine recorders, barographs, thermographs, and devices which register automatically a continuous record of the local weather conditions and changes as they occur. The results of the daily observations are immediately telegraphed to the central office at Washington, D. C., where they are chartered for study and interpretation by experts, trained to forecast the weather conditions which may be expected to prevail during the following thirty-six to forty-eight hours. A complete telegraphic report includes the following data: temperature, pressure (reduced to sea level), precipitation, direction of wind, state of weather, current wind velocity, maximum and minimum temperature since last observation, and kind and amount of clouds with the direction of their movement. From these data the forecaster by comparison with preceding reports is able to trace the paths of storm areas from the time of their appearance to the moment of observation and approximately determine and forecast their subsequent courses and the occurrence of other weather conditions.

It is a wonderful picture of atmospheric conditions that is presented twice daily to the trained eye of the weather forecaster. It embraces an area extending from the Atlantic to the Pacific, from the north coast of South America over Mexico, the islands of the West Indies and the Bahamas, northward to the uttermost confines of Canadian habitation. It is a panoramic picture of the exact air conditions over this broad area. Their development since last report is noted and from the knowledge thus gained their future course and intensity is quite successfully forecast. Every twelve hours, the kaleidoscope changes and a new graphic picture of weather conditions is shown. Nowhere else in the world can meteorologists find such an opportunity to study storms and atmospheric changes.

The system for the collection of telegraphic reports of observations is so arranged that all of the principal stations in the United States receive reports from a sufficient number of other stations to represent the general weather conditions over a considerable portion of the country. Forecast centers are also established at Boston, Chicago, New Orleans, Denver, San Francisco, and Portland, Ore.

Within two hours after the morning observations have been taken the forecasts are telegraphed from the forecast centers to about one thousand principal distributing points, whence they are further disseminated by telegraph, telephone, and mail; in this manner the forecasts reach about 80,000 addresses daily; the greater part being delivered early in the day, none later, as a rule, than 6.00 P. M. of the day of issue. This system of forecast distribution is wholly under the supervision and at the expense of the government and is in addition to and distinct from the distribution effected through the press associations and daily newspapers. The rural free mail delivery system recently inaugurated and which is being rapidly extended will afford a means of bringing within the benefits of this system a large number of farming communities heretofore impracticable to reach with the daily forecasts.

The question is frequently asked whether this large outlay of money for the support of the Weather Bureau is warranted. Let us answer this question by giving some facts relative to the number of people and industries that are daily in communication with the Bureau. In our Atlantic and Gulf ports alone there are floating over $30,000,000 worth of craft on any day of the year; and at every port whether on the Atlantic, on the Pacific, or on the Lakes, there is either a full meteorological observatory or else a storm warning displayman who attends to the lighting of the danger lights on the storm warning tower at night, and to the display of danger flags by day, and to the distributing of storm warning messages to vessel masters. This system is so perfect that the Chief of the Weather Bureau or the forecaster on duty at the central office can dictate a storm warning and feel certain that inside of one hour a copy of the warning will be in the hands of every vessel master in every port of material size in the United States, provided it is his desire that a complete distribution of the warning be made. As a matter of fact the storm warnings usually go only to a limited portion of the coast at one time. While the daily predictions of rain or snow, by which as previously stated, the public measures the value of the weather service, are subject to a considerable element of error, the marine warnings of the service have been so well made that in over six years no protracted storm has reached any point of the United States without the danger warning being displayed well in advance. As a result of these warnings the loss of life and property has been reduced to a minimum, being doubtless not more than twenty-five per cent of that it would have been without this extensive system which comes daily and almost hourly into communication with mariners. The public does not appreciate this part of the service, since, as a rule, these warnings do not appear in the newspapers because it is not desirable to publish them so far in advance as to unnecessarily hold shipping in port. We only aim to place warnings twelve to sixteen hours in advance of the coming of the storm, and then we communicate by telegraph, by messenger, and by warning lights and flags directly with the masters of vessels. It is a notable example of the utility of the new West Indian weather service and of the wisdom of Congress in continuing as a perpetual instrument of peace the service organized to meet an emergency of war that the Galveston hurricane was detected on September 1st, 1900, at the time of its conception in the ocean south of Porto Rico and that the new system of West Indian reports gave us such complete simultaneous data that at no time did we lose track of the storm and everywhere as it progressed northward, such full information was given that notwithstanding the extensive commerce of the Gulf of Mexico, little or no loss of life or property occurred upon the open waters of the Gulf and the destruction at Galveston was many times less than it would have been without the premonition that was given, and the activity of the Bureau's officers in urging people to move from the low ground of the city to its more secure portions. Again, as this storm recurved and passed over the Lake region, the storm warnings were so well distributed that, notwithstanding the energy of the storm was so great that few vessels were staunch enough to live through its fury, shipping remained safely in harbor and there was not a life lost. These are some of the utilities of which the general public is not thoroughly informed.

When a marked cold wave develops in the north plateau of the Rocky Mountains and, by its broad area and great barometric pressure, threatens to sweep southeastward with its icy blasts, the meteorological stations of the Bureau are ordered to take observations every few hours in region immediately in advance of the cold area and to telegraph the same to headquarters. By this means every phase of the development of the cold area is carefully watched, and when the danger is great each observatory in the threatened region becomes a distributing center, from which warnings are sent to those who have produce or perishable articles of manufacture that need protection against low temperatures. In such cases the system of distribution is so perfect that it is not uncommon for the Bureau to distribute 100,000 telegrams and messages inside the space of one or two hours, so that nearly every city, village, and hamlet receives the information in time to profit thereby. What this means to the farmer and shipper is well illustrated by the fact that we gathered from those personally interested statements relative to the sweep of one cold wave, which showed that over $3,400,000 worth of property that would have been destroyed by the low temperatures was saved. To be sure sometimes the surging of the great air eddies which constitute our rainstorms and cold waves—one the low-pressure and the other the high-pressure eddy—deflects the course of the storm or minimizes the degree of cold, and the warnings may partially or wholly fail of verification; but in these important atmospheric disturbances the warnings are justified in such a large proportion of cases that those whose property is at stake do not longer question the utility of the government service. That no other country brings its citizens into such close touch with its weather conditions is shown by the fact that when severe storms are not imminent there is, in addition to the printing of the forecasts in the daily press, a daily distribution of 80,000 telegrams, maps and bulletins, that place the information in the hands of millions whose personal interests are materially affected by the weather.

There are over 2,000 daily papers in the United States, and each one of these prints in a conspicuous place the daily weather predictions. Did it ever occur to you that there is no other information that receives publication and attention by readers each day of the year in every paper in the country? There are 15,000 weekly and semi-weekly publications, the greater number of which publish the weekly weather crop bulletins of the Bureau for their respective states. Each state forms a section of the national service, and from a central office issues monthly reports on the minute climatology of the state. These climatological data are gathered from standard thermometers and rain gauges that are placed in each county. The information finds extensive publication in the weekly and monthly periodicals.

Few people realize what a complete system the Weather Bureau forms for the accurate and rapid collection and dissemination of crop information. It has 1,200 paid and skilfully trained officials, outside of Washington, who are quite evenly distributed over the continent and its island possessions, and who are available to report on any matters concerning weather crops, climate, or statistics. It has 200 officials and employes at the Central Office in Washington. It has 180 fully equipped meteorological stations quite equidistantly scattered over the United States and its dependencies, each manned by one to ten trained officials, which stations are not only weather observatories, but are centers for the gathering of statistical and climatic and crop reports. It has a central observatory in each state and territory to which all subordinate offices in the state report, and to which all voluntary weather and crop observers report. These central observatories are equipped with printers, printing plants, trained meteorologists and crop writers, clerks and messengers. During the past fifteen years the work of the substations and voluntary crop and weather observers has been so systematized under the state central offices that these centers constitute the most efficient means for the accurate and rapid gathering, collation, and dissemination of statistical and climate and crop information. The state central offices are under the systematic direction of the central office in Washington. The central office at Washington is equipped with force and appliances for the printing and mailing of large quantities of national weekly, quarterly, or annual reports and bulletins. The telegraph circuits of the Weather Bureau are ingeniously devised for the rapid collection, twice daily, of meteorological reports; they are also used to collect the weekly national crop bulletin. The Weather Bureau has over 300 paid temperature and rainfall reporters who daily telegraph their data from the growing fields to certain cotton, corn, and wheat centers. The Bureau has 250 storm-warning displaymen distributed among the Atlantic, Gulf, and Pacific coasts and the Lake region. The Bureau has an observer serving each morning on the floor of each important board of trade, commercial association, or cotton or maritime exchange in the country, who displays weather and crop information and each day charts the weather reports on a large map. The Weather Bureau has 3,000 voluntary observers—nearly one for each county in the United States—equipped with standard thermometers, instrument shelters, and rain gauges, who have for years intelligently served the government by taking daily weather observations and rendering weekly crop reports to state central offices. There are 14,000 persons reporting weekly to the climate and crop centers on the effect of weather upon the crops in their respective localities. These voluntary crop correspondents could quickly be increased in number to several hundred thousand if occasion required. In one month of four weeks there are distributed 168 different state crop bulletins, four national crop bulletins, and forty-two monthly eight-page state climate and crop bulletins.

The utilities of the service are well illustrated by the benefits that the fruit interests of California derive from the rain warnings, which, on account of the peculiar topography of that region, are made with a high degree of accuracy but a few hours before the coming of rain, yet far enough in advance to enable the owners of vineyards, most of which are connected by telephones, to gather and stack their trays, and thus save the drying raisins from destruction. Along the Rocky Mountain plateau and the eastern slope our stations are so numerous and our system of distribution so perfect that the sweep of every cold wave is heralded to every ranch that has telegraphic communication. In the cranberry marshes of Wisconsin the flood gates are regulated by the frost warnings of the Weather Bureau, and where formerly a profitable crop was secured only once in several years, it is now a rare exception that damage occurs. As we go farther south and east into the Gulf and South Atlantic states, our frost warnings are made with a greater degree of accuracy than in any other part of the country. We find the growers of sugar cane in Louisiana, the truck growers from Norfolk south to Jacksonville, and the orange growers of Florida timing their operations by the frost warnings of the Bureau. From the estimates of these people, it is indicated that the amount annually saved to them is far greater than that expended for the support of the entire Department.

No less valuable is the flood-warning service which is in operation along our large river courses. So much advance has been made forecasting flood stages that it is now possible to foretell three to five days in advance the height of navigable rivers at a given point to within a few inches. The danger line at every city has been accurately determined and charted, so that when a flood is likely to exceed the danger line residents of low districts and merchants having goods stored in cellars are notified to move their property out of the reach of the rising waters. An illustration of the efficiency of this system was shown during the great flood of 1897. Throughout nearly the whole area that was submerged the warning bulletins preceded the flood by several days, and the statisticians of the government estimate that $15,000,000 worth of live stock and movable property was removed to high ground as the result of the forewarnings. These warnings are distributed from fifteen river centers at each of which a trained forecaster is located who daily is in possession of such measurements of precipitation on watersheds and such up-river stages as are necessary to enable him to make an intelligent prediction for his own district. On account of the recent disasters from floods in the rivers of Texas steps are now being taken to establish a flood-warning service specially for that state.

Measurements of snowfall in the high mountain ridges of Montana, Wyoming, Idaho, Utah, Arizona, and New Mexico during the past several years have given us information that now enables us to make a very accurate estimate in the spring as to the supply of water from this source that can be expected during the growing season. In this way the weather service has been brought into close contact with those interested in irrigation and has become a valuable aid to them.

The heavy responsibility that rests upon the Weather Bureau in the making of storm warnings is gathered from the statement that 5,628 transatlantic steamers and 5,842 transatlantic sailing craft enter and leave ports upon the Atlantic seaboard during a single year. The value of their cargoes is more than $1,500,000,000. Our coastwise traffic is also enormous. In one year more than 17,000 sailing vessels and 4,000 steamers enter and leave port between Maine and Florida. Their cargoes are estimated to be worth $7,000,000. From these facts one can readily measure the value of marine property that the Department of Agriculture, through the Weather Bureau, aims to protect by giving warning of approaching storms.

The climatology of each state is now so well determined and the information is so systematically collected as to be drawn upon daily by thousands of those engaged in public enterprises, such as the building of waterworks, where it is essential to know the precipitation on given water sheds; the building of culverts, where the extremes of rainfall within short periods must be known; the building of great iron or steel structures, where the expansion and contraction of metal with changes of temperature must be accounted for; the speculation in land in regions that are not known to the purchaser, and the selection of residences for health and pleasure.

It is not generally known that the meteorological records daily appear in numerous of the courts of the land, and that many important cases at law are settled or greatly influenced by them.

Under the direction of Secretary Wilson we have recently arranged with Europe and the Azore Islands for the receipt of meteorological reports that, in connection with our present extensive system, enable us to forecast wind direction and wind force for transatlantic steamers for a period of three days out from each continent. This is an extension of the meteorological service that has long been sought by mariners. The new German cable from Lisbon to New York enables us to get direct communication with several islands, the reports from which are necessary in the taking up of this new and important work.

Recently the Post Office Department, through the rural mail delivery, has placed at the disposal of the Weather Service one of the most efficient means of bringing its daily forecasts, frost and cold-wave warnings to the very doors of those who can make the most profitable use of them in the agricultural sections of the country. The latest forecast of the weather is printed on small slips of paper and each carrier is given a number equal to the number of houses on his rural route. Thus does the meteorological service insinuate itself into every avenue that promises efficient dissemination of its reports. To be forewarned is to be forearmed. The last appropriation for the support of the Weather Bureau was $1,058,320. It is the opinion of many insurance and other experts that the meteorological service of the United States Government is worth over $20,000,000 annually to the agriculture, the commerce, and the industry of the country; and this notwithstanding the large element of error that must for a long time to come enter into its predictions.

It may be asked what the prospects are for an improvement in the accuracy of the weather forecasts during the coming century. To this it may be answered that when our extensive system of daily observations has been continued for another generation or two a Kepler or a Newton may discover such fundamental principles underlying weather changes as will make it possible to forecast the character of the coming seasons. If this discovery be ever accomplished it will doubtless be made as the result of a comprehensive study of meteorological data of long periods covering some great area like the United States. While we cannot make such prediction today, we feel that we are laying the foundation of a system that will adorn the civilization of future generations. At the present time I know of no scientific man who essays to make long range predictions and in closing this paper I would especially caution the public against the imposture of charlatans and astrologists who simply prey upon the credulity of the people. I believe it to be impossible for any one to make a forecast based upon any principles of physics or upon any empiric rule in meteorology for weeks and months in advance.

THE FUTURE OF THE FARMER.

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

Our only method of judging of the future is by the past. If the history of a country or of an individual has shown progress, we may prophesy for that country or that individual progress in the future.

What has been the history of the farmer in this country and in other countries? Has he been held at all times in equal esteem with, superior to, or inferior to the manufacturer, the warrior, or the statesman?

At the most glorious period in the history of Rome, the most distinguished men were engaged in agriculture. Later, when the barbarians overran the more thickly populated and highly civilized portions of Italy and other parts of southern Europe, it became necessary for those who lived upon the land to be protected from the incursions of these warlike individuals.

For this, and other reasons, the feudal system grew up, wherein the powerful lord or chief became the head and protector of a large body of people scattered around the country near his castle. In time of war he was their leader, and they his soldiers; in time of peace they labored upon his land and the property was held in his name. Through the middle ages there was so much war, and the fields were so often devastated by enemies, that the best of agriculture was carried on only within territories owned by the church, and the farmers and farm laborers were the monks in the monasteries. As the feudal system fell greatly into decay in the sixteenth, seventeenth, and eighteenth centuries, there was more and more development of agriculture outside the monasteries and on the large estates of the nobility. But the nobles, no longer compelled to act as leaders in war against their neighbors, drifted away from the country to the capitals of the various countries. In France, the wealthy land owners and titled nobility gathered in Paris and Versailles, leaving those who tilled the soil with the heavy burden of providing them with sufficient funds for their rioting and debauchery in and about the King's Court. The condition of the peasant, or farmer, was not so bad when the great proprietor lived in his vicinity, for then he was acquainted with him, knew his necessities, and appreciated his desires and personality; but when he was away, the only interest he had was in the amount of his income from his estates. This state of things grew worse and worse until, shortly before the French Revolution, the name farmer was a synonym with misery.

It would be too much like a lecture on history, and would perhaps be out of place here, to continue the details of the condition of the farmers in France until the French Revolution. Sufficient to say that almost no condition could be worse.

If a field of wheat were growing, there was no certainty that the farmer might himself harvest it. If it were not eaten by the game birds belonging to the proprietor it was tramped over by noble huntsmen with their horses. The farmer might not keep fowls of his own, for the game birds of the lord must have the food. To pay taxes and dues consumed all of the product of the farm which was fit for human consumption, and the farmer himself might eat the refuse. This condition of things largely caused the French Revolution.

Conditions were little better than this in the other countries on the continent. Austria, Hungary, and various states in Germany all suffered from similar causes. The condition of the farm laborers and tenants in England was but little better.

The great convulsion known as the French Revolution compelled the rulers of Europe to begin the recognition of human rights, the rights of men because they were men. No class of people profited by the change in the political situation more than the farmer. During the period of the French Revolution, both before and after the overthrow of the monarchy, large public domains, territories belonging to the Church and to individuals of the nobility, were divided and sold to those who tilled the soil. Thus the farmer became the sole proprietor of the land upon which he worked. His interest in his work was increased, his profits doubled and trebled, and prosperity began to exist where but a little while ago were famine, disease, hopelessness, and sorrow.

There is nothing like the possession and tilling of the soil to give a feeling of independence. The impetus that was given to the agriculture of France by the new conditions after the French Revolution, has caused the French to become the best farmers in the world. The changes came so rapidly, the improvements were so sudden, that one could scarcely believe that the new France had grown so suddenly out of the old.

In this brief outline we can see how political conditions wrought great changes for the farmer. The physical conditions of soil and climate had existed for ages, but the freedom of the man to make the most of himself depended upon political conditions.

Here, perhaps, we had better turn to the consideration of the farmer in the United States.

We all know that permanent settlements were effected in this new world only because the soil was cultivated and the new comers made for themselves permanent homes. Thousands upon thousands of those who came to the new country came from the political and agricultural conditions existing as they have been already described, from France, England, Germany, and some other countries. Great as were the difficulties of the new settlers in clearing away the timber, in fighting with the Indians, and in contending with all the difficulties which must exist in a new country, their condition of independence was from the beginning far superior to their condition of dependence in the mother countries. It was not until those engaged in agriculture had succeeded in producing enough, and more than was necessary, for their maintenance, that anything besides agriculture could be developed. In other words, all industries and business enterprises depend primarily upon agriculture for their success and maintenance. The food supply is the all important question. Fish and game can never support a whole nation.

Farmers in the past have had to learn bitter lessons by experience. In the southern part of the United States it was early discovered that the one crop of cotton grown by slave labor would be profitable, but this could not go on forever. Two results were sure to follow. One, that the careless method pursued in raising this one crop, ruined the soil and did not fit it for anything else. Again, that slavery, as a system, could not, in the progress of the world, continue to exist. We are all familiar with the causes and results of the Civil War, which did away with the whole agricultural system of the South, and which, of course, brought ruin to all the great agricultural states of that district. But in the end this was a blessing for it taught the proprietors of agricultural states that development of a different sort was necessary for permanent progress. Hired labor and intensive farming are to prove a greater success to the southern agriculturists than the most expanded system of slave labor and extensive farming.

Much of this lesson had been learned in the northern states before the Revolution. But still more was to be learned. The vast tracts of soil suitable for farming west of the Allegheny mountains and west of the Mississippi river, served for years to earn a living for all comers. But difficulties of transportation prevented the moving of surplus crops to a profitable market. The tremendous multiplication of railways and steamship lines in the past quarter of a century has made it possible for farmers in almost every section of the United States to send their surplus crops to a profitable market, but the objections to living in these remote districts still operated to prevent the best results.

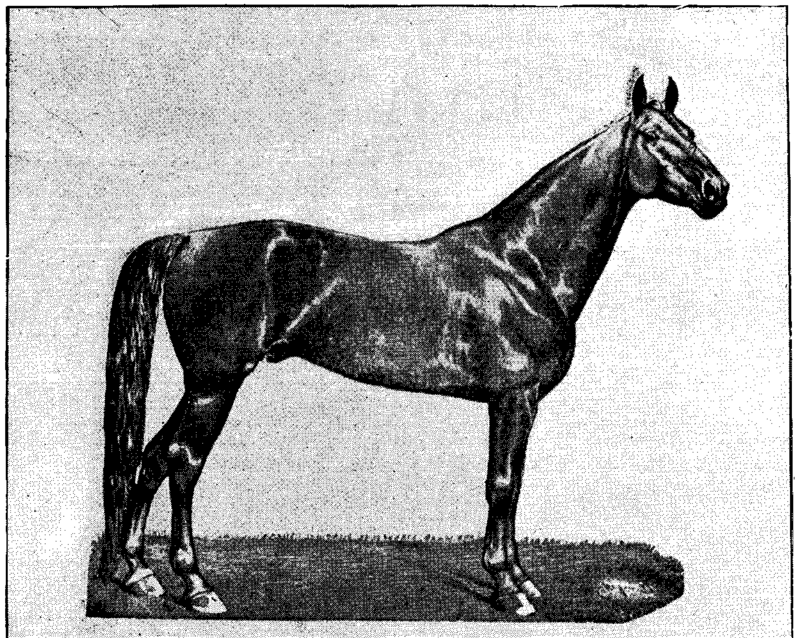
While there was opportunity to sell crops for cash, the farmer and his family lived at such great distances from the social centers that the isolation itself became a burden. Many gave up their residences in the country to move to the cities and engage in different employment, merely for the sake of society. This made it difficult to obtain sufficient labor for carrying on the agriculture of the country in a successful manner. But no sooner does a great difficulty become apparent than some genius discovers a method of overcoming it, and in the past quarter of a century so many improvements have been made in means of communication and transportation that one can scarcely find a spot on the face of the earth where he would be so isolated as were farmers only a decade ago.

The tremendous multiplication of industrial enterprises and the great growth of the cities increase the demand for agricultural products, and more crops can be raised and better prices obtained without glutting the market.

Again, the intelligence of the man conducting the enterprise is his best capital. While the earth, with careless treatment, may produce sufficient for the existence of a few, with the intelligent culture it will supply an almost unlimited demand. The farmers have been becoming more and more intelligent. Not alone experience, but definite education in the lines of their business has made farming more profitable to the farmers. The isolation has been overcome in many parts of the Union by the extension of the telephone, by the pushing out of the systems of electric railroads, by the increase in the number of rural free mail deliveries, so that no longer isolation stands as a barrier to residents away from the cities, but rather the joys of living in the country, which have always existed, have added to them all of the comforts and conveniences which cities enjoy without the inconveniences and dangers incident to living where population is congested.

Again, the financial success of those who are skilled in agriculture need no longer be doubted. My position in connection with the State University brings to me constantly the demand for trained agriculturists to take positions at salaries fully as high as those paid in other professions.

The present condition of the farmer in the United States is one to be envied rather than avoided. The life of the farmer in the future in the United States, with all the changes that have occurred, and with all the changes that are about to occur, is to be happier, more independent and profitable than life devoted to most of the other occupations of man.



NELSON, 2.09. KING OF STALLIONS.
In 1890, in trotting condition, at Kankakee, Illinois, where he broke the world's stallion record.

A FEW OF THE PROBLEMS FOR MAINE FRUIT GROWERS.

By Hon. D. H. Knowlton, Secretary State Pomological Society, Farmington, Maine.

When we were deluged with fruit in 1896, I told the Maine fruit growers assembled at a meeting at Winthrop, that profit in the future for fruit growing would result from two things,— first, the production of varieties of fruit that are favorites in the market; second, such cultivation of the orchard as will produce the most choice fruit at the least cost. To these must now be added the marketing of the fruit. It was referred to then, it has always been important, but now that we have the whole world to compete with, it comes before us as one of the problems of successful fruit growing.

The other day I read this item in a New York paper: "Could the California apples beat the New York fruit in this market if the latter were packed and graded like the former? If so, why?" Now this may not immediately concern Maine fruit growers very much, as New York has never been regarded as a market for Maine fruit; but I think it does concern the future very much. It is generally considered by all experts in fruit matters that Maine and Eastern apples are superior in flavor to those grown in the Pacific States. Last June I met one of the managers of the Washington Exhibition at Buffalo. He was a native of Maine, and one of the first things he said was, "Won't you give me a Roxbury Russet? I haven't had a decent apple for nine years." Just across the aisle the Washington tables were covered with immense Ben Davis apples. They looked fine, but you may judge what this man thought of them. This year many carloads of apples have come east, some for the eastern markets and some for shipment to Europe. In New York City they are in many instances outselling the New York apples. In this case the perfection of the packing sells the fruit. The fruit comes carefully sorted, wrapped in paper, and packed in boxes. All this is happening when there are thousands of barrels of apples unsold in Maine. This matter of sorting and packing apples is one of the most important problems that we must meet. In my own county the past season, there has been a general scrabble to get barrels, and anything that was round and had hoops enough to hold it together answered the purpose. I have thought many times how these filthy barrels would look beside the neat, clean boxes from California, with their carefully wrapped fruit. Yet our fruit is better, but the buyer here, as elsewhere, is governed by the looks. The freight charges on a carload of fruit from California to Boston or New York cannot be less than $400 to $500, and yet this fruit is selling in the markets only 200 to 300 miles away from us. The imperative demand will be for the best fruit put up in the most attractive style. Most of the commission men seem to favor barrels for Maine apples, yet in Cincinnati, Philadelphia, Chicago, New York, and Boston too I think, they are selling Western (California) apples for more money than ours are selling for. You must work out this problem.

There is another problem,—perhaps as I have presented the subject, it is only a part of the last. It is the storage of the fruit before it is shipped to market. Mr. John W. Clark of North Hadley, Mass., in his talks to the farmers last fall gave some very good advice upon this subject. It is important, as he says, to provide in some way for good storage. The New York people placed some over 300 barrels of fruit in cold storage in the fall of 1900 for the Pan-American Exposition. I regard their figures as more valuable than ours, as the data were more accurate and the fruit was stored much earlier. Of these varieties—there were 345—the best keepers were Gano, Ben Davis, Esopus Spitzenburg (Schoharie Valley), Baldwin, Spy (grown in sod), Boiken, Bethel, Coopers Market, R. I. Greening, Jonathan, Fameuse, Rome Beauty, McIntosh Red, Canada Red, Russet and Red Romanite. One barrel of the Yellow Bellflower came from cold storage on May 20th, with a loss of only four per cent, and the best specimens held up on the exhibition tables for more than two weeks. This fruit, with the exception of a few barrels for experiment, was all wrapped. These barrels were stored in the same place and received the same treatment as the others. Up to the first of May they kept in remarkably good condition, but after that they lost flavor and color and began to speck badly, at least twenty-five per cent being in bad condition May 20th. Those that were well packed in waxed papers, making practically an air-tight compartment for each specimen, which not only preserves the apples from outside influences, but prevents the germs of decay spreading from one specimen to another, were found in fine condition as late as November 1st. On May 20th, barrel after barrel of Spies, Baldwins, Newtown Pippins, Jonathans and Fameuse suffered a loss of less than one per cent. One barrel of Newton Pippins, placed at this time, contained but one apple unfit to go upon the table, and the last of those were not removed from the table until thirty days later. In one case an entire shipment of apples decayed very badly. Investigation proved that the grower allowed them to stand in the orchard over Sunday, after packing and before shipping, and, as the weather was somewhat warm, they became thoroughly heated. This last item is most important, and so essential do I believe it to be, that after apples are picked I would not permit them to remain in the orchard, or in outbuildings. I would follow Mr. Clark's advice and cool them down in the quickest time possible and then keep them cool till they are placed in the market. The use of cold storage in the cities and by many large growers, assures me that Maine fruit growers must provide it in one way or another, or else they will fall behind in the procession.

There is another thing of which I wish to speak, but concerning which I have been unable to obtain very much information. It is the inspection of our fruit before it reaches the market. The Canadians have a law bearing upon this subject, but it has only been in force a few months and as yet fruit growers over the line have very little to say of its operation. As we are sending more or less of our fruit abroad, this inspection would be of great advantage if it could extend to European and other ports where the fruit is sent. The reports come back to us that the fruit was slack, or some other trouble, and without any evidence save the commission man 3,000 miles away the price is cut down and disappointment follows. The shippers and growers need such inspection to prevent dishonest dealing on the part of the commission man, while the commission man would be able to satisfy the shipper that his apples were properly or improperly packed, and confirm his statements as to their condition. Such inspection, under the authority of the U. S. consulates, would be a great help all along the line. I do not know how it can be done, or rather I am not yet satisfied as to what would be the most practical way of reaching the difficulty. We need something of the sort, and if there is any practical way of reaching it, I am sure the Maine fruit growers would have great influence in bringing it about. I am offering it for your discussion and consideration, for it is one of the problems of the future.

Stories are coming to us on every hand of the vast plantings of apple trees in the West. They frighten many faint-hearted people, just the same as stock raising in the same region has done in the past, but all the while the eastern farmer who stuck to his business has made money raising stock. The great markets of the country are almost at our doors, and consumers more and more are demanding fruit of the best quality. When we place it before them in attractive form our fruit will have the prestige. With proper care our orchards outlive those of the West and they outbear them too. Again, our lands are cheap. The other day I was looking over the valuation of real estate in one of the smaller Kennebec towns, and I noticed that there were only two or three farms in the entire town that were valued as high as $1,600. There is no locality in Maine which produces better apples, and I am not sure but I would cut loose, if possible, from everything else and go to that town and plant and cultivate fruit, but there is one thing I would not do. I would never plant a fruit tree on land I could not till. We have been told many times that our granite hills, that are too rough and rocky for cultivation, are the best soil for the apple. Some have been misled by it, when they have found how much difficulty there is in getting around among the trees, and how much trouble there has been to supply good nourishment for the trees. When good land is so cheap I would not plant an orchard on anything but the best.

There is another important point, and that is to grow the kind of fruit the market wants. I will not attempt to tell you what this variety is, but I do feel like warning the public against planting the Ben Davis, and I would put with it the Gano. I am aware that they have sold well in the past few years. The Western Ben Davis, although it is really not a first class apple, is much better than ours. The season is longer and it is better matured, larger in size, better colored and much juicier than ours. This year it has come more directly in competition with eastern fruit in the foreign markets, and the Baldwin has outsold it in nearly every case. I would not plant them, but others may do as they please. There are enough others that are better, and I am quite sure will be more profitable in the future.

A New York paper put the case so clearly, that in closing these hastily prepared remarks I will read an extract from that paper.

"We have heard people praise the keen foresight and shrewdness of the true Yankee, and then go on to say that those who live in milder climates cannot compete with him. Is this always true? The purest bred Yankees left in this country are to be found in the State of Maine. There is no place in the country where richer and higher colored apples can be grown than in northern New England. Yet only here and there can be found Maine men who do their duty by their orchards! The result is that few customers know the superior quality of Maine fruit. In California, with a climate which, in theory, ought to be 'enervating,' apples are grown, shipped 3,000 miles right into Maine's natural territory, and sold at a profit. How is the Californian able to beat the Maine man? The chief reason is that he is able to agree with his neighbors and combine to learn to operate and to sell! Must a Yankee go 3,000 miles from home to raise a boy that can grasp opportunity?"

A PLACE FOR THE PIG ON THE FARM.

By Forest Henry, Dover, Minn.

(Stenographic Copy.)

I am advertised to speak to you on the subject "A Place for the Pig on the Farm." I really believe that there is a place for the pig on the Maine farm as much as on the Minnesota farm, and, although you may not want to keep them in such large numbers as we do in the West, I do believe that you can raise pigs successfully and profitably here in the East, perhaps not as your main industry but as a side issue, in connection with your dairying and your orcharding. It is a fact that the pig can turn the waste products of the farm to better account than can any other animal. It is also a fact that the pig can make more than twice as many pounds of meat out of a bushel of grain as any other animal, and as a rule his products sell side by side, as far as prices are concerned, with those of the cow or the steer.

I think I will tell you why I began raising pigs in the West. Thirty years ago Minnesota was one vast wheat field. Raising wheat was the chief occupation, but in 1877-8 wheat failed with us. We had to turn our attention to something else, and unfortunately, or as I think now, fortunately, that year of failure was my first year on the farm for myself. I sowed my whole farm to wheat, and raised nothing that I could sell. We thought then, as we had been raising wheat every year and had made it a success, that wheat would come back, but year by year wheat fell off and stock raising had to substitute our wheat farming. I had run in debt for the farm which I had bought and was not able to keep up the interest by growing grain, so I looked around to see what branch of the live stock industry I could follow and make it profitable, in other words, in what way I could pay for my farm. I did not think I had acreage enough to raise as many animals as I wanted in order to make a success, as my farm was small, so I sold it and bought a larger farm, running in debt \$7,000 and paying eight per cent interest. I knew nothing about stock raising and so made many mistakes at first along the line of raising pigs. But I made this business a study and year by year kept improving upon my methods, and I soon found that the hog was profitable to us, and it was only a few years before we had our farm paid for and were laying up money rapidly. To show you what hogs may do in the West—not what they always do but what may be done with them—I will give you my experience for the last two years. We occupy about sixty acres of land with pasture and grain, in our business. While we have more land than this, we find that we can raise only a certain number of hogs in one herd and make the business profitable; in order to enlarge, we should have to make new pastures and new pens, in other words, practically fit up a new ranch, so we raise only about 150 a year. We have about forty acres of corn, and the rest of the sixty acres in oats or pasture. With this we buy \$300 worth of shorts or bran. (By shorts I mean wheat middlings.) Two years ago we sold the products on the open markets at regular prices for \$2,384. Last year hogs were a little higher, and we sold \$2,700 worth from the same area. Deducting \$300 for the feed bought each year, it gives us about \$2,100 and \$2,400 respectively, for those two years. We cannot always do quite as well as that, as pork has been high, but we have never seen a year since we began the industry but that we have made it pay, and pay well.

There were several things which I took into consideration when I went into this business. I found that if I followed the same methods that my neighbor did, I had to compete with him; but if I could keep my pigs a little more healthy so that I did not have as much loss, and could raise them a little more cheaply, I had an advantage, and we worked along those two lines.

We will consider first the brood sow. Let me say that a man to be successful in raising pigs for pork does not need to keep a full-blood brood sow. She can be of any type, but the sire should always be full-blood and also a good individual of his breed. What constitutes a good brood sow? I shall not say much about breed, as we have found that there is more in type than in breed. The breeders who have been raising the different breeds of animals have all been aiming toward that ideal porker, a hog that we can rear cheaply and that is always ready for the pork barrel, in other words, one that will turn corn to the best account; and we find at the present time they have nearly come together. There is not nearly so much difference in the animals as there was years ago. They are almost all practically of the same type. So I would say that it makes but little difference what breed of hogs you raise. Raise the breed that you are in love with, as you will take the best care of that breed, and it will make you the most money. But I should raise an animal of a good type. The brood sow should have length of body. We all admire a short snouted hog, but six inches of body should not be sacrificed for half an inch in the snout. Get a long, deep and wide body, set on strong but short legs, and you will have the ideal brood sow, provided she has been reared properly. I would not take her, no matter how fine in appearance, if she had been raised in a pen. We find that the brood sow, to be successful, must be raised in a pasture largely. She must at all times have had proper exercise and proper feed. A brood sow raised in a pen and fed on corn is absolutely worthless. I would prefer that the brood sow be a mature animal. We find that the mature sow will give us healthier, stronger pigs, and those are the ones that give us the most profit.

The sire should be a full-blood animal, preferably a little more compact in build than the dam, and then the cross gives us the best kind of pig. Our success with pigs in the spring will depend largely on the care and feed we have given the brood sow during the winter season. What shall we feed her in order to be the most successful in raising pigs? If we should feed her corn largely and keep her shut in a pen, we might expect her to produce a weak, poor litter of pigs, and quite likely she would eat them up before they are twenty-four hours old. By this method of feeding you have been giving her a one-sided ration. You have first deprived her of sunlight and exercise, and then you have been feeding a ration that is a large producer of fat, but contains very little that will make bone, muscle or nerve, and this muscle and bone making food is what we must feed in order that the sow may be successful in rearing her litter. With us this feed is clover hay, wheat bran and oats, with a little corn in cold weather to keep up the animal heat. This, with plenty of exercise and plenty of sunlight, is all that is necessary. It may be interesting to know how we feed these feeds. The clover hay is fed while it is dry almost anywhere. The wheat bran is fed largely in troughs, and the oats are scattered on the feed floor. We scatter them very thinly so that the sow will pick them up one by one. In that way she grinds them very thoroughly, as a hog when eating will keep her grinders working whether she finds much to eat or not, and she will get exercise, as she will walk over that floor backward and forward for twenty, forty or fifty times in getting the ration of oats. Of course we keep water before them all the time.

The brood sow needs exercise. A hog is a sluggish animal and if you have, as you should have, very comfortable sleeping quarters, the tendency is when she has eaten to go and lie down. She needs some place for exercise, and so we give her the barnyard, and she will work around for hours while if it were not for that she would be lying down. I want my feed floor out of doors, because I can keep it sweeter and cleaner there than anywhere else. I have never been successful in keeping a feed floor clean under cover. If I clean it half a dozen times a day it is more or less filthy. We are told by scientists that sunlight is the best disinfectant known; that two seconds of sunlight will kill any hog cholera germ in existence. I want my feed floor out in God's broad sunlight, where it can be scalded out for me when the sun shines and where every rain can fall on it and wash it out. I would surround it, however, by a high board fence. The snow of course will fall into it, but in shovelling out the snow we take out a good deal of filth. A good housewife sprinkles snow on the carpet when she sweeps it, and the same rule holds good when we clean our feeding floors.

We find it necessary in the spring, when the sows farrow, to have a pen for each of them, and it was quite a question to find what was the cheapest farrowing pen. After trying a great many pens I made the one which I have used now for three years, and I find it very successful, not only in being the cheapest but the best pen I can build for my brood sows. The framework is very simple, being made of poles, with a ridge pole, and is about six by eight feet. We nail six-feet lumber on the sides, and close up the back and the front with the exception of a door, and we have a pen that looks very much like the gable of a house. One reason why we like this pen is because it is made in such a way that the mothers cannot lie on their litters if they wish to.

As a rule the pigs will hover to the sides and they are out of harm's way. Across the back end we put a pole, about eight inches from the floor, which protects them in that direction. We find in this everything that is necessary in a farrowing pen. These pens have no floors but are placed right on the ground. They cost in our section from \$1.50 to \$2.00. They will not cost as much with you. They are set in open yards, with a little litter scattered in, and the sows will find them at farrowing time. I never yet have had two sows try to occupy the same pen. Another advantage which these pens have is that, being without floors, the little pigs can walk right out into the open sunlight just as soon as they wish. They do not have to go down a long bridge. I want to get the pigs out on the ground just as soon as I can. I would not take a little pig that had been shut up closely for two or three weeks as a gracious gift. Everything goes nicely with a little pig shut up in a pen for a time, but if he is confined long where he cannot get exercise he will become over fat. The fat will form around the heart and lungs, cramping them, and the first thing we notice the pig has the thumps; he will breathe very short. And it will always be the fattest, nicest pig in the bunch. His hair will stick up, his tail will get dry and drop off, his mouth will get sore, and soon the pig is dead. Not so with the pig that is allowed exercise. My pigs are allowed out on the ground the very first day they are born, if it is possible. This is why I do not care to have them come before the middle of April.

QUES. How long will the sows stay in these little houses?

ANS. Six or eight weeks usually.

QUES. If there is a severe storm will she take the pigs in?

ANS. They always go in in a storm. We face the buildings to the south but in a hard storm we turn them a quarter around, away from the storm. The sow will sometimes root holes in the ground but I watch her pretty closely and when she has her hole nicely rooted I move the pen to one side a little and leave her on the level ground.

The tendency of a good mother is to give more milk than the pigs require for the first few days, as they require but very little when young, and when this is the case if the milk is not drawn from the udder it is bound to get feverish and we have trouble, not only with the mother but with the pigs. So we are very careful about feeding the mother heavily, for the first few days. She should be fed lightly at first, and the feed increased as the pigs grow. For the first twenty-four hours I do not feed her anything; then I give her a small quantity of thin slop, made largely of wheat middlings. Barley meal or oat meal would be all right. After the pigs are three or four weeks old we find that they draw very heavily upon their mother, in fact, the mother does not give them sufficient nourishment, and we have to feed them. We find that milk is the very best thing we can give them, and that is why the pig and the dairy cow go so well together. We have our cows fresh in the fall and give the milk to the calves in the winter, and by the time the pigs are three or four weeks old the calves are turned out and we have the milk for the pigs. We feed them very little at first, being very careful not to give them too much. The milk is warmed and is given to them sweet. You should guard against giving pigs sour swill. It may not kill them, but they will do better on sweet swill. After a little we find that the appetites of our pigs increase very much faster than our milk, and to make the milk hold out we use wheat middlings. We mix this with water, in a vessel by itself, and let it soak from one feed to another, and to prevent souring we add the milk at the time we feed it. We do not feed the sows any corn until the pigs are three or four weeks old; then we find it is necessary to give them some corn or they will depreciate in flesh.

So far I have been speaking of grain feeds, but I am to tell you how you can grow pigs healthfully and cheaply. For healthful feeds, there is nothing equal to a pasture. That is where I failed in my first venture in raising pigs, and that is where you are making a mistake in raising pigs. You are keeping them shut up in pens where you would not think of keeping any other animal. You cannot make pig raising profitable in that way. You should give the pigs just as good care as you do the family horse or dairy cow. How many farmers clean out the pig pen every day and put in fresh bedding? I will venture to say that if there is a man who does that he is making money. We have not a pig pen on our farm and I intend there shall never be one. They have a comfortable barn where they sleep and are always at pasture, winter or summer. Of course in cold weather they do not go out and eat all day, but there is hardly a day in winter when they are not out sometime, rooting around and getting a little green grass which is beneficial. What we want in this country is fewer pig pens and more pig pastures. We have a permanent pasture that has been seeded down twenty-five years which we use for early spring and late fall pasturing. We depend largely on clover for pasture, and would not care to turn them into our clover fields very early in the spring while it is still wet, so we keep them in the permanent pasture until the clover gets well up and the ground settled, then turn them into the clover pasture. The trouble with clover is that, while it is the best and the cheapest feed ever fed to a hog, it is a biennial. We sow it one year, it gets a good start, and the second year it is used for hay or pasture, and then its life work is done. You may get a little the third year, but not enough to make it profitable. So we reseed every year. We have two pastures and while the pigs are in one we are preparing the other for another year. We plant it to corn and cultivate in the usual way until about the last of June, and then sow June clover at the rate of eight quarts to the acre. We also mix in a little Mammoth clover. In the fall we pick the corn off and leave the stalks standing. We have but very little snow but all that comes stays, and we never yet have failed in wintering a stand of clover with this method. The next season this will be our hog pasture, and the next year it will be broken up and planted to corn and treated the same as before. In other words, we are rotating with clover and corn.

I have said that clover makes the best pasture for hogs, but we have found that dwarf Essex rape is nearly as good. One trouble is that it does not come as early in the season. In feeding hogs, as in feeding other animals, the greater the variety the better they will do. So we wanted both the clover and the rape. For a good many years we sowed rape in a field by itself, but we found that where the hills of corn stood there would be vacant places, and of late years we have been sowing dwarf Essex rape right on the corn ground. That will fill in every inch of space not occupied by the clover. You will not see much of it until about July. When the clover begins to get tough the rape springs up, and we have a good feed of rape from this on to cold weather. It may be necessary, in a wet season especially, to mow the field once or twice. The clover and rape will get very large, so we run the mower over a portion at a time, and then it will spring up and we shall have a tender hog pasture. I would not do this late in the season, as I like to have the feed at a pretty good height as cold weather approaches. The hogs will feed on it a little later than they will when it is short.

This will not furnish enough cheap feed. We have found that cheap feeds are healthful feeds. What is it that we can raise that is not only cheap but of the best quality? With us, it is pumpkins. I raise them by the acre and give the hogs all they can eat of them from the time they are fully ripe until the ground freezes up. If we plant them with corn we cannot get at them when we want them, and it is not economy for us to plant them on the corn ground, so we plant them by themselves, in checks eight feet square, putting eight or ten seeds in a hill and then thinning the plants out to about three or four, when they are out of the way of the bugs. Here in Maine, I would plant them about six feet apart each way. As soon as ripe I begin feeding them, sparingly at first, but when the hogs are used to eating them, I give them all they will eat. We drive out into the hog pasture with a load of pumpkins and a corn knife, and as we throw out the pumpkins we hit them with the corn knife which breaks them open, and by the time we have the load emptied the hogs will have every pumpkin seed eaten, and then they will begin on the pumpkin proper. The pumpkins will act as a corrective when you are feeding much corn, and they will free the animals from intestinal worms. Another thing, where pigs have been fed pumpkins during the pumpkin season we never find them getting off their feed later in the season.

The little pigs during the summer we feed not only slop feed but a little shelled corn. This corn is soaked from one feed to another, and we feed a bushel of shelled corn to 100 pigs once a day. We prefer the new corn to the old. We commence very carefully, and increase until we get them on to full feed about three or four weeks from the time of beginning. We never feed a hog corn more than twice a day, and we never feed more than the animal will eat up quickly. A healthy hog is a hungry hog. The slop feed is fed at noon, not when the corn is fed. They have access at all times to pure water. We want to keep them perfectly healthy, for a perfectly healthy hog means an animal that will convert the feed into pork cheaply. An unhealthy animal means an expensive animal. We have found at our experimental stations and in our work on the farm that hogs need something besides grain. They need a tonic and we give them salt and wood ashes, all they will eat, from the time they are born. Charcoal would be preferable, but it would be almost impossible for us to get charcoal, so we feed ashes. We usually haul a load into the barn, mix it thoroughly with salt, and throw it out, arranging it so that they can help themselves. This keeps their stomachs in good condition, and we are never troubled with the hogs rooting when they are supplied with wood ashes, even in our clover fields, but if the ashes is taken away for ten days we find them rooting. If a hog roots it means that he wants something which he is not getting.

I would say that I think we receive one-third more in cash by feeding corn to animals than we would receive to put it on the open market. Besides this, we are retaining the fertility on the farm.

Ques. How do you fence the hogs?

Ans. The fence question is an important question with us. I have tried at least twenty different kinds of fence for hogs. For the last eight or ten years I have been using a fence which I have never seen improved. The manner of building it is just as important as the material used. It is composed of barbed wire and wire netting. First, I should set posts very solidly. I would dig a hole four feet square and three feet deep, and fill in around the post with rocks. The posts should be made of cedar or oak, something that will last twenty-five years. If the posts are not properly set, I do not care how well the fence may be constructed, it will be a failure. When those are set solidly, I draw a barbed wire around very tightly. No matter what kind of a hog fence you construct, it is necessary to have one barbed wire on the ground. That also serves as a guide to set the remaining posts. These intermediate posts should be about a rod apart. We let them freeze in and then every post is as solid as a tree. In the spring, before the ground thaws, we stretch the wire netting. It requires a great deal of tension, so we stretch it from the posts while they are solid. We draw it up as tightly as the tightener will allow, and then we have a fence for a lifetime. Our fence has been up ten years and it is about as tight as when it was first built. We draw a second wire, six inches above the first. This will keep hogs, and another wire breast high will turn any kind of stock. We have never had a pig get through the fence.

QUES. Do you not have sows when they are farrowing very cross at times?

ANS. I have not had a sow on my farm for years but that I could go right in among the pigs and handle them. They are never cross with us. Where a sow has been shut up in a pen and fed on corn, she has been having a fat producing ration, she has had nothing that will produce muscle or bone. She has been robbing nature all winter and she is feverish and cross, and when she approaches the litter of pigs she bites a pig and gets a taste of the blood, a taste of that feed which she has been deprived of all winter, and she eats them up. We want to look after their wants carefully, to take so much pride in them that we will give them proper care, and then we shall make a success of the business.

AGRICULTURAL EDUCATION.

By Hon. J. A. ROBERTS, Norway.

(Stenographic Copy.)

Education is something in which we are all interested. We feel proud of our educational system, and we appropriate large sums of money every year to support it and make it better and more progressive as time goes by. All people should learn to read, write and spell, and use figures, and also the common business forms, etc. That is education which should be acquired by all people, whatever may be their calling; but I am to speak to you this morning on agricultural education. The doctor gets an education that is peculiar to his business, the lawyer gets an education that is peculiar to his business, and so the farmer must have an education that is peculiar to his business. If we go back many years, away back centuries, to those days before the invention of the printing press, back to those days that we call the dark ages, days that are now almost forgotten by us because the light of science has illumined the world so brightly, we find that the farmer and those who were engaged in any other industrial arts in those days were people who were ignorant and lowly. The gentlemen of that day, the men of influence of that day, engaged in what to them seemed the noble art of war. But times have changed, and now we are devoting our time and our energies to the cultivation of peace, and those arts and sciences that put us upon a higher footing. The fact that the tillers of the soil in those days were expected to be ignorant and lowly has come down through the years to us. That feeling was strong everywhere on the continent of Europe and in England. The farmer, the tiller of the soil, was not expected to have any sort of an education, or but very little; he must belong to the lowest class, or one of the lower classes. They were men without influence, their round of life being beaten in a circle, doing little, and having no influence in the community. That idea has been handed down, and even back no farther than my boyhood days farmers

POTATO FIELD OF W. E. JOHNSON, BOWDOIN.

scoffed at the idea of farming upon a scientific basis; and that feeling, I am sorry to say, is not entirely gone, but, under the influence of the agencies that exist today, it is fast disappearing. I might speak to you today of several instrumentalities that are in existence, provided for the education of the farmer. I might speak to you of the agricultural press, I could talk a half hour on that. I might speak of the Grange, one of the most potential factors in the State of Maine in the education of the farming community in their calling, as well as in other directions. I might speak of the department at Augusta, represented by our friend, Mr. Gilman, a department that is doing grand work for the farmers of the State of Maine. Or I might speak of the department at Washington, a department that is represented in the President's cabinet, a department which has appropriated for it four or five million dollars every year for the advancement of agricultural knowledge in this country. But I cannot spend time to speak of any of those things. I do not pass them by as being less important than the subject of which I intend to speak. They are all important and powerful agencies in the education of the farmer today, but time compels me to pass them by, as I wish to speak of agricultural schools. Besides colleges we have secondary schools, that is, academies and high schools, and we have that class of schools which is below the academy and high school, the primary school, the common school. I want to speak for a moment about education in the common school. There has been a demand for upwards of half a century, in the states of this Republic, for the teaching of agriculture in the common schools. You see what that means. It means that farmers have felt all along that an agricultural education was needed for them, and in order to make it universal they have turned toward the common school for it, because the common school was universal, and so attempts have been made in this direction in many states. Attempts have also been made in European countries to introduce the teaching of agriculture into common schools. An attempt was made in the State of Maine a few years ago. The matter was taken up by the State Grange, resolutions were passed in its favor, a law was put upon the statute book looking towards that end, and some attempt was made to teach agriculture in our public schools. I think I may safely say that it proved a failure; and I believe the foremost reason for that result came from the fact that our teachers were not prepared to teach it. Agriculture is a business, and the teacher must be *qualified* to teach that before she *can* teach it. If we had put into the statutes that the teachers of the common schools of this State should teach the Latin language, those teachers would have fitted themselves to teach that language, and would have taught it, and there were plenty of schools in the State where they could learn the Latin language without great expense, and the teaching of Latin, if it had been required by our statutes, might have been successful, even though not desirable. But when the teaching of agriculture was required, the teachers were not fitted for that line of work, and they did not know where to go to fit themselves for it. There was only one place in the State of Maine where they could go, and that was to the State College, and of course it was out of the question for all the teachers of Maine to go there and educate themselves for this work. That is one of the reasons why agricultural teaching in the common school failed.

Another reason, perhaps of less importance, was the fact that the men in charge of it attempted too much, they aimed too high, and they shot over the heads of the children. This matter has been tried not only in this country, but in European countries. I find in France the study of agriculture is compulsory. They met there the same trouble that we met. When the study of agriculture was introduced into the common schools the teachers were not fitted to teach it, but a provision was put into their law which helped them out in a measure. This was that the normal schools which educated the teachers (and I understand there are many of them in that country) should establish a course in agriculture. In that way they are attempting to overcome the greatest difficulty in the way. I believe that the study of agriculture in the common schools can best be accomplished in an indirect manner. I want to speak to you of what has been done in the state of New York, where the attempt has been made to teach nature studies, which is along the same line. Cornell University, I think it was, issued some leaflets, of a few pages, upon some common subjects in nature, some phenomena that arise in nature. These leaflets were issued by the professors in the college, and these professors went right out into the common schools and talked with the teachers, and with the school officers and the pupils. The subject of one of these leaflets is "How does a Candle Burn?" We see candles burning, we see that a candle is made of tallow, and a wick. When we apply a match we see the flame. We see all those things, and yet many of us in seeing do not see after all. I sometimes fear that is one of the troubles with us. We go through the world seeing and yet we do not see. In that leaflet many things were explained in relation to the candle, what made it burn, how it burned, etc. I remember one question which was asked,—Was there anything else burned besides the candle and the wick? This, of course, led the children to look about. They found that if they put a candle inside a lamp chimney and placed it flat on the table or floor and covered the top, the candle would go out. Why was that? They performed other experiments, in some of which the candle would go out, and in others burn more brightly. And under careful guidance they worked around to the point that there was something in the air necessary for the candle to burn. They found that that element in the air was oxygen. If the oxygen burned it helped the candle to burn. They found that one of the results was carbonic acid, and that led to the study of carbonic acid. After the wick burned it became black. This led the children to the study of carbon, something in which all farmers are interested. This method of instruction appealed to the children. Although they had seen hundreds of candles burning, they had never though much about it before. They were led to observe, and that is one of the most important features of education. I saw a picture the other day of some men standing by some machines, and each man had a hen under his arm and had her head tipped up and was applying food to the machine and cramming the hen. Some have thought education was secured in a manner similar to that; the children go to school and a certain amount of knowledge is turned into them, and then they are fitted to go out and do business. That is the old idea but it is passing away. While we need knowledge and must have it, education means development, it means growth, it means training. This way of taking up nature studies in New York proved a success, and hundreds of those schools have become interested in the work. Those children have become indirectly interested in agriculture through the introduction of nature studies in this manner. Other states have followed in the same line of work.

I remember a leaflet set out by Prof. Plumb of Indiana upon the care of domestic animals, and there is a good deal of valuable information in it, for farmers as well as children. Children are interested in nature studies, whether they are to be farmers or not.

Let us come now to the secondary schools, the high schools and the academies, and let us see about the teaching of agriculture there. You are all acquainted with some high school or academy; you are familiar with its work, you are familiar with its courses of study, but have you ever found one, or heard of one, in the State of Maine, that teaches agriculture in any way? Many of our high schools will teach young men to become merchants, they will fit them for college, they will put them on their way towards some learned profession, but I have failed to find yet an institution of that order in the State of Maine that pretends to teach agriculture; and what is worse, yet a solemn fact, the boys and girls of this State who get a high school education, who advance as far as that point, do not go back on to the farm. Now that is one of the most serious things that the farmers of this State have to contemplate, in my opinion. What does it mean, my friends? What does it mean that the boys and the girls to whom you give the best educational facilities leave the farm? It means a great deal. I have heard men say that farming did not pay. It is barely possible that their boys may have heard them say that, and it has been the means of inducing them to leave the farm. Do you know what I think when I hear that expression? I always wonder why that man went into the business if it does not pay. It is a sad commentary on his own judgment. What must a man think of himself, what must his neighbors think of him, when he will deliberately go into an occupation which he declares does not pay? But farming does pay. It pays the man who puts business principles into it, if he is fitted for it, as well as any other business. The farmer is apt to envy the man who draws a salary of $800 or $1,000. But there are hundreds of farmers in the State of Maine that, reckoning in their living expenses, reckoning in the things they draw from the farm and use in their families, are making more than that. There are hundreds of farms in the State of 200 or 300 acres from which the gross receipts are from three to five thousand dollars. There is no calling where there is a greater opportunity than there is in farming today. But the price of success is work, and eternal vigilance. You may not find a million dollars on your farm; you may not find a gold mine; you may not be successful in five years, but in a life time you can be. The point of time will come early in life with those men whom you envy on account of their salaries when they will be crowded out by younger and fresher men, but the farmer's work goes on with increasing results as the years of his life go by, so that his last years may be his best years. We ought to have agricultural teaching in our high schools. The farmers pay their share of the bills. Can we not bring this about? I find in looking the matter over that the state of Minnesota established a secondary course of study at the university, and even when there was but that one school in the state and that at the university, it became popular, having some years as many as 300 students. And I find on further investigation that that example has been followed. The state of Wisconsin, for instance, has gone further. They have made a provision whereby the state will appropriate twenty-five hundred dollars for the establishment of an agricultural school in any county that accepts it, and there is also a provision made that the school shall have three acres of land where the teachings may be demonstrated. Other states are taking up this matter of education for farmers and establishing agricultural courses in the secondary schools. If we had had those courses established previous to the introduction of the study of agriculture into the common schools, then there would have been institutions where the teachers might have fitted themselves for the teaching of agriculture.

I will now speak about agricultural colleges. What are these agricultural colleges? There is one in every state. The United States government made an appropriation to establish them. It gave that appropriation to the state and the state established the colleges. In some states they are called colleges of agriculture; in others, colleges of agriculture and mechanic arts; in some they are called universities. In the state of Massachusetts we have a college of agriculture. I think it is the only public institution in this country where agriculture is the only thing taught. That institution has an income of $75,000, an income almost equal to that of the University of Maine, and there are eighteen or twenty professors and about 150 students. This institution is doing a grand work. I presume those men and women who graduate there do not all go back on the farm. As I understand it, these agricultural colleges have a four years course in agriculture, the same as they do in electrical engineering, for instance, or mechanical engineering. There is a four years course in agriculture, where a boy gets a liberal education in literature and the arts and sciences that are particularly applicable to agriculture, and when he leaves that institution there is a call for him to become a teacher, or a journalist, or an investigator in some other college or experiment station. That is the field of work for which the four years' course at our agricultural colleges seems to fit young men. There are other courses also. For instance, at Orono there is a two years' course,—a boy can go there and stay two years and study practical agriculture, he may go there and stay one year, or he may go there and stay one term, eighteen weeks, and not pay any tuition and not be obliged to be examined for entrance. And then there are short courses, one this winter of six weeks, in dairying, one of three weeks in horticulture, and one of two or three weeks in poultry management. These are for the farmers as well as the boys. All the expense is for board and transportation. In the Western states the boys and girls are flocking into these colleges. I read an article in Hoard's Dairyman the other day, in which it was stated that in the state of Minnesota 400 students had entered the three years' course in agriculture and 300 had entered the course in dairying. Think of that! Three hundred students in one state entering the course in dairying! My friend tells me that the sentiment in that college, and in that state, is all in favor of the teaching of agriculture. The majority of the students go there to study agriculture, and go back upon the farm. The same is true in many of the Western states. The sentiment is different here. Who is to blame for it? I was at the University of Maine yesterday, and I find that there is a class of 189 students who have entered this year. Thirty-one or thirty-two of those are in the law school. The balance were in the collegiate department proper, and I was told that ninety-nine of those men had entered the engineering departments. Now, who determined what department those boys should enter? They went there and took their choice, and only a few of them took the agricultural course, although I will say that more have commenced the study of agriculture than for a number of years past. I am afraid, my friends, that we are not appreciating our opportunities. I wish we might appreciate them more. I believe in the old adage that "Knowledge is power," and it is just as true when applied to agriculture as to running a store, or following a profession, and we shall appreciate it before many years in this State. It has been hinted that there may be a feeling on the part of some farmers against the Institution. I do not know why that has arisen or how. My friends, it does not make any difference; I say, "Let the dead past bury its dead." Let us always face towards the future; let us not be guided by our jealousies, our envies, and our prejudices. If this agricultural college, supported by the taxation of the national government and the State of Maine, is capable of doing any good for the farmers of this State, let us take advantage of the privilege; if we do not, we are at fault. If you have any boys who prefer to live on the farm, send them down to Orono. If you cannot afford to send them for one or two years, send them for the shorter courses. It will pay them; they will start in life on a higher vantage ground; their future will surely be brighter.

THE HORSE FOR THE FARM AND THE FARMER.

By Dr. G. M. Twitchell, Augusta, Me.

Among all the departments of farm work the friends and champions of each find their followers, for in the economy of nature many men of many minds fill the universe and each, following the natural trend of his desires, seeks that avenue of labor which is most congenial, or seeks to bring about those relations by which and through which this congenial line of work may be carried forward successfully.

For nearly a score of years a peculiar condition has seemed to dwarf all enthusiasm for horse breeding. The craze for speed, in the lottery of haphazard breeding, filled the barns with what had little value when the bubble burst, yet, strange to state, the owners of good brood mares sold as rapidly as possible not the trotting bred colt, which so often had not a single requisite of merit, but the brood mare, the possible fountain head of revenue. As these disappeared, breeding ceased and the West, gorged as it was with a mass of indifferent stuff, began to pour its "chunks" into our market to do the work on the farms not possible to be done by the native bred horses.

This in brief was the situation through which we have been passing, and while the conservative press and the institute speaker have been urging the breeding with reference to a famine sure to come, the sight of a weanling following its dam has been a novelty rather than a most common occurrence. The famine came. The fact of the great dearth of good road horses of size, stamina and courage forced itself upon the public mind, and buyers, who formerly could find a carload in any given section, were forced to pick up one here and another there, going over towns and counties, until the shortage has become so marked that would-be purchasers have practically dropped out of New England and seek their supply from the ranches of the far West.

Meanwhile the greatest curse which could befall our New England agriculture has been met in the dull mettled, low headed, slow motioned, draft horse of the prairie. That it can do fair service, is faithful and willing there is no question, but it grew under other conditions and as a rule is not fitted to the bracing, energetic life of this climate. It can neither inspire pride in the farm nor the farmer, and pride is the one factor which dominates life.

Make the distinction clear and sharp between the trappy, fast walking, bold draft horse, walking more than four miles an hour, and the one already described. In the one case you can plow an acre in three to four hours; in the other it requires from six to eight, and New England agriculture has no place today for six to eight-hour plowing. Too many ox horses are burdening our farms which might be enriched by trappy, prompt, native drivers, and the sooner we get back towards the old New England product, the Morgan type of a horse, the sooner will we find enthusiasm permeating the atmosphere about the farm home.

As a promoter of agriculture the high class road horse has no superior. If it jerks one who follows the harrow or cultivator out of old habits, it jerks in the conception of a larger, freer, better life and this ambition we must have in these hustling, bustling days when every industry is keyed to rapid motion and competition forces renewed activity.

Here is the situation which confronts the farmers of Maine, a great horse famine, a sharp demand for high class stock, the certainty that this must increase for some years, and breeding well nigh at a standstill.

Three classes of horses must be taken into account and the peculiar characteristics of each distinct type kept clear in mind in any fair discussion of this question. There never will come a day when the lover of the large, noble draft horse of size and quality will not find profit in breeding to a choice, pure bred sire, and right here is a lesson, the force of which is not appreciated. Other countries have encouraged by liberal grants the breeding of pure blooded stock, and with us, in every case where a well selected male has come into the State he has left his imprint and materially improved the quality of the stock in that section. Certainly it will be found necessary in the breeding of draft stock for the future market to rely upon these well bred, carefully selected, pure bred males, clean in the head and throat, strong in the neck, straight in the shoulder, to secure the perfect fitting collar, broad in the chest, allowing not only ample room for lung and heart capacity but also that power necessary to sustain a heavy draft; long in the fore-arm and short from knee to ankle and strong in the pastern, with good quality of hoof and a well rounded, symmetrical foot; short in the back and round in the barrel, square and full in the quarters. This is the type of horse best fitted for heavy work. With all this structure there must also go courage and elasticity of movement to insure the highest service. Here is one extreme in breeding and it offers an opportunity, sadly neglected by our farmers, by which not only our farms may be stocked with horses of great virtue and value but in the breeding of these a ready sale will be secured for all surplus animals and at prices satisfactory to the grower.

At the other extreme let me call your attention to the race horse type as clean cut and intelligent in the head, finer in bone, with more fire in the eye, longer in the neck, with extremely sloping shoulders, allowing for that extension necessary to carry high speed, flat in the bone of the leg, with long, springy pasterns and deep rather than round body, of good length, not too full or broad in the chest, long and slim in the quarters, insuring in the length from the point of the hip to the hip joint and from the hip joint to the stifle that length of stride which will lift and project the animal and sustain its speed for the mile.

One of these horses is built for quiet, though active service, under gentle treatment and with no thought of possible extreme action; the other is nervous and highly strung, requiring intelligent care and the best treatment in order that all these qualities may be directed towards the fastest possible record. Such a horse finds his champions among the lovers of the turf, those who with patience seek the education and development of all the speed possible and reaching the highest market value in proportion as the records are reduced.

Here are the extremes; between them let me put the road horse as the one best fitted to the farms of Maine and offering the greatest inducements to the careful, intelligent farmer. The horse standing 15.2 to 16 hands, weighing 1,050 to 1,150, of good color, clean in the head, intelligent in the eye, with a well shaped, arching neck, sloping in the shoulders, fairly broad in the chest, deep in the barrel, short in the back, long in the quarters, such a horse with good legs and feet and possessing courage without stint, will fit the farms of New England, doing the work thereon at a fast walking gait, and on the road prove his power to carry a load eight or more miles an hour and satisfy his owner. If your fancy is for the large, blocky draft type, then multiply these colts on your farms, breeding always with the thought of the greatest value in the individual and the highest service it can render.

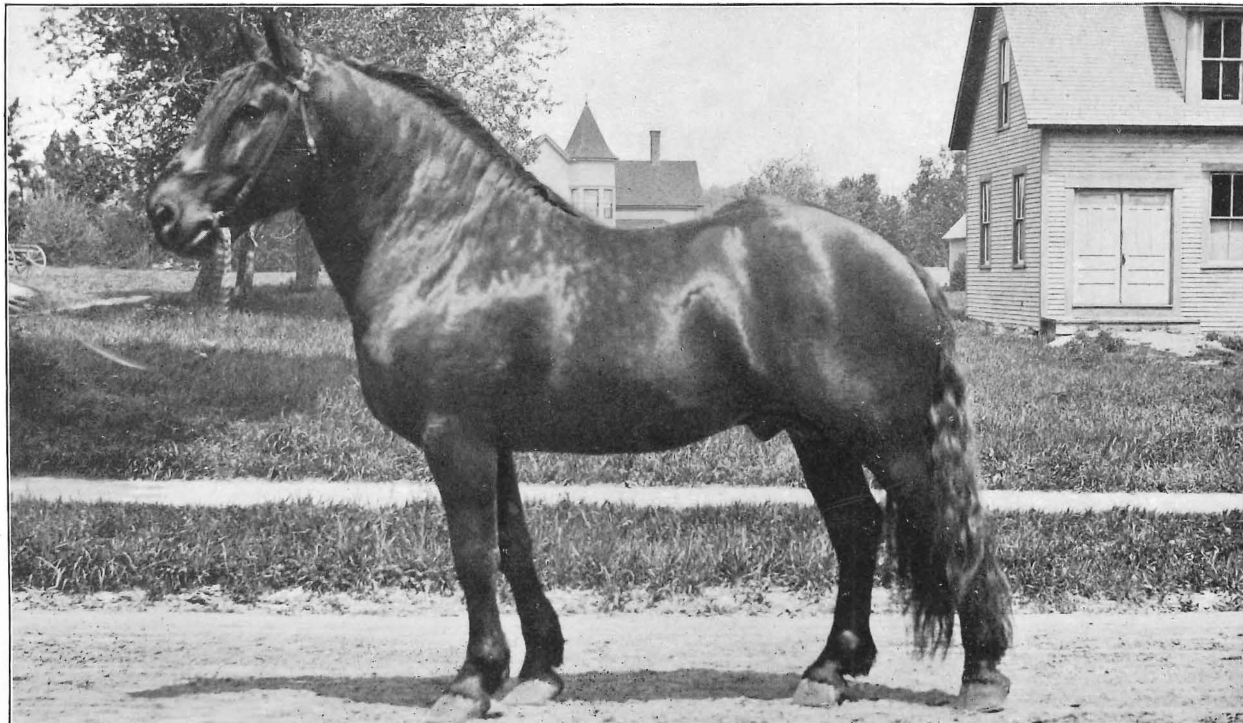
With the race horse the man on the farm has nothing to do. So much is involved in education and training, such care must be exercised in fitting before the highly strung, nervous temperament can be adjusted and its speed realized, that breeding this class can hardly be sustained in the light of our present experience, upon the farms and for general use.

You will see that the field narrows to the high class draft horse or the all-purpose, fast walking, smooth acting, intelligent, courageous road horse; and of these the state can never have too many. Thousands could be sold this spring if the supply could be obtained. Maine, which formerly occupied such an envious position in the horse markets, has been practically abandoned by buyers, and it remains for the owners of brood mares to reach back as fast as possible towards the Morgan type of horse which so delighted the buyer and brought such revenue to our farmers thirty and forty years ago.

It is a fact that the demand today is for something larger than the average of that class, which in style, action and conformation, we shall never surpass, the horse carrying a large per cent of Morgan blood.

Among the families most noted today because possessing in themselves and their breeding in largest measure the form, intelligence, size and courage wanted, the State of Maine must recognize the work done at Elmwood Farm, Lewiston Junction, by Mr. J. S. Sanborn. He brought sharply to the attention of Maine breeders the essential qualities of the road horse wanted, through the introduction of French coach blood, noted for its prepotent powers along the line demanded by the market of today and has done a service to his native State which future years will be prompt to recognize. Find your sires wherever you may, but let this general type of horse be your model, for in the breeding of road horses answering the call of the market there is sure profit for the grower, satisfaction for the owner, comfort for the driver, pleasure for him who rides, success for him who with such a team follows the plow, harrow or cultivator and better agriculture for the State and grower. With this will go an enthusiasm for farm life as numbers multiply, and the return of those days when buyers shall flock here by the scores and horses be shipped by the carload to satisfy the demands of the critical buyer in town and state throughout our country.

Among all the agencies by which and through which we may hope to develop the farm life of the future, let me place the road horse, modelled after the demand of the market of today and fitted for the high class of work demanded, as one of the potential factors, fitted peculiarly to our climate and especially adapted to our necessities. Multiply these colts on the farms of Maine and in their training the boys will find that satisfaction which will hold them to the farms, and in their services that profit which will insure comforts to the farmer. Maine can never possess too many high class, well bred, fast walking draft and road horses. Over and over again may the lesson be enforced and always will it return with added emphasis to the individual who carefully studies the situation.



GILBERT, No. 27516. Weight 1650 pounds at three years old. Property of W. H. Hall, Dover.

SHEEP.

By L. B. HARRIS, Lyndonville, Vt.

You cannot go into the sheep business without some capital, but you can go into it with less money than is required in any other branch of live stock industry. Let us assume that you have borrowed the money and must pay it back with six per cent interest. We will also assume that you are able bodied and that your wife can do the work indoors. In your condition every cent must be saved.

Your first move is to buy a team. You should buy two brood mares, which should cost you $300. You will have a farm, $1,000; sheep, $300; team, $300; and other things to the amount of $400, making $2,000 as your investment. Your ewes have not been bred, and two good strong rams are needed, and here comes an important point at the outset. A mistake in the ram is an expensive error. So far as the breeding problem is concerned, the ram is half the flock. We cannot afford expensive rams, and we need not have them. The true shepherd can find what he wants in the ranks of the common sheep. A good constitution is the first and most important requisite. The general appearance of a sheep is a good test of constitution; he should have a distinctly masculine style. As good an indication of strength in the ram as any is to place the hand on the back of his head and give a sudden push downward. If the sheep gives under the sudden pressure, don't use him. If, on the other hand, he resists your push, the chances are that he will be a good sire. His feet should be wide apart, to give plenty of room for the heart and lungs. A good sized stomach is of the greatest importance; in fact, I should reject as a sire any ram that did not have an ample place to store his dinner. For our purposes breed matters little, except that perhaps we had better not try a coarse wool, nor yet a fine. We must go slow in the matter of shelter and the sheep cannot be got up at every rain or snow, so we must keep within the middle wools. All breeds of sheep are good for their purposes, but some of the middle wools are perhaps best when every minute of the farmer's time is needed on this $1,000 farm.

Do not get a very large ram; quality rather than size is desirable in a ram. I would not get a cross-bred ram. Let us plan to have an even lot of lambs, so get either a native or a pure bred; there is little reliance to be placed on a mixed ram. Get your ewes home and feed them a bit before you breed them. Get them thrifty and do not shut them up. The chances are that their bad condition is due to their having been shut up in some place unfit for a sheep. Give them a run on a hill or in a field where they can get exercise if nothing more. Nothing is so good for a flock of ewes as clover stubble. For grain, a handful of whole oats is the best; wheat bran is good. All grain is good and all fodder except timothy hay. That should never be fed. When the ewes begin to show a little gain, turn in the rams. You have no time to look after rams and you have probably bought some well along in years. Do not be afraid of old rams; they get the best lambs.

We must provide shelter, and we have no money to hire carpenters and build expensive barns. An open shed facing the south and east, on a high piece of ground, to let the water run away from the building, is the best. This is an ideal place to winter sheep. A tight board fence as a windbreak is better than a barn cellar or basement. A shed made of spruce boughs would answer our purpose well, but room enough must be provided. Sheep know very little. They should always have at least twice as much room as they would need if they were more intelligent. We need no feed racks. The clean snow is an ideal place to feed a sheep hay. Move the well shaken hay a little farther out each feed, and at every storm begin back at the shed, always feeding on clean snow. If you have a few roots, feed them whole. We cannot afford grain now. If you do not confine the sheep in a yard, and you should not, you need not bother about water. If they can always have clean snow they will eat that and thrive, but without clean snow they suffer for want of water quicker than any other animal.

Watch for disease; take pains to kill the ticks; feed regularly. It matters little how many times a day you feed, once, twice, or three times, but the feed should be regular in time and amount. Make them eat their fodder clean. You can soon get their ration so as to make them waste nothing. You should make your ewes gain on hay alone.

You have turned your ram out late and your ewes are well on grass before the lambs begin to fall. Give them a dry hillside where they can get out of the wind. Every day the rams should be castrated and the tails docked. The best way to dock is to strike a blow with a sharp chisel on the end of a block of wood, working the skin of the tail towards the body before the blow is struck, so the skin will make a pad over the end of the tail. The most successful way to castrate is to do it as soon as the lamb can get on to his feet. Then take a pair of shears and clip the scrotum off next to the body, leaving skin enough to make a pad. If a sheep loses a lamb, be careful that her udder does not spoil.

Spring has come, and the first thing is fences. The best sheep fence is barbed wire, with posts fifty feet apart, cleated every eight feet. A sheep never tries a fence that yields a little at his pressure, but he will sometimes force himself through a fence that is rigid. To put posts so far apart the ground must be smooth, and in practice you can seldom do it, but you can approach it.

Spring also brings the question of crops before you. You should put in this first year five acres of oats. Let them get dead ripe and harvest them as hay, and feed them to both the team and sheep without threshing. Both will eat them clean and thrive wonderfully. You should have two acres of ruta-bagas. Plow in good season and harrow every two weeks until June 25th, then plant. You have killed the most of the weeds by the harrowing. When the turnips are large enough single them to twelve inches, and the most of the cultivating can be done with the horse. The turnip should get its greatest growth in September and October. For lambs, roots must be cut. For any animal with a full mouth, feed them whole. Let them sweat in piles covered with the tops before you put them in the cellar, for a week. At the same time that the turnips are planted, June 20th to 30th, put in five acres of rape into which you can turn the sheep when the fall feed gets short. Make this and the turnip ground rich, and a wonderful crop will result. Sow in drills or broadcast, as suits you best. If you are skilled enough, one pound of seed will do on an acre, but twenty will do no harm. It is a wonderful grower and will clean your land. Get the land back to clover as soon as you can. Clover is the great sheep hay. Turnips (rape is of the turnip family) are essentially a sheep feed.

If you have followed my directions you will have a few choice ewe lambs to keep for breeders, the best in the lot, and will have 125 lambs that will weigh eighty-five pounds each by the middle of November. From September 15th to November 15th, on rape and the run of the field, they will gain thirty-two pounds each easily, without a handful of feed except a daily ration of salt, or salt kept in a box near the rape.

Now if you have improved your buildings a little and have a good bed in your sheep sheds you may breed earlier and get your lambs well started before grass, but you must have some turnips for the ewes and crushed oats for the lambs. Then you may have 100-pound lambs by November 15th; that is, the whole bunch should average that. If you will do this you can get five to six dollars through for them. Meanwhile shear as early as you can, and shear the sheep yourself. Do not hire a man to do anything. A few days after shearing, dip the lambs for ticks. Do this within a week, as the ticks will be on the lambs the first few days after shearing.

Now let us see what we have to sell after a year or two of our experiment. With the two mares we should have one colt each year to sell. We shall have 150 fleeces, 125 lambs, and a few fat sheep. If you have followed the rape, turnip, oat and clover policy, the fleeces after the first year will average eight pounds, and the fat sheep will bring eight to ten dollars each.

I challenge any system of farming to make a better showing and I have not said a word about the apples that are coming on.

I have closely followed a case that I know of in my presentation of this experiment, except that the man had but one horse. Now I want to say a word to the housewife. To you falls the care of the food of the household. See to it that in addition to the pig you have a couple of good, fat sheep for your own use. Kill them any time after the flies are gone. See to it that they have nothing to eat for at least twelve hours before killing (twenty-four hours are better) so you will get no bad flavors from food eaten. When dressed, hang them in a cellar, unless it be

ISLAND SHEEP.

a very moist one, or in some dry room where they will not freeze. Do not let them touch anything. Do not cut them until they have hung at least five weeks, then saw off the neck for a stew or pot roast; next take the flank and ribs and cut in squares for stews, and so on as you need meat on the table, until when you get to the thick chops and loins you will have a food that millionaires would envy. It will keep any length of time, if you keep it hung up and keep the air fresh. If the inside gathers a blue mould, it will do no harm. Carry the meat out and lay it on the saw horse in the sun an hour if you want to get rid of the mould, or wipe it off with a dry cloth. In this way, all winter long you can now and then have a choice piece of sweet, tender, healthful meat at small expense. In my opinion, mutton is very much better after it has hung about two months. Then instead of the fat being distasteful it is as palatable as butter and will not cleave to the roof of the mouth like fresh killed mutton. But if you lay the meat down or hang it against anything, it will soon spoil. Hung as it should be, it will never spoil.

Let me give you a recipe for cooking a leg or shoulder. Clean it, but do not soak it. Put it in a pot with water enough to cover it well, and keep a record of the number of cups of water it takes to cover it. Put in a little red pepper,—a pepper of your own raising cut up is best. Let it boil slowly until you think that fifty minutes more will make it tender. Skim off the extra fat so that the water is as high in the pot as when you began, salt and pepper. Then put in one cup of washed Carolina rice for each five cups of water. Do not stir the meat or the rice but cover at once and boil for fifty minutes. Take it hot to the table and serve the rice instead of potatoes.

Meat of itself never spoils, it can only be assailed through moisture on the outside. Hung where it can dry on the outside it always remains sweet and improves in flavor and tenderness with time.

FARM RENOVATION.

By E. P. Mayo, Waterville, Me.

I am asked to address this company on what I know about agriculture, but really I have to admit on the start that I know little or nothing about agricultural operations as conducted today on practical lines. If you wanted me to tell you how a poor man, rich only in an abundance of boys, could take a depleted farm and bring it into a state of fertility in the space of a few years, without a dollar to expend for improved machinery or for fertilizers, I could do it, because nearly forty years ago I was an active participator in just such an operation. How many of us who have passed the meridian of life could do what my father successfully accomplished on a small, stony, run-out farm? When he undertook the problem he had other duties that took more or less of his time, but which paid him a very small stipend for the time thus employed. This rèduced the working force very considerably, and the only aid he received was from two small lads who had no more relish for hard work than the average boy has. The task that he undertook was not only to bring the farm back to a state of fertility, but to support his family therefrom in the meantime. Does any one for a moment think that it was a light, trivial matter? If so try it, and you will be corrected in your error. When he commenced the task he commenced it with a sturdy determination to win, and that is one of the elements that should not be lost sight of in considering the problem under discussion. He did not take hold of it to see if farming would pay. Neither was he a trained agriculturalist, either in theory or in practice. But he had a theory as to how a farm should be conducted to be successful, and he had the courage of his convictions, and nearly single handed, as it were, he undertook the almost herculean task.

Nerved with the enthusiasm that always goes with the determination to succeed, he took possession of the farm, and the first winter had to buy hay to winter a single cow and a horse. How well I remember the plans and thought that were given during that long, cold winter as to what should be planted and sowed the next season that would not only go the farthest towards wintering the family but that would help support the largest stock. It was so long ago that I cannot recall just what the next year's crop was, but I remember very distinctly how carefully it was husbanded and watched over, and what a bountiful yield we had, everything taken into account. And above all do I recall how carefully the barn dressing was looked after and put where it would do the most good.

The next winter we wintered two horses and two cows. This gave us a team to work with, and the two cows produced milk and butter enough so that we had something to sell every month in the year. Things were now progressing. We had become manufacturers, and that winter, with double the stock of the winter before, we had double the amount of dressing for our poor, impoverished fields, and a corresponding increase of crops, which in turn allowed us to winter two more cows and make a start not only on a flock of sheep, but to winter four calves, a pair of steers and two heifers. Now we were surely getting along finely, but not a dollar had been spent for fertilizers nor for help on the farm. When we thought we could spare any money in this direction we put it into fodder, which allowed us to winter one more head of stock, and thus increase our fertilizer supply and our holdings of live stock.

We had now got to the endless chain phase in farming. We kept more stock each season so that we could raise more crops, and we raised more crops so we could winter more stock. Thus you will see that things assumed a very easy condition. Of course there was lots of hard work yet to be done, but the labor brought us quick returns for those times, and each year we could see that we were making sure, if not rapid advancement. When I finally left the farm to engage in other pursuits we had four horse kind, six cows, a yoke of four-year-old steers that no one had ever held a goad over but myself, a yoke of three-year-olds, two-year-olds, yearlings and four calves, and twenty-five sheep, not to mention a good showing in the poultry yard. In the meantime we had built a large, capacious barn, made necessary by the increased fertility of the farm, which, by the way, was under a high state of cultivation, thanks to a well polished plow, operated by a good team, which never was allowed to lie idle because there was nothing to do. The mortgage on the farm had been paid, the house rebuilt, and we were making money, and it was all done without commercial fertilizers or financial backing, and yet today we are told that a man who takes up a run-down farm and attempts to pay for it, much less to get a living for himself and family, has a task that no wise man would undertake. If it could be successfully accomplished forty years ago what is there to hinder its accomplishment today? If the problem could be successfully solved in a rocky, sterile portion of the state, what is the difficulty in accomplishing it in the fertile Kennebec valley?

In the face of this recital of plain, unvarnished facts who is there in this audience that dares tell me that it cannot be duplicated with much greater ease and much less hardship today? You, Mr. Commissioner, would have accomplished the same result as far as restoring the fertility of the farm is concerned as we did, and with much less physical effort, because you have the means, as many gentlemen here before me today have, to purchase ready made, ready mixed fertilizers that we had not only to manufacture from the raw material, but mix in the soil by our own unaided efforts. If this recital does not prove an incentive to some one to go and do better under the improved conditions afforded him, I shall be disappointed, to say the least.

But I hear some one saying "If you were so successful on a farm why are you not there today?" or "Why did you ever leave a business that you were so well adapted to prosecute with such rare success?" It was a case of the man with the hoe. I was then a mere boy, and farm life with all its successes was to me as tedious and uninviting as it ever was to any lad, or is to any one today. I simply performed my humble part from a sense of duty. While others were struggling to their last degree of strength, I could not do less than perform my small part, and I was willing under the circumstances to do it until I had seen the problem before us solved, and a ray of light opened up for me in another direction. You must remember that forty years ago the social conditions on a Maine farm in the back country towns were entirely unlike what we find today. For instance, the rural delivery was never even thought of. The telephone had never been dreamed of, even for the most popular sections, and the local Grange was twenty years from its establishment.

What, then, was there left for a lad who had ambition to do something and see something that others were doing and seeing in the world? Not very much, I think you will all admit. Even the Farmers' Institutes, that have done so much to encourage and stimulate the farmer boys and their parents of late years, had not been thought of, and as for a course in the University of Maine which is so highly prized nowadays by many of the young men who are to adopt dairying and other branches of agriculture as their life work, it was a long way from realization in our State. As a lad on the farm, if I could have had the encouragement and help that the boys of this town and this community are enjoying today, I have no doubt but that there would have been one less poor editor and one more tolerably successful tiller of the soil.

SUCCESSFUL POTATO CULTURE.

By E. A. ROGERS, Brunswick.

Potatoes are one of our quick money crops. It takes years to grow an orchard, or breed up a herd of cattle, but a crop of potatoes can be planted, grown and marketed in less than six months time, and I believe at a greater profit per acre than any other hoed crop which we grow on a large scale. Aroostook county last year produced about six million bushels, at an average price of sixty-five cents per bushel, or nearly four million dollars. The net profit on many of her farms last year would have bought those same farms at the beginning of that season. And can we here, in the older parts of our State, share in this prosperity if we adopt methods used in that supposed favored county? From my own experience I must unhesitatingly say yes, and I believe even greater profits await the progressive potato grower in this section than in our northern county.

There are many reasons why potato growing in this part of our State should continue to be profitable. These reasons are: First, the two largest potato producing states, which most seriously invade our markets (New York and Michigan) have as yet sprayed but very little for blight. A number of Michigan farmers have, within a few weeks, assured me that the yield in their state would not average fifty bushels per acre, largely on account of blight, and the same conditions prevail in many sections of New York. The farmer there has not only to learn that he must spray, but, what is more important, how to spray. This is one of the most essential features in potato growing, and it will be years before the farmers of those states master the art.

Second, we are near the market, which means less freight; and besides, there is a growing home demand.

Third, I believe we can raise as large a crop, of fine quality, as can be produced anywhere, and that on commercial fertilizers alone. A yield of from three to four hundred bushels of marketable potatoes per acre can be raised with practically no hand work. And let me say right here, that there is no limit to a man's farm operations except his own capacity and the size of his farm. The size of his manure pile has nothing to do with it. Make and use all the manure on your farm that you can, and then get commercial fertilizers. We can raise potatoes for less than twenty-five cents per bushel on commercial fertilizer and figure our own labor and that of our team at a price of which we need not be ashamed. I will try to give you methods showing how this can be done. We will first take up plowing.

The depth to plow depends on the soil and its condition. A clover sod of two years standing does not need to be turned as deep as an old witch-grass sod of twenty years growth, which will take all summer to rot down. The latter would need to be plowed from eight to ten inches deep. Fall plowing is preferred, as the action of the frost will help break down and fine the soil. Another important point in fall plowing is that if land is broken up then the sod will get settled down together, but if broken up in the spring it acts as a drain, drying out the soil quickly. Commercial fertilizers must have moisture to become available. To ensure this we must practice breaking up in the fall, and must also run our fertilizer as deep in the drill as possible in order to get it down where the ground will be moist, thus making it available for the growing plants.

How much fertilizer shall we use per acre? On our old fields in this part of the State I should not advise less than one ton of high grade goods, putting as much of this in the drill as you can get there with the planter and as deep as you can get it, and applying the balance broadcast just before you cultivate and bury the potatoes, which will usually be from three to four weeks after planting.

The ideal time of planting in our State is between May 12th and 20th, but under our new method of protecting from bugs and blight it can be carried into June and good crops produced; but the crop is not usually as good as when planted between the dates named. The harrowing should begin as early as possible, and the field should be harrowed from seven to ten times, on our heavy soils, the last of these being as deep as possible; and if they should extend over a few weeks' time, all the better.

We now come to the selection of seed. It is better to use nothing but smooth, sound potatoes, not too small nor too large, if to be planted with a planter, and I believe we cannot afford to plant in any other way. A potato about the size of a hen's egg, or a little larger, is, all things considered, the best. A man who is planting only an acre or two does not consider the labor of cutting the seed of much consequence, but with the man who is planting ten acres or more, it becomes a matter of importance, and with a medium sized potato the labor of cutting is very much lessened. Take such a potato, cut the stem end off about one-third the length of the tuber, and split the remaining two-thirds, beginning at the seed end. This gives three pieces of uniform size, and you will always find two or more eyes to each piece. This method of cutting saves time, as it is only necessary to give one good look at each potato as you pick it up, to be sure you cut the stem end off first, and such seed will work much better in a planter than if cut in all shapes and sizes. As it is not desirable to cut the seed much before planting, the saving of time in cutting is of value. A few hours exposure of the cut surface of the seed to the air to dry it off is of benefit, but if it were possible I would not have seed cut more than a few hours before planting, and would rather plant as cut than have it kept over for even a few days. The only objection to using freshly cut seed is that the fertilizer will stick to it, the acid eating into the freshly cut surface. This objection, however, is very slight with some planters.

How thickly this seed is to be used in the drill depends somewhat on the fertility of the soil. A naturally rich soil could handle more seed than a poor soil. I plant about fourteen inches apart in the row, with rows three feet apart. I think this is about right for land that has not been plowed or fertilized for fifteen to twenty years and does not produce a half-ton of hay per acre.

Get the rows started straight when planting, and keep them so, as much better work can be done, both in cultivating and spraying. The cultivator should be started as soon as the planting is finished. A span of horses with a riding, spring-tooth, double cultivator is much the best, as not only can the work be done twice as fast but it can be done much better in all ways, especially if there is any witch grass. Keep the cultivator going at least once a week,—twice a week if you can get time, running as near the rows as possible, and if this work is properly done you will find that you will not have a weed or any witch grass between the rows by the time the potatoes are breaking ground, but all clean, loose dirt. The only weeds will be along the top of the row, which should not be more than six or eight inches wide. When the potatoes are breaking ground, no matter if some of them are two or three inches high, take the horse hoe or shovel plow and bury them up, not too deep but deep enough to cover any little weed and a good part of the witch grass. This will leave your field just as free from weeds as when planted and will hardly check the potatoes. A potato or thistle will readily force its way up again through a few inches of loose dirt, but all small weeds and a good part of the witch grass will be killed. Keep the cultivator going until the potatoes are fifteen to eighteen inches high; when they are from six to eight inches high, spade or hoe them up again, throwing the dirt so that it will meet along the top of the rows. If this work has been properly done, there will be no need of any work with a hand hoe, unless there are thistles in the field, which will have to be cut out from between the hills by that method. The object is to do all the work with the team and save the expensive hand hoeing.

SPRAYING.

I am often asked, At what time do you begin to spray? I usually begin when the vines are from six to eight inches high, but always as soon as I can find a single tiny slug hatched out, and I think, taking one year with another, that this is soon enough. The first three sprayings should not be over a week or ten days apart at the most as this is the period of the most rapid growth of the vines and insecticides should be used at each of these first three applications, especially if bugs are plenty. These should be followed by one or two more applications, at periods of two weeks apart, of the Bordeaux mixture, and if there are any slugs, if only a few, an insecticide should be used. Do not try to save money by not using Bordeaux mixture at all sprayings, as it will be mistaken economy, and go over the piece and back on the same rows. In this way only can you be sure that you have reached both sides and all parts of the hills. This is especially important at the first three sprayings, and important at all of them. The few minutes extra it will take per acre will be many times repaid in yield of tubers, and in this way we are sure that we shall not lose our crop by rot.

SPRAYERS.

No farmer who has an acre or more of potatoes can afford to get along without the use of a four rowed horse sprayer, and the best of these are made here in our own state. I want to give a word of warning against getting a low pressure or cheap machine. A poor sprayer is one of the meanest implements a man ever owned. Spraying, to be effective, must be done thoroughly, especially in a season like the past, and it cannot be done thoroughly with a low pressure sprayer. As perhaps some of you do not understand the principle of spraying for blight, I will try to illustrate. If you could take a hill of potatoes and dip it into Bordeaux mixture four or five times during its growing period, that hill would never be struck by blight, or its tubers by rot, as you would have coated leaf, stem and stalk with the Bordeaux. Now we cannot hope to do as good work as this with a sprayer, but we must come as near to it as we can, and we cannot begin to do this with a low pressure machine. If we have a high pressure machine, of perhaps sixty pounds, and use a fine nozzle, we will get our spray like a jet of steam from a boiler, forcing it among the leaves of the plants, coating the stems and stalks and to a large extent the under side of the leaves. A barrel of mixture with a high pressure will go farther and do better work than in a low pressure machine.

A very good pump sprayer, all fitted for work, can be bought at retail for thirty-five to forty dollars, while the power sprayer will cost from sixty to sixty-five dollars for the one horse machine. The hand pump machine will do good work if you have a good man on the pump, but it is hard work to keep the pressure up where it ought to be, and the power machines are much more satisfactory. Do not buy a sprayer without first looking at the agitator, as this is one of the most important parts, and be sure that it extends across the barrel or nearly so, whether the barrel is upright or on its side, and that it plays close to the bottom. In no other manner can the mixture be kept perfectly stirred and even work with Bordeaux mixture ensured.

WHAT IS BORDEAUX MIXTURE?

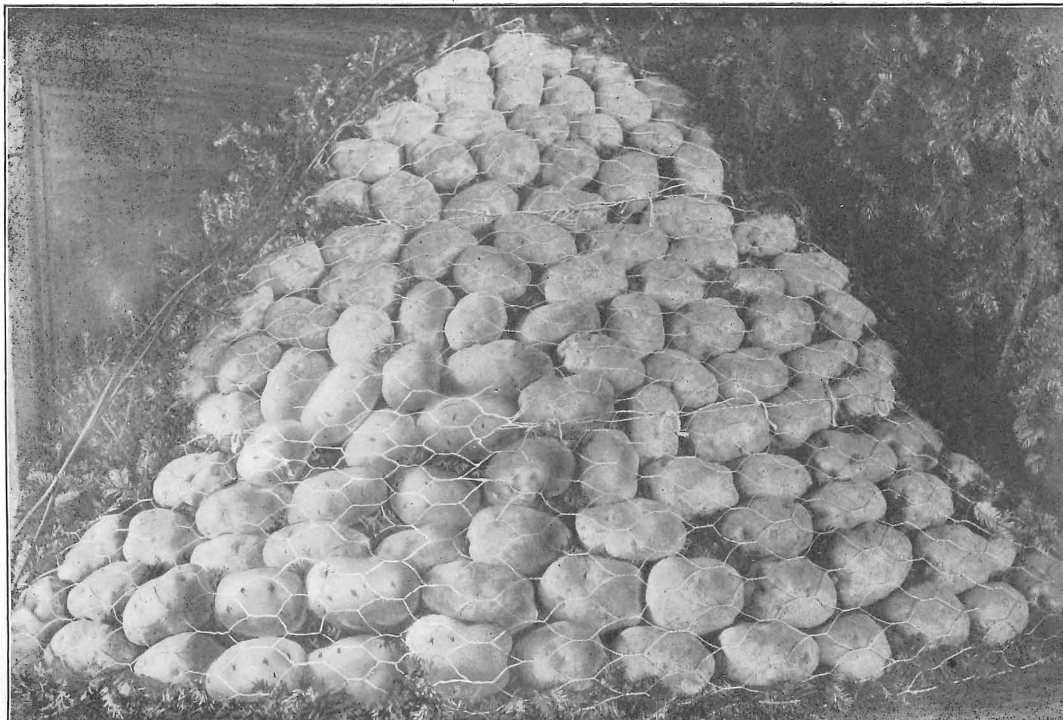
Bordeaux mixture is the proper mingling of two mineral substances, viz., copper sulphate or blue vitriol and common lime. As my subject is potato culture, I will give the method used by me in preparing the mixture for potatoes. It should be borne in mind that for plants of tender foliage mixture of this strength must not be used. I find that it is a great saving of time to make what is known as stock mixtures, as these will keep indefinitely, or until mixed together. Get two strong barrels, holding fifty gallons each. Oil barrels are the best, as they will not dry out as quickly when exposed to sun and wind. Dissolve in one of them fifty pounds of copper sulphate; this will give one pound of sulphate to each gallon of water. Pour into the other barrel about three pails of water and then turn in fifty pounds of good, unslacked lime, having at hand a stout paddle for stirring. Watch carefully when this begins to boil and stir constantly, adding more water as it slacks to keep it from burning, the object being to cook the lime without burning. When this is properly slacked the barrel will be about half full of the lime which will be about the consistency of mush. If not desired for immediate use it is well to let it remain in this state for a few hours before filling the barrel with water, as cooking dissolves the lime better, there being less coarse material to strain out. Before using, fill the barrel with water and stir. This gives you one pound of lime to each gallon of water. This mixture, as well as the copper sulphate solution, will keep indefinitely.

If your sprayer holds fifty gallons, when it is desired to spray pour five gallons of the copper sulphate solution into your sprayer, add clear water enough to fill about half full, and then add fifteen or more pounds of Bug Death (this should be mixed in water enough to run easily in a pail, and then turned into the sprayer before the lime solution is put in) ; now put in five gallons of the lime solution, stir thoroughly and fill the barrel up with water. Mixed in this way the copper solution will not curdle the lime and clog the strainer over the feed pipe. You now have a mixture that is not only the most deadly to bugs but the best fungicide known. There are two ways of dissolving the copper sulphate. One is to put it in a coarse bag and hang in the barrel of water, near the top, but with fifty pounds of vitriol this is rather slow. The better way is to take a box about one foot square, inside measure, knock the bottom out and tack on a piece of fine copper or brass netting; then nail on two cleats, one on each side of the box near the top, so you can set it in the top of the barrel, the box resting on the cleats and the bottom of it being about six inches below the top of the barrel. Put the fifty pounds of copper sulphate into the box and pour the water to fill the barrel through it and the box, and by the time the barrel is full the sulphate will be about all dissolved. The balance will be in the best possible condition to dissolve rapidly, and will be dissolved in a very few minutes.

INSECTICIDES.

Insecticides are of two classes,—Bug Death, which is non-poisonous and is in a class by itself, and the arsenical poisons, consisting of Paris green, London purple, Arsenate of Lead, and such arsenical mixtures as Black Death, Quick Death, Kno Bug and many more, all having arsenic as their killing basis and being in no way superior to pure Paris green.

On my experiment field at my home in Brunswick this season the net profit per acre of using Bug Death over Arsenate of Lead was $29.42, and over Paris green $38.50. This is figured at 75 cents per bushel, the price I am now getting in 100 bushel lots, in my local market. This would make a total profit of from 160 to 200 dollars per acre. Surely the farmers of Maine need not go West to make money. A large part of the wealth of the western farmer is due to the rise in farm values, and we shall see the value of our farms double in the next ten years. The time is again coming when a man will be proud to say that he is a farmer.



POTATOES GROWN BY E. A. ROGERS, BRUNSWICK.

REPORT OF PROCEEDINGS

OF THE

STATE DAIRY CONFERENCE

UNDER THE CONTROL OF THE

MAINE STATE DAIRYMEN'S ASSOCIATION AND DEPARTMENT OF AGRICULTURE

HELD AT WATERVILLE, DECEMBER 3, 4 AND 5, 1902.

The State Dairy Conference at Waterville, held in connection with the Maine Dairymen's Association, was a meeting of much interest. A large number of dairymen and creamery men of the State were present. The exhibit of dairy products and of dairy and farm machinery and appliances was noteworthy from its extent and the attractiveness of its arrangement. The dairymen were cordially welcomed by the citizens of Waterville, a very pleasant reception being tendered them on Wednesday evening, December 3d. The sessions on Thursday were of much interest. Addresses were given by Dr. L. Frothingham of the Harvard Medical School, Boston; Prof. H. H. Wing, Cornell University, Ithaca, N. Y.; Prof. J. W. Sanborn, Gilmanton, N. H.; Dr. Geo. E. Fellows, president University of Maine, Orono; Hon. J. A. Roberts, Norway; Prof. G. M. Gowell, Orono, and Hon. R. W. Ellis, Embden.

The Friday morning session was devoted to the annual meeting of the Maine Dairymen's Association. At this meeting the president of the association, Hon. Rutillus Alden of Winthrop, was chosen as a member of the advisory council of the Maine Agricultural Experiment Station for the coming year. It was voted that the Commissioner of Agriculture be directed to confer with the officers of the Maine State Agricultural Society, the Eastern Maine Fair Association, and all other agricultural societies in the State which receive three hundred dollars or more annually from the State for the promotion of agriculture, and urge better methods of stock judging at their fairs.

Remarks were made by prominent creamery men and dairymen in relation to the best methods of improving dairy products, and the advisability of an organization of the creamery managers in order to better harmonize their interests.

A committee on resolutions was appointed, consisting of Dr. G. M. Twitchell, Augusta, Prof. G. M. Gowell, Orono, and Hon. J. A. Roberts, Norway. The following resolutions were presented by them and adopted by the meeting:

Resolved, That the members of this association desire to express their obligations to and testify their appreciation of the lifelong devotion and faithful services of Major H. E. Alvord, Chief of the Dairy Division, in behalf of our dairy interests.

Resolved, That renovated butter is second only to colored oleomargarine as a counterfeit and fraudulent competitor of all genuine fresh butter and should be subjected to similar legal restrictions. The provisions for taxing and stamping renovated butter, included in the so-called Grout bill, are approved, and the regulations for identifying this article when sold, which have been made and published by the Secretary of Agriculture, are fully commended. That officer is respectfully urged to require strict compliance with those regulations.

Resolved, That as members of this association, devoted to the advancement of our dairy interests, we desire to express our sincere obligations to the citizens of Waterville, city officials, members of the Board of Trade and Pomona Grange, for the grand reception, the free use of City Hall and the armory, the generous hospitality and cordial assistance which have contributed so much to the complete success of this Conference.

Resolved, That our thanks are due the hotels of Waterville and the railroads for reduced rates.

Resolved, That the welfare of the dairy and creamery interests of Maine requires the appointment of a dairy instructor, whose duties shall be, first, to familiarize himself with the dairy industry in all sections of the State, and by personal work seek to harmonize and make common the interests of all dairymen and creamery men for their mutual benefit; second, to give instruction to butter and cheese makers, at the creameries and the farms, and to instruct in and urge better methods in the production and handling of milk and cream, said officer to be under the direction and control of the Commissioner of Agriculture.

Resolved, That R. Alden, Chas. L. Jones and J. W. Thompson be a committee to formulate a bill in harmony with the above resolve, containing an appropriation sufficient to carry out the objects of the bill, and present the same to the legislature.

Resolved, That as members of the great body of farmers in Maine, realizing the inefficiency of the present pure feed bill, we demand such modification of the same as will ensure to the feeder greater protection and meet the purpose of the movers for the original act, and that we ask of our representatives and senators in the coming legislature prompt action in our behalf.

Resolved, That we declare our purpose to oppose the present unsatisfactory and unreasonable method of awarding prizes at our State agricultural fairs, and will labor to secure the adoption of the system of single expert judges and the use of the score card, a copy of which shall be returned to every exhibitor.

Resolved, That we pledge our most earnest efforts to promote the introduction of choice dairy stock and the improvement of our dairy product, thereby adding materially to the wealth of the State.

Some of the papers at this Conference are presented in the following pages:

ADDRESS OF WELCOME,

By Mayor Blaisdell.

As you have already been tendered a reception, in which our college president, our lawyers, our doctors and our merchants have taken part, and have listened to addresses of welcome from some of the best talent, it appears to me that anything along this line would be entirely superfluous. Therefore I will only say in this regard that I hope we shall be able to give you such accommodation and welcome as will induce you to come to our city again, and bring your neighbors with you. And right here I want to say that I fear some who would be most benefited by this meeting are not present. If I could reach all the farmers in Maine I would say to them, Go about more and get new ideas. If interested in dairying, go to the dairymen's convention, if in stock, go to the fairs; go about more, learn more, be broader men and women. I have been interested in dairying for the greater part of my life. When I was a young man we made butter and cheese the same as most New England farmers did in those days. I cannot quite remember the time when the blooming milkmaid went to the barn to milk the cows, but I do remember the old fashioned churn, and the long, hard hours with the cream that refused to be butter.

I thank you very much for bringing to us, where we can see them without money and without price, the beautiful display of dairy machines that are on exhibition at the Armory. It is very interesting to compare this machinery with the old machinery that I can remember.

RESPONSE,

By RUTILLUS ALDEN, President Maine Dairymen's Association.

In response to the able address of welcome extended to our Maine Dairymen's Association by the mayor of your beautiful, inland city, which is the pride of our State, I wish to say that this grand reception and cordial welcome have proven what we have always heard of Waterville and its citizens, that they do nothing by halves.

The generous premiums you have offered to assist us in our dairy work will never be forgotten but will be held in kind remembrance by the members of our association.

We also feel greatly indebted to this County Grange for the noble and untiring efforts it has put forth to make this meeting a grand success. We are very grateful and I trust appreciate the liberal premiums offered by the leading firms representing dairy goods.

I want also to testify to our appreciation of the efforts of the press of the State to bring home to our citizens the importance and significance of this conference and our dairy interests. Without this powerful ally our labors would surely fail.

These facts ought to be an eye-opener to our young men who are growing up on the dairy farms scattered over our State. It should have a tendency to show them the possibilities of our rural sections and the lasting value of our great industry. When we realize the fact that the dairy products of Maine in 1900 amounted to between $8,000,000 and $9,000,000, as given by Commissioner Matthews' report, and believe that it is just in its infancy and that its growth in the next decade will surprise our most enthusiastic dairymen, the question arises: Who among our wisest men can comprehend the importance of this great industry to the State of Maine?

Here is a single branch of our farming that during the year just passed has brought far more money into the State, created it, so to speak, right out of the soil, than the most enthusiastic estimates have ever claimed from all the summer boarders and visiting sportsmen combined.

It can with trifling aid be doubled and quadrupled on the same land while at the same time the land will become more valuable and the owners gain in wealth. It will be wisdom on our part if we try to foster this business.

I have no doubt the results derived from this meeting will be far reaching. As we realize the magnitude of this industry and the importance of its development in increasing the valuation of our State, I am not surprised to see our business men all over the State taking a deep interest in this branch of farming. They are willing and anxious to help us, the only question is, Are we willing to help outselves? The law that has recently been passed by Congress taxing colored oleomargarine ten cents per pound and which was enacted largely through the united efforts of the National Grange of this country ought to inspire us with new zeal.

Let us look at a few facts. I find from the report of the State Board of Assessors for 1901 that we had in our State 144,000 cows, not including two-year-old and three-year-old heifers. Allowing that the milk and cream from 44,000 cows, and all that of the heifers, is used for other purposes than the manufacture of butter, and the cream from 100,000 cows is made into butter, and estimating that they will average 200 pounds of butter per cow, annually, we have a product of 20,000,000 pounds of butter per year.

What can be done to promote this growing industry is the great question that confronts us. Much can be accomplished by education, which is the great work of our nation today and is the keynote of the success of the United States in commanding the markets of the world. Why cry down the agriculture of Maine when there is an opportunity for us to develop the grand old State in the production of the finest butter and cheese produced on this continent? I ask you, gentlemen, why not place Maine in the front rank as a dairy State while it is in your power to do so?

We should have a Dairy Commissioner or Dairy Instructor, I do not care what you call him, as our sister states already have. He should be appointed by the Commissioner of Agriculture and be under his direction so there would be no new department in the State House. He must be a man who is thoroughly posted and competent to impart instruction to our dairymen. He should assist in institute work, and should hold dairy schools for brief terms in different sections of our State, and give instruction from the feed to the marketing, in the production of pure milk and cream and the manufacture of choice butter such as you see here today, butter that will score from 90 to 100 points. Who doubts that this would be the means of increasing the price of our butter from one to two cents per pound? As you will readily see, every cent we raise the price of our butter per pound means $200,000, two cents per pound means $400,000 to the dairymen of Maine. How long would it take to pay for this instruction? This amount of money in clean cash put into the hands of our farmers would give new life to the agriculture of Maine, and our State would soon become one of the leading dairy states of this country. I beg your consideration of this important problem.

In view of the recent outbreak of the dreaded foot and mouth disease in Massachusetts, it gives me great satisfaction to be able to state that so far Maine is free and I would urge that watchfulness on the part of every dairyman which will protect our State. Eternal vigilance is the price of liberty, and eternal watchfulness and enterprise are the price of progress.

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FOOT AND MOUTH DISEASE.

By Dr. L. Frothingham.

(Stenographic Copy.)

It has occurred to me that perhaps the simplest manner of bringing this subject before you would be to ask myself a series of questions and then proceed to answer them. I fear that even by this method a great many of the most important points which many of you would desire to know will escape us and consequently when I have finished I hope that you will ask me any questions that you desire to ask, and I will answer them to the best of my ability.

In the first place I will ask the question, What is the foot and mouth disease? Foot and mouth disease, or as it is also known, hoof and mouth disease, is a very acute, exceedingly contagious disease of animals, especially of cloven footed animals. It manifests itself by the appearance of vesicles, or blisters, within the mouth and upon the feet. It is one of the most contagious diseases known affecting animals.

What is the history of this disease? Foot and mouth disease has been known for centuries, probably for two thousand years or more. It seems to have had its original seat in Western Asia and Eastern Europe, and there it seems to be at home. As civilization advanced, and as the means of transportation became more easy, it rapidly spread through Western Europe until finally almost all European countries had the disease. It did not reach England until 1839, and it remained there, with occasional interruptions, affecting in some years nearly a million of animals, until 1894, and then only by the strictest quarantine measures did England succeed in ridding herself of this disease. Previous to that time they had endeavored, more than once, to pass the strictest quarantine laws for the whole country, but the farmers objected so much, saying that it would ruin their business to a certain extent, that the law was not finally passed until 1893. As soon as it was passed and carefully carried out, the disease ceased in England. It reached this country for the first time in 1870, coming to us by the way of Canada, through the importation into Canada of a few infected cattle. It seemed at that time to have invaded to a slight extent certain parts of New York state and parts of some of the New England states. It lasted only a few months. Strict measures were taken and it was stopped. Since that time there was a very small outbreak in 1884 in this State. I think at that time a few cattle were imported from England and were landed at Portland and carried to the quarantine station there, and from there perhaps one or two herds in the State, in the immediate neighborhood, became infected. The disease was quickly stamped out, however, and since then we have had no foot and mouth disease in the United States until this recent outbreak.

What animals are affected by this disease? Primarily it is the cloven footed animals, cattle, sheep and swine, but the other farm animals are not exempt. The horse is occasionally attacked, also dogs and sometimes even poultry. Man is also attacked by this disease. We have many instances of men having been affected in the olden days. All the members of a cloister have become diseased by drinking the fresh milk from infected cattle. Some years ago, perhaps thirty or forty, Prof. Hertwig, a very learned scientific German, experimented upon himself. He and two of his friends undertook to prove whether the disease could be transmitted to man, and consequently drank milk from infected animals. In a very few days they became ill with foot and mouth disease. So that nearly all animals, and man as well, can be affected by this scourge.

What are the symptoms? I will begin by describing shortly the symptoms as they appear in cattle, as those are the animals in which we are more apt to see it first. Two or three days, as a rule, after exposure to the disease, sometimes even twenty-four hours after, the animal begins to show signs of sickness, uneasiness, lack of desire to feed, saliva running more or less from the mouth, general uneasiness. If at that time the temperature is taken it will be noted that it runs quite high, 106 or 107, sometimes higher. Very shortly after this, a day or two, the slobbering or flow of saliva from the mouth increases, and if the mouth is examined at such times it will be found that the mucous membrane is decidedly reddened, and in places will be observed small or large blisters or vesicles. These blisters are very superficially seated, that is, they are in the very upper layers of the skin. The skin at these places is simply elevated to a slight degree, and evidently contains a fluid. Perhaps the nearest simile I could draw is what you all have had on the hand or other parts of the body, resulting from a slight burn,—what is known as an ordinary water blister. The outer skin is elevated and contains a watery fluid. It is something like this that we see in the mouths of these diseased cattle. The little blisters may be quite small, not larger than a pin head, or they may be as large as an inch in diameter. They occur on the lips, occasionally outside of the mouth but usually on the inside; on the gums, on the tongue, on the sides of the cheek and even back in the throat. It is the serum or lymph within these little blisters or vesicles which contains the infectious agent, whatever it may be. Very shortly after they have formed they burst, and with the bursting of course the infectious agent is dropped from the mouth with the saliva, onto the floor or the food. As soon as the blisters burst they leave raw surfaces which are increased in extent by the constant motion of the mouth and the tongue, so that at such times the mouth, or parts of the mouth inside appear to be exceedingly raw, as if they had been quite severely injured. During this time of course the animal eats with great difficulty, and evidently suffers more or less pain. When the lesions or blisters are upon the foot, they appear most commonly between the bifurcations of the hoof and just above the hoof where the skin and the foot join. They are similar in every respect to those found in the mouth, simply water blisters or vesicles containing this lymph or serum, which, when they burst, runs down upon the hair or hoof. The animal at this time shows decided pain in the feet, great inability to walk and a strong desire to lie down and rest. If such animals are in the pasture, they find great difficulty in getting about in quest of food and consequently lose very rapidly in flesh. These vesicles may also appear upon the udder and upon the teats of milch cows, sometimes also extending along the belly. It is perfectly easy to see how such an affection takes place through the hands of the milker. Probably he has been handling the cow, treating her in some way, and then he milks and the infection is carried to the teats and to the udder. You can see how from the bursting of these vesicles the lymph reaches the milk and the milk is infected.

The symptoms in other animals are similar to these. In the sheep, goat and pig the lesions are apt to be confined more to the feet than to the mouth, but this varies very much. Sometimes the mouth is the only part involved, and vice versa. In pigs it is not at all uncommon to have quite large blisters appear on the snout, on the outside of the mouth and nose, instead of the inside. In birds these vesicles appear upon the mouth, tongue, gums and feet. It is not a common disease with birds. In man the disease appears in the mouth exactly as we have described it in animals. Vesicles also appear upon the face, chest, arms and hands. I remember a student at the Berlin Veterinary School who suddenly had these peculiar symptoms inside his mouth and upon the side of his face. He went to one of the professors there, and inquired about it. The professor became convinced that it was the foot and mouth disease, and inquiring into the matter found that this young man's parents had a large farm with many cows upon it, and upon this farm was the foot and mouth disease. The farm had been quarantined as well as all the products of the cows, and being unable to sell their milk and butter they had sent their boy a present of some fresh butter, which he had been eating and enjoying very much.

In man the chief danger is, of course, for those who drink much milk or those who are constantly handling cattle, and especially for children, where the milk is taken in large quantities and fresh. The disease in children is apt to be quite fatal, as it is also in calves or young animals.

What is the duration of the disease? Foot and mouth disease is very seldom fatal. The mortality is very low, perhaps one to four or five per cent, according to the severity of the outbreak. Almost all the animals, without any particular care, recover, and the recovery takes place in about three weeks. The principal danger is not in the loss of animals but in the financial loss to the community. It is only in the case of young animals, calves and pigs that are fed, perhaps, upon the fresh milk from these cattle, that there is a large mortality, that the disease proves to be fatal to any extent. With these small suckling animals the mortality sometimes reaches as high as sixty per cent.

What is the treatment? There is no treatment for the disease proper. All the treatment that is necessary is to alleviate the sufferings of the animal as much as possible, and to prevent any subsequent trouble which may be complicated with this disease. The disease runs itself out very quickly, and only good nursing is necessary. The mouth should be washed out with alum and borax, or some such astringent fluid, and the feet should be well taken care of. Good dry bedding should be provided, never moist, dirty bedding. Perhaps when the feet become very sore it would be well to use an antiseptic foot wash. Carbolic acid and glycerine is very good. Great care should be taken with the feet to keep them as clean as possible. This is a precaution simply to prevent complications. You can easily see that after these vesicles have burst we have open sores, and we all know how easy it is for an open sore to become infected, and make serious trouble, sometimes resulting in swelling of the limbs and blood poisoning, from the effect of which the animal dies.

What is the cause of the foot and mouth disease? That is a simple question to answer, because we do not know. It has been sought for many, many years by scientific men the world over. It is supposed that the disease is caused by some form of bacterium, such as many infectious diseases are caused by, but the germ has never been discovered. Much work is being done along this line. At present in Germany there are at least two commissions, of which I know, which are appointed by the state simply and purely for the investigation of this disease, to find its cause, and they have been working for at least six years and as yet have not made the desired discovery. They have, however, added very much to our knowledge. Most infectious diseases are caused by germs, by bacteria, and we know that these batceria are visible. We can see them with the highest powers of the microscope. Moreover, we can cultivate them artificially, outside of the body, in our laboratories. Now if we take what is known as a culture of these bacteria, a fluid in which countless millions of these germs are growing, and if we force this fluid containing these bacteria through a very fine porcelain filter we know that we can filter off the germs by this means. They do not pass through the filter. It has been discovered in the case of the foot and mouth disease that if we take this serum from the vesicles and force it through a fine porcelain filter, the germ goes through the filter. It goes through the smallest pores of the finest known filter. Consequently this germ, if it is a germ, is exceedingly small, the smallest thing which we can imagine, and very likely is beyond the line of our vision, even with the highest microscope. So far, then, we know nothing as to the exact cause of this disease.

By what means is the disease spread? Well, it is spread in all manner of ways. It is, of course, spread by diseased cattle, or diseased animals of any kind. It is supposed that it is even carried great distances by birds that have been infected, and some experiments have been made in this line, to prove whether birds could carry the disease or not. I remember one experiment, which consisted of feeding pigeons with the infected material which had come directly from cattle, and then the feathers of these pigeons were fed to animals, and the animals were infected in that way. It is easy to see how far the disease might be carried by this means. I do not wish to state that the disease is carried by this means very often, but I do wish to assume that it may be carried by such means. The ordinary means, of course, is by traffic, by cattle travelling from one district to another, by putting other animals into the cars in which they have been confined, and by people travelling from one place to another. A person coming from an infected farm to a farm which has never seen the disease, will carry the infection upon his clothing, and upon his shoes. The manure, also, may carry the disease from infected to uninfected regions. The milk, the cheese, all the products of the animal, may carry the disease from one region to another. So you can see the great difficulty in keeping the disease away from a locality after it has once started in its neighborhood.

What is the prevention? The prevention consists practically in keeping out all animals. You must have the strictest quarantine laws, and prevent any animal from an infected district from going into a district that is not infected. The strictest laws should be now made for the State of Maine, to keep cattle and all products of cattle from Massachusetts, Rhode Island or any of the infected states, out of Maine. This is the only way in which you can keep the disease from your borders. Quarantine the borders of the state so carefully that nothing can get in, not alone from New England, but from Canada. Keep everything out in the way of cattle until the danger is passed. I think it is also a wise precaution to take, to be exceedingly careful how you allow cow dealers or men interested in cattle from infected regions to visit cattle in Maine. It undoubtedly will occur before a great while that Massachusetts men who have lost cattle, or Rhode Island men who have lost cattle, will be coming this way to look up fresh cattle with which to supply their herds. I should consider it very unwise to let those men go into your stables, for a while at least, until we know that the disease is becoming less. At any rate, you should take the greatest precaution with these men, if they do come, and see that they have nothing on their persons that they have worn in the stables of infected districts. They should have absolutely clean clothes, clean shoes, *clean hands*. Otherwise you will never keep the disease from your State. When it has once arrived in the State, which I sincerely hope will not happen, then comes another question. Everything then must be quarantined in the strictest possible manner. All the products of the farm should be quarantined, all communication between infected districts and other districts, or infected farms and other farms, should be most carefully guarded against. No man taking care of sick cattle should ever go to a neighbor's place, in fact, he should never go on the street without changing all the clothes that he has had on when in the vicinity of these diseased cattle. All traffic with cattle has to be suspended, all marketing, public or private. No sales can be allowed. It is for these reasons that the disease is so much dreaded in a community. It means so much financial loss to almost everybody connected with agriculture or dairying or farming in every possible way. Just see in the daily papers what the steamship companies lose by not being able to transport our cattle to England! I cannot beg you to be too careful with these regulations. It may seem foolish, but I assure you that it is not, if you wish to keep the disease out, and you certainly do. You must be exceedingly careful, also, in feeding and using the milk of diseased animals. Do not use the milk or feed it to animals upon the farm unless it is first thoroughly boiled. One of our Massachusetts farmers, the other day, was told very carefully not to feed the milk from these diseased cattle to his pigs because the disease was very contagious and these animals would get it also. He was a most conscientious man and obeyed these rules to the letter. He boiled the milk before he gave it to the pigs and the pigs did not become diseased, but he did not boil the milk before giving it to his calf, and the calf died. If you take every precaution, as far as I have been able to indicate, I think you will succeed in keeping the disease from Maine.

QUES. How long, after the disease has appeared, would there be danger of infection from that diseased area?

ANS. Probably about three months. The disease would disappear in the animal in three or four weeks, and then the possibility of carrying infection might last two months longer. It would be on the safe side to call it three months.

QUES. Will an animal have it a second time?

ANS. That is a very important question. An animal may have it a second time, even within six months. That has been shown very definitely. Sometimes animals have had it as many as three times in one year, in European countries, but most of the animals will not have it again within six months, probably.

QUES. Is lime, or whitewash, a good disinfectant?

ANS. It is a very excellent one. There is nothing better than whitewash as a disinfectant, especially if a certain amount of carbolic acid is added to it, four or five per cent.

QUES. Does the germ of this disease travel through the air?

ANS. That is a very difficult question to answer. I presume, like the germs of most diseases, it must travel through the air, but how far is another question. It undoubtedly does for a short distance.

QUES. What is the comparative liability to the disease between herds in stable and at pasture? Also, how long a time must elapse before it would be safe to return a fresh herd to the pasture where infected animals had lived?

ANS. Whether infection takes place easier in the pasture or in the stable I do not know, but I should say that it would be six of one and half a dozen of the other. In the stable the animals come in close contact, but not quite as close as they can in the pasture, where they are licking each other, and nosing each other. But I think there is practically no difference.

The second question I am not prepared to answer definitely because I think we know but little about it. I should say it would be wiser not to use the pasture again for the season. In that way you would be absolutely safe. It might be perfectly safe to use it after two or three months, but it is better to be on the safe side.

QUES. Would it not be better to wait until after the frosts of winter had passed?

ANS. This germ, or whatever it is that causes the disease, is much more easily affected by heat than by cold. Cold seems to be good for it, whereas dryness and heat are very bad for it. Probably with good dry air and plenty of sunlight the germ would be killed within a few weeks, but during the winter I should not want to trust it, from our present knowledge.

QUES. Will the temperature of boiling water render the serum innocuous?

ANS. Yes, even less than that. Pasteurization for perhaps ten or fifteen minutes renders it so.

QUES. Does the healthy and robust animal take the disease as quickly as weak and poor animals?

ANS. As far as we know there is no difference. The healthy animal takes it just as readily, but the results will perhaps be less severe. The possible complications which may arise afterwards may affect an ill nourished animal much more severely than a well nourished one.

QUES. Would it be safe to use the dressing from infected herds for farm crops?

ANS. Not for some time. That question will probably be solved by the authorities now working in Massachusetts. My impression is that they will allow the manure from the infected barn to be carried to a field near by, which is not used as a pasture; then it should be packed hard and fenced in with a temporary fencing so that no animals can get near it; and if allowed to stay there until spring, and then mixed with a disinfectant, it can be used to put upon fields where cloven footed animals do not frequently go. It should be put on by horses, not by oxen.

QUES. Within a few days several letters have come into the State from farmers in Massachusetts, in the infected regions, inquiring about cows to replace their stock which may be destroyed, and asking about visits to the State, and the question has arisen on the part of several of our farmers as to whether they should be allowed to come in. Will you please tell us how it is possible to know that they are not wearing the same clothes or the same boots which they have worn in infected stables, and how we can be sure that it is safe for them to come to our farms?

Ans. I should think it would be the wisest thing to keep them out for a while. Let them do the business by correspondence. Of course, as a rule, a cattle dealer will not wear the same clothes when he goes to another state to make a visit, which he has worn about the cattle. He will probably put on his Sunday clothes, but why not be on the safe side for a little while?

Ques. Is there any danger of contagion by correspondence?

Ans. That is a question which is open to discussion. I think that a man who had been handling his cattle, and milking his cattle having diseased udders, getting this material upon his hands and then immediately writing a letter, without taking any care, might be liable to transmit the disease through correspondence.

Ques. What do you consider the best disinfectant?

Ans. I think a solution of about five per cent of carbolic acid is the best. Any of the disinfectant solutions are good; chloride of lime is exceedingly good, to be used with the bedding, but for a final disinfectant I think whitewash with five per cent of carbolic acid is the best thing.

MAN AND COW AS CO-WORKERS.

By G. M. GOWELL, Professor of Animal Industry, University of Maine.

It is a truth as old as time, that every plant and creature adapts itself to place and circumstance, or dies in the attempt. If conditions are better than those which had previously attended it, it improves and its offspring develop into higher orders and capacities. If conditions are poorer than those under which it spent its earlier life, it yields to them, and finally, if the same environment continues for a few generations there may be developed a family that is peculiarly adapted to endure, and even thrive, where its predecessor found life almost unendurable. These are Nature's laws, and they are simply the laws of adaptation.

It was a peculiar environment that developed the New England countrymen. They were born of an ancestry that had spent its life in the open air in the rugged struggle for existence and homes. They were cradled in rockers made from pine boards by the fathers' hands, or sung to sleep as they lay in the laps of the mothers who had nourished them. As boys they were clad in homespun, made by the hands of their mothers, from the wool which the boys themselves had clipped from the backs of the sheep, which were then a part of the stock of every farm.

Their food was homely but appetizing and nutritious. The great brick ovens in every kitchen were heated on every Saturday, and Sunday mornings when the doors were opened and the great pots of beans and pork, and the loaves of rye and Indian bread and pumpkin pies were drawn out, the family table was loaded with a feast which was eaten only after the mercy of God was acknowledged by the father for permitting the existence of his family, and His blessings for the future implored.

The food obtained from the ovens was supplemented, as the week wore on, by boiled dinners of salted and corned meats, and potatoes, cabbage and turnips. The tin bakers yielded their loaves, bannocks and Johnny cakes. Ham was the pan meat during summer, and fresh meat abounded from the beef and hog killing time at the holidays, until the weather became too warm for its keeping. Comparatively few of them wore undershirts or drawers until sixty or seventy years ago, and good woolen stockings and cowhide boots, well greased, were the foot coverings through the cold and wet of winter and spring. The family lived in the great kitchen with its open fire, which was sometimes fed with dry quartered wood and sometimes with logs of green beech, birch and maple from which the sap ran and the steam hissed as they threw out their health-giving heat. The best room was the mother's "holy of holies," and not for every day use. The boys slept in the open chambers, under the rafters, with only the boards and shingles between them and the stars and storms. The day's work was from sun to sun in summers and much longer in winters. Haying time lasted six weeks, and mowing in the meadow by starlight in the early morning was common in my boyhood days. Necessity made almost every man a mechanic, and with his axe, auger, chisel and saw he built his houses, barns, carts, sleds, plows and ox yokes and thanked no workman but the blacksmith for a helping hand. Amusements and recreation were furnished by the trainings and muster days, and the singing and spelling schools; while the two sermons on Sundays, at the meeting house, furnished food for thought and conversation the rest of the week.

The Bible, almanac, dictionary and weekly papers were the appliances upon which our fathers' education was grounded. The hardness and simplicity of their lives developed strong bodies, and freedom from overheated houses and enervating conditions kept them clear from disease. They lived under low pressure, and had time for digesting the mental lessons they set for themselves.

The demands upon them caused them to work out the questions of life for themselves and produced strong minds and skilled hands. The old New England men and women were among God's best creations and their environment fitted them for the part which they performed in the development of this great land of ours, better than any other people with whom they came in contact could have done.

Native New England men and women of today, whose parents settled in the woods a century or two ago, come from a foundation stock of which any man may well be proud, for they had no superior on earth.

During the last half century times have changed. The old environment has gone. The ox has given place to the horse. All the world has moved forward. The New Englander is better fed, better clothed, better housed, and better educated than ever before. He has learned how to spend, but he has not learned equally well how to earn. This will be more true as the years go by, for as he develops, his wants will increase and those wants must be supplied from the old farms which his fathers wrested from the forest and upon which they grew crops at little cost until the brown soil rebelled at the robbery practiced upon it. Many of our brothers sought fresh soils or other vocations with the promise of better returns for their expenditures of brawn and brain. Those of us who remained at home groped in the dark for many years. We labored and studied and tried to regain the lost fertility, but with indifferent results. This was the first period of self-imposed agricultural education among the farmers of the East. It was not a matter of choice, but of necessity.

Agricultural literature was crude and limited. The text-book which the farmer's necessities prompted him to study more than any other was the living cow. For many years she was for the most part a sealed book to him and he was barely able to read her beyond the title page. The binding was not of morocco but of raw hide, and it was generally thicker and firmer during cold weather, when food was coarse and dry, than when succulent pasture grasses abounded in the summer's sunshine, for this book of ours was a living creature, and she had been a constant companion of our fathers—in different editions—ever since they landed at Plymouth, at our beginning.

The cow, brought into the wilderness by the first settlers, was subjected to all the hardships endured by her master's family. To a great extent she was her own caretaker. In winter the New Englander tied his cow in his cold barn during nights and stormy days, and fed her on straw, corn fodder and dry hay, and watered her at the running brook, or ice bound trough. She naturally brought forth her young in spring, as had her wild mothers before her, and she ceased giving milk in the fall, when the green pastures turned brown, and the fetus which she was carrying required for its development all the nourishment which she could extract from her meagre winter rations.

When the first agricultural depression came to New England, because our markets were cheaply supplied with human food by other states, whose soils yet retained their virgin richness and yielded crops with little labor, we turned our eyes from our beef steers, and mutton and wool producing sheep—the animals that had been the chief source of the income, which was now lost—to the cow, that creature that had been the constant companion of our fathers from the first, and had yielded more food for the nourishment of their families than had any of the other animals they owned although as yet she had been credited with working but half the year.

This was the creature that the farmer turned to thirty years ago and asked to become his co-worker. She was not an expert worker. She was only just a common cow,—rugged in form and feature and varied in her colorings. She yielded some milk and some beef. As her breeding had been a matter of convenience rather than of care, her offspring varied in form and function as much as she varied from her father and mother. She belonged to no family, she had no breeding, but in one respect she excelled all of the breeds of her race and kind that followed her. She was, in truth, a result of the law of the "survival of the fittest." She had lived with our fathers through all their generations, from the time when they built their first little cabins in the clearings down until we remember her. Whatever they suffered and endured she suffered and endured, and she, as well as they, developed such vitality, stamina, and hardihood, which we call constitution, as no race of animals or men, since them, have been blessed with.

We older men who are in this meeting today, took this cow when we were boys, thirty odd years ago, and we have wrought a mighty change in her since then, and she, in her turn, has had as much as we to do in bringing back fertility to worn New England soils and giving us again a prosperous and hopeful agriculture. Protected from cold and storms and with more and better food, she recognized the care of her master, and in her turn gave him more milk. Half a century of this better treatment by skillful men would, doubtless, have resulted in the advancement of the native New England cow to a high standard of beauty and profit, and the establishment of one or several breeds of recognized and special merit, equal or superior in their capacities for work and endurance to any that we now have.

But the New England man and boy were different from their fathers who had cleared away the forests and built stone walls around their fields and pastures. Villages or cities were but a few miles away, the steam whistle was within hearing and the whole country was pulsating with the throbs of life and progression. They, too, were impatient, they could not wait. They could not afford the time for the evolution of their animals by the slow processes of care, breeding and selection. They turned their eyes to Scotland, to Holland, to Jersey and Guernsey, the homes of the then known dairy breeds, and pondered upon the value of the blood of those animals for mingling with that of their own creatures.

They brought the Ayrshires—the true descendants of the Scottish Highland cattle with their shaggy coats—from southern Scotland. They went to the lowlands of Holland, to the home of the black and white Holsteins. They went across the British channel to Jersey and Guernsey, where basking in the sunshine under the shelter of bank, copse and hedge they found the cows that gave the richest and yellowest milk of any breed in existence, and they brought them too, to rugged, cold New England. For more than a century these breeds had all been bred for doing special work. They had been refined until their capacities for doing something else were practically eliminated from them. The men who had made them what they were had become experts because of contact with their work. When these animals came to our New England farms they found new and strange surroundings and associates. They throve and yielded profit to the men who understood them, and surrounded them with conditions as congenial as those which had served to cause their development to the high plane which they occupied. In the hands of indifferent farmers they proved disappointing because of the violation of that law in animal husbandry which demands that the conditions which caused the improvement of an animal must be continued or it will revert to the lower plane from which it started.

PRINCE HENRY MECTHILDE, No. 30051; four months old. Bred by C. L. Jones, Corinna, now the property of C. C. Dunham, Foxcroft.

While we have been benefited much by the breeds kept in purity, by far the greater good has been secured from them in the part they performed in elevating our native stock, until many of our best animals are the peers of the best representative of the pure breeds.

The condition of our native stock was most favorable because of its great hardihood and lack of prepotency. It was the host, into which the new blood came and took possession and throve, as it did not in its purity. The law that all animals and plants must, after a time, have new soil, new climate, or new blood, in order to maintain and develop themselves, was most forcibly illustrated in this work.

The pure breeds had but little difficulty in stamping their offspring with their peculiar markings and characteristics, which, after a few generations, became so fixed, that the high-grade Ayrshire, Holstein, Jersey and Guernsey transmitted their quality with almost as much certainty as the pure bloods themselves did. Close breeding of the pure breeds had made them prepotent, and when coupled with the natives, whose ancestors were generally aliens, the pure blood took control because it was the stronger current.

This work has gone on, until today it is difficult finding an animal among our cattle that has not some of the improved blood in its veins. Our old native stock furnished a practicable and cheap method of breeding and they also furnished the most important factor in the make-up of all animals used for productive purposes, for they furnished constitution, and they made the good grade, better than the pure blood, for performance at the pail, and endurance.

Do I hear you asking: "If this is so why have we so many poor and unprofitable cows? Why are they not all good?" It is characteristic of our people to all want to do the same thing at the same time, and our experiences in dairy farming show no exception to this truism. The demand for cows has been so great that nearly all of the heifer calves have been raised for cows. Very few indeed of the pure bloods have been rejected—if they were not malformed—because they were not good enough to raise. A calf might be peaked, narrow loined, and weak, yet it was raised by somebody and consequently we have a lot of cows that are yielding but 4,000 or 5,000 pounds of milk and 200 pounds of butter a year. This is one of the reasons why we receive so small prices for the hay and grain which we have to market, and why we are so poorly paid in our business.

The law which has been vigorously applied by all men who have improved their animals, has been "the saving of the good and the rejection of the poor." In breeding our dairy stock in New England we have not applied the rule, but we have raised the poor as well as the good, and we can see the results all about us. The Dutchman, the Scotchman, the Jersey and Guernsey men selected the best and rejected the poor. We New England people are conducting our dairy farming under the unfavorable conditions of a cold climate. The long winters during which it is necessary to keep the cows under cover, if we would get the most they are capable of yielding, for the food they eat, are exhaustive of vitality.

I accept the idea that the digestion of food, the making of blood, and the elaborating of milk, are labor to the cow, as much as the drawing of heavy loads is labor to the ox. We know well that the milch cow requires but little exercise, for the sake of exercise alone, that the less she has of it the more milk she gives, so long as all her organs are normally active.

Are we assured because of good yields that she is at her best, so far as the future of herself and her offspring is concerned, and her present productions not alone considered? Has the cow become so artificial a creature that she can be shut into rooms that she shall warm with her own body heat, and keep confined there half of the year and still become the mother of other generations of cows capable of repeating the good work that she herself is doing? Has the world another class of breeders that have ever dared to undertake the work that we are daily practicing with so little fear? The old native stock that we started with had lived lives of privation and exposure and had developed hardihood sufficient to sustain them. We have built warm homes for them and given them lives of luxury in the sunshine admitted through glass windows. We have grafted special purpose blood upon that hardy common stock, and the results are to be seen in our magnificent dairy animals that do only one thing, but do that one thing well. Shall we ever reach, or have we already reached a place in this work when warnings to desist will not be stilled? How long will the strong constitutions that were inherited from the old native stock and the foreigners we imported stand the strain of confinement, high feeding, and heavy milk yielding?

We remember the law in breeding, that when one organ or function is highly developed, it is done at the expense or weakening of other organs. The dairy cow is valuable, not because she yields heavily and economically for a week, or a year, but because she can do it for many years. She must work and last. She must have inherited constitution to do it, and good constitutions are not inherited from weak parents.

Last year I visited the Ayrshires on the farms in Scotland where the breed originated, and studied the conditions which caused their origin and development into one of the hardiest and most profitable breeds the dairy world has ever had. I learned that the climate of Scotland is mild enough so that the hills are not often covered long so deep with snow that the cattle cannot dig down to the grass. All stock are fed daily with hay when they need it. The cows are put in barns during nights and storms in winter, and the heifers have open sheds out in the pastures which they can go into at will, but they are never shut in. Some of the herds are milked ten months of the year, and others calve in April and go dry in November. Some of the best herds I visited are not milked in winter but are used in summer cheesemaking.

The heifers get two or three pounds of cake daily in winter. In summer they get no cake or grain, but an abundance of succulent food from the pastures that are kept green to the hill tops, by top-dressings of slag and potash, and the mists and rains of that moist climate.

Everywhere the stock was strong and vigorous with every evidence of large milking capacities. The mossy coats which prevailed showed plainly their descent from the old shaggy Highland cattle that to this day spend the winters out on the Scottish hills.

I went to Guernsey and Jersey and found those little, low-lying, wind-swept islands, divided by earth banks, hedges and copses, into small lots and fields, and there, in the shelter of those artificial protections the Jersey and Guernsey cattle and their ancestors have lived for two centures or more.

The barns are of stone. They are small and dark and have stone floors. The cows are in them only during storms and winter nights. The mild climate admits of their spending night and day in summer and most of the winter days in the open air.

It is the boast of the Jersey and Guernsey people that they have never had tuberculosis among their cattle, and yet they have bred and developed animals that are as sensitive and refined as the thoroughbred horse or the Collie dog.

During all the years which have been spent in breeding and developing the most perfect butter-making cattle in the world, the Jersey and Guernsey people have never warred with nature; they have never lost sight of the imperative necessity of constitution in their animals, but they have preserved it by keeping them in the open air as much as possible and allowing them moderate exercise. They took the old aboriginal stock and warped and molded it to suit their own purposes, but they never dared to interfere with constitution. They fed them on roots, grasses and forage plants that grow in the open fields much of the year in that mild climate, and they became big bellied because of the nature of the food. Careful breeding, gentle treatment, pure air, succulent foods, and moderate grain rations caused the development of the Jersey and Guernsey cows.

Have we in New England been content to pursue the same course with her? Have we not rather tried to do better by her? Have we not fed her on rich foods up to her full capacity to digest, and sometimes beyond and forced her to her full limit? We have subjected her to high pressure and required her to milk close up to the time of bringing forth her new calf, which far too often has proved to be a weakling, because its mother had been bred and trained to yield her all to her *foster son,*—the man who reared and treated her so kindly, that he had her love.

A part of our dairy education *was,* and many of us have not unlearned it yet, that the shorter time the cow went dry the better; that "there must be no boarders in the dairy herd;" and we have acted on that charge, and robbed, not only the unborn calves but ourselves as well. I am thoroughly well satisfied that the cow will yield more milk through life if she is allowed to go dry ten weeks each year, than she will if she is milked longer. One has but to recall some cow that by oversight was not dried off at all, then he will recollect that when her calf was born she did not freshen with as much force as in previous years, and at no time during the year that ensued did she approach her maximum yield of other seasons. But diminished milk yield and an enfeebled offspring are not the *only* bad results of protracted milking.

As the season of gestation advances, the composition and character of the milk changes. It becomes poorer in fat and richer in albumen. It becomes sticky and viscous, and its flavors and odors are usually depressed, sometimes to an alarming degree. Indeed there are very few cows whose stripper milk is not of low quality.

As at such times the fatty globules are diminished in size and the milk serum thickened and viscous, it is well known that the fat is not secured by gravity separation. The greater force exerted by the centrifugal separators recovers practically all of it, but the wisdom of saving the stripper cream is a matter of much doubt. Its quality is poor; its flavor and odor are obnoxious and demoralizing to the bulk of the stock with which it is mixed, and it is not infrequently the cause of the lower prices received for the marketed product of the whole dairy or creamery. If we are to keep our hold on the markets of the East, we must make better goods than the Western men do, or they will drive us out of our home butter markets as surely as they did out of the beef markets years ago.

We cannot gainsay the fact that our northern agriculture is handicapped by long, cold winters. Unless the greatest care and protection are given all classes of animals suffer from their intense severity. We have long recognized this, and know well how to keep them warm. Far too many of us who have provided them with warmth and shelter have forced them to breathe over and over the poisonous exhalation from their own and each other's lungs. We have contrived or adopted systems of ventilation which in the great majority of cases, are far from adequate. How often we find little eight or ten inch square ventilating boxes running from the tie-up, up the walls of the barn and opening out of doors, under the plates at the eaves. These little shutes, scarcely a dozen feet long, are weak in their capacities for the removal of the vitiated air. In the "lower barn" at the Maine Experiment Station, I constructed shutes, one by three feet in size, which extend from the tie-up up the walls to the plate, and then up the roof to the cupolas at the ridge of the barn. They are closely made and do not admit air along their sides to hinder their drawing. They are forty-five feet long, and because of their length and size they have strong drafts and displace large volumes of the impure air and discharge it out of doors.

The tie-up is not shut off from the large feeding floor which opens into the cupolas except in severe weather, and then dependence is had upon the ventilating shutes alone, and they do their work well. Upon entering the closed tie-up in the early morning the air is not damp or heavy with odors. Many a morning I have climbed up to the cupolas at the top of the shafts to see how the thing was working, and whenever my nose went over the edge of the shutes the currents that assailed me were strong and convincing. Nothing could be more so. We need not worry about the supply of fresh air; enough will enter the tie-up through the little openings that we will not close, build as well as we may, to create draft and supply pure air. It is the same system of ventilation that our fathers put into their houses when they built their big brick chimney and open fireplaces. It is the system which we abandoned when we adopted stoves and steam heat. In the old times the heifers were cold blooded and did not mature for early breeding. Comfortable housing and generous feeding have made them warm blooded and precocious. We have mistaken their ability and willingness to breed early as an indication of maturity, and have caused them to become mothers when but two years or less of age, when they are but little more than half grown. Sometimes this may be advisable with fleshy heifers, but with well bred ones it is rarely so, and should be rigidly discouraged as one of the evil practices that produces undersized cows with low vitality.

The cow has been a co-worker with man ever since he took her from a state of nature and molded her to suit his own purposes. In her wild state she cared for herself in the wilderness and shunned man as her enemy. In domestication she had become an artificial creature, helpless of herself, but helpful to man, her master, friend and co-worker. Under the guidance of the skilled man, she is the factor more than any other, that is bringing back a prosperous and hopeful agriculture to the worn soils of the East. Through her agencies more intensive husbandry will be practiced in the future, because her products sell for more in proportion to their food cost than do those from any other class of animals. Through her is made practicable, for the farmer's home and business, the small land holdings that shall yield food on every acre ample for the needs of a cow per year. Were I posing as a philanthropist I would raise the cry of New England for New England people, and had I the power, I would reach out to the cities, and bring back to the country every one of her heart sore sons, and locate them on small land holdings, and teach them, until they were masters of some of the farm industries, that they might live among the hills where they were raised and breathe in the pure air that comes all the way over the old north woods, instead of the dust and smoke of the city's streets and factories. I would teach them to plow, pulverize and till the land until they made available the great stock of plant food that now lies locked up in these soils, under their brown autumn blankets and winter snows, waiting only for the plow to turn the furrows that will surely open up the riches they contain.

Almost every neighborhood in our State has hundreds of acres of naturally good arable land that every year yield crops, that are worth but little more than the cost of harvestry. It is labor and a little money that are required to change these lands into conditions of profitable productiveness. Labor will loosen and pulverize the ground, and nature will generously give her aid of air, sunshine and rain in covering the brown soil with crops of luxuriant green. It is not, as has been so generally supposed, great money expeditures for chemicals that is necessary for crop growth, but rather moderate outlays for fertilizers and generous expenditures of labor. The young man has his labor at his command, and after he has accumulated earnings sufficient for the purchase of a small farm, I believe he will prefer to work for himself, upon his small land holding, where he can build his home and work out his life's plans, rather than labor for the landed master, even though he might receive greater money for doing so.

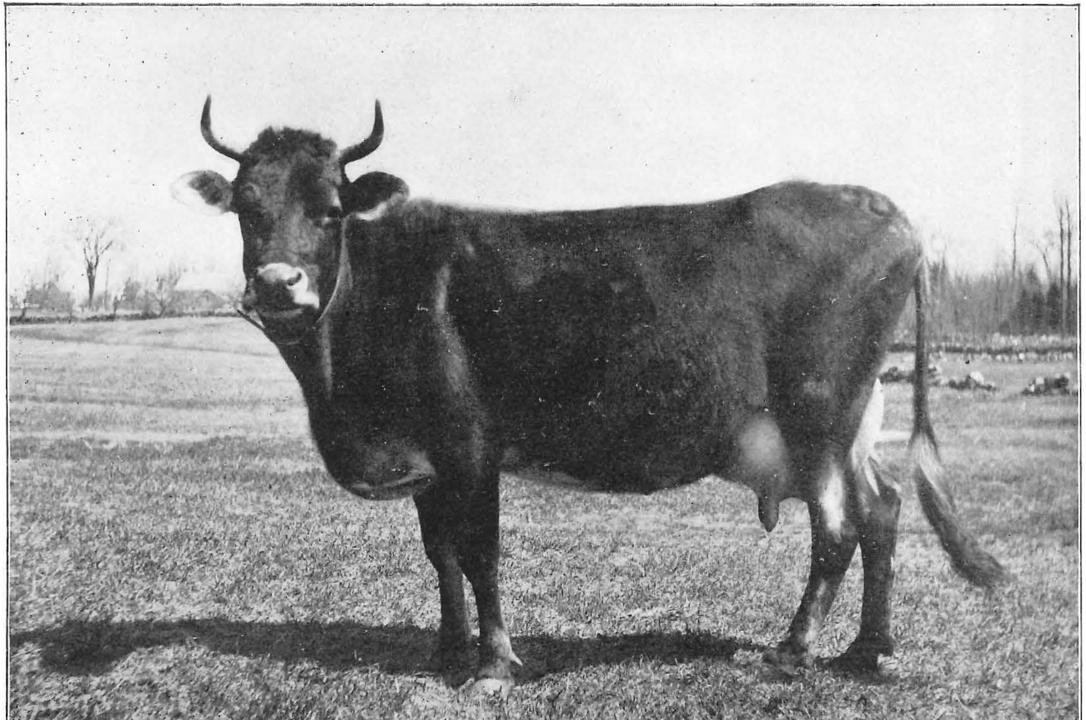
I have been told that twenty acres is but a garden spot, and the person who occupies it must of necessity ever remain a small man.

I often wonder if the men among us who have hundred acre farms that feed fifteen cows will ever realize that a cow per acre—the year through—is an easy matter, and that the labor and risks from droughts and crop failures are far less on the thoroughly worked farm than on the other.

With these small farms and homes, and a dense peopling in the country, neighborly intercourse and social life will be as easy on the farm as in the village, and with the ownership of the land vested in the people who live upon and work it, I can conceive of no happier condition on earth.

While the conditions of the future are to be different from the conditions of the past—for paddock grazing and stall feeding will be more largely practiced as the years go by—yet, under the stimulus of business activity and the desire for gain, we must not forget nature's laws or dare to violate them, as so many have done in the past.

The cow that we breed must be able to work and last. She is not our co-worker for the present only, for she and her descendants are to remain with us, and our boys, on these old farms, through all the years to come. She and the plow, guided by the skilled hands of men, are the keys that are to unlock the treasures that lie hidden in the brown soils, all up and down the hills and valleys of our grand old New England.



Grade Jersey cow, formerly owned by R. Alden, Winthrop, now the property of V. W. Macfarlane, Greenville, Me.
Record, 43 pounds of milk in one day.

THE DAIRY COW AS A FARM RENOVATOR.

By R. W. Ellis, Embden.

I started in life on a very small farm, which would carry only four cows and a horse. It has never been my aspiration to make money for money's sake, but my highest desire has been to attain a position among the good farmers of the State, and I have changed my location three times in order to get where I could do more and better work.

Thanks to the dairy cow, which has always been the prime factor in my success, I have been able to double the capacity of each farm on which I have lived, and have trebled the capacity of the one we now own and where we have been living for fourteen years. So if I have a right to speak on any phase of the dairy question, and if what I may say is entitled to any weight, it is in regard to the building up of the farm with the dairy cow.

One of the most hopeful signs in the agricultural outlook of Maine at the present time is the earnest desire on the part of so many of the farmers, and especially the younger ones, to do better and more thorough work, to build up the character of the soil and to bring it back to its original fertility.

Altogether too many of our Maine farms have been sadly neglected in the past, occupied by a sleepy, slide-easy class who enjoyed bewailing their own condition much better than trying to improve it. Their fields are running out and weeds and bushes are taking possession. They will boast of what their farm has done in the past, and give as a reason for not keeping it up that help is so scarce and high that they cannot afford to hire, and their own boys have all left them. Who wonders that the boys have run away from such farming? It was the wisest thing they could do. Bright boys are not caught with chaff.

Some one has said, "Seeing is believing, but feeling is the naked truth." It is what a child feels and realizes that makes a lasting impression. Let a boy get up behind a good trappy pair of horses and ride to spread manure, to plow it in, to pulverize the ground, to plant the corn, to cultivate it, to harvest and bind it; let him ride to sow and mow, to rake and to gather in, and that boy is not going to leave the farm. He sees that there is pleasure as well as profit in farming, that it gives health and vigor to both body and mind, and more real happiness and independence than any other calling known to man. But, you may say, the small farmer cannot have all these privileges. I affirm they are within the reach of all who will to have them, for where there is a determined will there is always a way.

In the first place, all of the more costly implements can be used by half a dozen farmers just as well as by one. Again, there need be but few small farmers. There are but very few farms in the State which have not twenty-five acres or more of tillage land, and on all such twenty-five cows can easily be kept. Surely it is not a very small farmer who has a dairy of twenty-five cows.

In order to show how this could be done, I took the subject on which I am now speaking,—The Dairy Cow as a Farm Renovator. The dairy cow is always at home. For 365 nights and at least 200 days she is housed where all her droppings can be saved. She returns to the soil a larger per cent of what she eats than any other living animal. In fact, ninety-nine per cent of all she eats, except what nature requires to sustain life and keep up the waste of the system, is returned to the soil, seventy-five per cent in her voidings, liquid and solid, and twenty-four per cent in the waste product of her milk. Less than one per cent goes off in butter fat.

In reckoning the profits of the dairy, these by-products do not get the credit due them; in fact, they are scarcely ever reckoned at all. But when you take into consideration the depleted condition of nearly all our farms, and the urgent need there is for recuperation, they should be ranked first in importance, for without the elements of fertility in the soil, our receipts in dollars and cents would soon be gone.

I propose now to give you some conclusions drawn from my own experience with the scale and rod pole during the year 1901. Three gallons of skimmed milk or buttermilk will make one pound of dressed pork. The average cow will produce milk enough in one year (with about four bushels of meal to finish him off) to grow a 200-pound pig. The cow herself, if properly treated, with what results from the milk fed the pigs, will make two cords of first class dressing. Six cords of such dressing is sufficient to fertilize an acre for sweet corn if the land is not too much run out. An acre of corn will yield, on an average, forty dollars worth of ears and nine tons of silage. A cow will eat about sixty pounds of silage per day, hence the nine tons will feed one and one-half cows 200 days. The same amount of land sown to oats and peas will yield two and one-quarter tons, of which a cow will eat fourteen pounds per day, hence it will feed one and one-half cows 200 days and have 300 pounds to spare. The same acre of land will produce one and three-quarters tons of clover, of which the cow will eat sixteen pounds per day, thus feeding one cow 200 days and leaving 300 pounds to spare. The money received for sweet corn at the factory, forty dollars, will buy sufficient provender for the four cows, fed as they have been on coarse fodder. Now you see that three cows have produced enough on three acres to keep four cows 200 days, the average length of our winters, with 600 pounds to spare, a gain of thirty-three per cent. We raised enough on thirty acres to winter forty cows. Where there is a corn factory, I think it is much more profitable to raise sweet corn, sell the ears and buy protein feeds than to grow a larger variety of corn and put it all in the silo.

These are no fancy pictures, but what we have done on our farm. Many others have done as well and some a great deal better. Mr. A. W. Cheever of the New England Farmer told me he had grown fodder enough on twenty-five acres of land to feed twenty-six head of cattle the entire year. They were not all full grown cattle, but the most of them were.

I have spoken of only three crops, corn, oats and peas, and clover. There are other profitable crops for the dairyman to raise. The millets, Hungarian and Japanese, are excellent milk producing feeds. The former makes very nice hay and is as easily cured as our common grasses. They are both hot weather plants and should not be sown until from the first of June to the middle of July. The Japanese millet is a ranker grower and is not so easily cured, but is an extra soiling crop. It will grow from five to seven feet high where the ground is rich, and two crops a year can be grown if it gets started the first of June.

Cattle eat it very greedily, and it is second only to oats and peas as a milk producer.

In order to find out what it cost to run our farm and keep our cows, we kept account one year, charging our own time at what it cost to hire the help we hired when they boarded themselves.

One man one year	$300 00
One man six months	163 00
Boy one year	100 00
Extra help at harvesting	50 00
Interest on farm	140 00
Taxes	110 00
Insurance	17 00
Interest on money invested in farm implements, and wear and tear of same	50 00
Interest on, and depreciation in, farm horses	40 00
Fertilizers	100 00
Feed for farm horses	45 00
Grass seed	20 00
Seed peas	10 00
Total	$1,145 00

Deducting $500 received from the factory for sweet corn, would leave $645. This divided by forty-three, the number of full grown cows that our herd would average, would make the entire cost for the coarse fodder and care and making and marketing the butter, just fifteen dollars per head. They had ten dollars worth of provender per head, making the total cost of keeping, twenty-five dollars per head. If there had been no corn factory, and we had planted a large growing yellow corn, we should have saved about fifty dollars in picking and hauling to the factory, and got about thirty tons more of silage, worth seventy-five dollars, and about 200 bushels of corn worth approximately $125, and should not have bought quite as much provender, and the total cost would probably have been about twenty-eight dollars per head.

How has this been done? First, by keeping a very large part of the farm under cultivation, making use of more of nature's fertility, of which she has enough in store for generations yet unborn, and securing against winter-killing; for a crop put in in spring and harvested in fall does not have much chance to winter-kill, and the oftener you cultivate the more humus there is in the soil, the more like a sponge it becomes, the better it can stand a drought or excessive moisture, and the surer you are of a liberal harvest.

What shall these crops be? I have already indicated that, on land which is suitable, I regard corn as the leading crop to be grown for fodder. I think it is the surest crop grown in New England. It will yield more cow feed to the acre, and with the silo is the easiest cured and best relished by the stock.

Next to the corn plant, and a very close second, is the oat and pea crop. We have raised enough on one acre to winter two cows, but one and one-half cows to the acre can safely be relied upon. It is a very rich feed in protein. The pea comes the nearest to cottonseed meal of anything we can grow here. Sow one bushel of black-eye peas to the acre, as soon as the ground is in condition to work, and harrow them as deeply as possible. In from five to seven days, sow two bushels of oats to the acre and harrow with a smoothing harrow. Follow that with grass seed, and roll. With us this crop will yield very much more, and is a richer feed for milk, than the clover plant; hence I cannot see the propriety of seeding corn ground directly to clover, as some are recommending.

Now, the third crop in the rotation is the only one that has to pass through a winter, and the only one about which there is much uncertainty; and were it not for its wonderful renovating properties, it would hardly be worth our while to try to raise it. But when we can get a crop it leaves the land in much better condition for succeeding crops than it could be in any other way. When we get a good crop to harvest and a second crop to turn under for corn again, it meets my ideal of farming perfectly.

But this system of rotation is objected to on account of the labor involved. There is less labor according to results obtained than in any other system we have ever tried, and with modern methods and implements one man, with a good, nimble pair of horses can accomplish more in a season than three men and four oxen could forty years ago. To illustrate: This past season we have had forty acres under cultivation, twenty in corn and twenty in other crops. We have hauled and spread more than

300 loads of dressing, have ploughed forty acres, and aside from harvesting the crops one man has done substantially the whole of it, and has been riding on a spring seat three-quarters of the time. Modern implements have changed what was once hard, manual labor into a mere pastime. They serve to keep the boys on the farm and make it easy to retain hired help. They not only do the work very much faster but in most cases very much better than it can possibly be done by hand, and I think it is not only every man's privilege but his duty to avail himself of their use. It is a duty he owes himself, his boys and his hired help. And the most expensive of them, such as manure spreader, sulky plow, riding cultivator, corn planter, corn harvester, and many others, can be used at different times and by a whole neighborhood as well as one person, so there is no excuse for not enjoying their use. We cannot afford to plow along in the beaten paths of our ancestors, if we would succeed in this twentieth century. We must not reject a system of agriculture that promises large profits because there is work in it, but adopt it and make the horses do the work.

If the farmers of Maine could be awakened to the opportunities that await them and induced to use the best there is in them, the problem of keeping the boys on the farm would soon be solved. There would be no more abandoned farms; and the stock of the State would soon be doubled.

ADDRESS.

By Dr. Geo. E. Fellows, Orono.

I will try to suggest a few thoughts that we should gather from such a meeting as this. We were told this morning by an expert about the nature of the disease which is now present in the neighboring states, and which we wish to keep out of our State. He told its history, its nature, its method of treatment. Now why did he do that? What was the use of it? A hundred years ago everybody would have laughed him to scorn for doing anything of that kind. They would have said that the disease was a visitation of Providence, and there was no more use in telling about that than in telling how to turn the wind in a different direction. People used to believe that all such things as cattle diseases or epidemics were visitations of Providence, but now we send for a scientific man who has investigated carefully all of the conditions under which this disease occurs, and we are inclined to believe the results at which he arrives. Most certainly we believe him if other men in other places, through a different series of experiments, arrive at the same results. The effect of that talk this morning will probably be either to keep that disease entirely out of Maine, or to so arouse everyone who is interested in it that almost superhuman efforts will be made to keep it out. If it does get in it will be in spite of our endeavors, and not because we are idle and allow it to come. That is one of the results of a meeting like this. You may say that this talk would have been put in the public prints, but we would not read it. We all have read headings about this disease, but we have not read all of the articles, and if we did we would not get the same idea as from word of mouth, and we would not have the opportunity to ask questions and have them answered directly. So one thing which comes out of our gathering for such a purpose is that we realize definitely for ourselves that science and its conclusions have taken the place of the blind reference of everything that was unknown to Providence or

Fate, or some other such deity. If we learn nothing more than that we can study and arrive at accurate results in relation to the lines in which we are working, we have gained a great deal from coming to this meeting.

Governments all over the world vary in power and influence, and governments are powerful and great only as the people that compose them are prosperous. Governments do not consist of grand forests, broad prairies, immense water powers and towering mountains; governments consist of people. If all these natural features made a government, there was the grandest government which ever existed before an inhabitant ever trod the soil of the universe, but that is not the case. The forests were worthless until the people made use of them, and all of these beautiful resources of nature which we admire and which we utilize were absolutely worthless until the people made something out of them. When the people are prosperous, then the nation is great. I only have to refer to a few nations, by name, for you to see that very clearly. People that try to live by exploiting others are not prosperous and they fall. There was that old government of Rome, with beautiful buildings, great works of art, sculpture, etc., but the people of Rome did not earn that by honest toil. They gained it by war and plunder, by robbing other people. The Spaniards for several centuries were the most powerful nation in the world, but how did they acquire that power? Not by tilling the soil and digging gold and silver out of their own mines, for their soil is still uncultivated and their mines still undeveloped. They did it by trying to exploit others. They came over to this country and obtained gold and silver from the inhabitants by violence and treachery. Spanish prosperity endured for a while, but the people were badly trained, they were not prosperous through industry, and other nations became superior to them. The people of Holland almost whipped them off the face of the earth, and, since that, other nations have had a trial and nearly every nation in Europe has whipped Spain within the last four or five hundred years. Now they are beginning to dig in their own soil, and if they ever amount to anything it will be because the people work and become prosperous.

England a few years ago (forty or fifty) had a theory that every man was entitled to so much for existing, whether he worked or not, and so laws were enacted which established what were called "poor rates." By these every head of a family was provided with a certain minimum amount of money from the town or county if he did not get it by work. Now a good many people are naturally lazy, and they soon began to stop work if they could get about so much money anyway; and then an addition was made to the law so that the employers of labor took advantage of the situation and did not pay the laborers so high wages. They reasoned that if the laborer would get so much anyway, from the public treasury, what use was there of paying him for his work. The result was a most awful situation of poverty, crime and immorality. It was evident that this law would not work very well, and some man rose in Parliament and said he thought it was because there was not religion enough in England. They figured it out that there was not church room enough for the population and appropriated a million pounds to build churches. You know what the result of that was. People did not flock into the churches just because they were built. The building of the churches and the spending of a million pounds did not do any good. Crime and poverty were still on the increase. If they had spent that million pounds in educating those lazy loafers to work and get something by the sweat of their brows, they would have received some benefit from what they spent and would not have had a lot of empty churches, which, by the way, are standing there still, hundreds of them, all over England. Within half a mile of St. Paul's in London there are 300 churches and the most of them have only the sexton and the rector to hear the service, the rector paid by the government. If they had spent that money in teaching the people, the way we are teaching the people by appropriations from the State for a dairy conference, farmers' institutes, etc., they would have had a prosperous set of citizens instead of a pauper class. I said in the beginning that a nation is prosperous if the people are prosperous, and now I will say that it is the duty of any nation to put its citizens in a position to become prosperous,—not to help the people but to help the people to help themselves. You know how that is in private life. You can help a man to a position where he can get good wages, which is better than to give him an equal amount of money out of your own hard earned wages. That is what our government is doing. A few years ago the government made an appropriation of $15,000 a year for agricultural experiment stations, and the total number of stations established and supported by that fund makes the amount of money something less than one million dollars a year. Think of the amount of good that is done with this money! We have about fifty experiment stations (all of the states have one and some more than one) partially supported by the government and partially by the state or other sources. Just that small amount, $15,000 a year to each one of those, furnishes an opportunity for scientific men with the best of training to study the problems that all of the people need to have studied, and cannot possibly study themselves. The people have not the money or the facilities for these experiments, but by making use of the experiments of others they can earn a better living and make use of their own resources. This illustration was given us a little while ago by the professor from Cornell. Through their experiment station they had obtained a large gift from the state, besides that of the nation, all to be used for the same purpose, and they were enabled to buy those poor cattle and prove something about them which has been of immense value to all those who have heard about it. Our government is thus, by its experiment stations, showing the people how they may help themselves and become happy and prosperous, thus making the nation stronger. No one comes here and stays a day or two at this Dairy Conference, and sees the exhibits of dairy products and machinery and goes away any worse for it. Whether you are an exhibitor or only a spectator, you cannot have wasted your time. If you have won a premium you will not go away and make poorer butter, and if you have not, you certainly will not go away and make poorer butter, because you will want to get a premium the next time; and if you do not go away worse off you must go away better off. We sometimes laugh at the illustration of the man who keeps cattle to sell and pastures them, and sells the cattle to buy more land to pasture more cattle to sell, to buy more land to pasture more cattle to sell, etc. It is a circle that goes around and around, and the advantage is that he is constantly getting more property. We laugh at him because if that is all there is to his life the man might as well die now; but it probably is not all there is to him. I want to apply that principle to this particular situation. This State has appropriated $500 to hold this Dairy Conference. We come here and get certain valuable instruction, and go away and apply it. Our own profits are greater, we are better citizens for it, we carry it back to our neighborhoods and those who do not come here cannot help but profit somewhat from our own improvement. Then we are more wealthy, we pay more taxes, the State has more money to appropriate for such things, and more citizens go away and come back and benefit their communities, and they all get more wealthy and pay more taxes, and so on. There is that same round of things and it is doing good all the time. One hundred and twenty-five years ago, or thereabouts, there were very grave doubts whether a nation would be established on this side of the Atlantic. England was trying her best to see that there should not be one, but it was established. About forty years ago there were some very grave doubts, here and elsewhere, as to whether the nation that was established could still exist. Those doubts have been settled and it does exist, and no one has any doubts now that a nation has been established and it can live and will live here on this side of the Atlantic. Its prosperity is so great that it is even making the old nations tremble with fear. Why is it? For the very causes that I have enumerated,—because the people are studying such problems as this, because it is the people and not the governments that are taking hold of the problems of the world. They are not leaving it to the legislators.

May we have more meetings such as this. May we have them often and more widely spread, until every man is not only a self-supporting citizen but an apostle of industry to all his neighbors.

POSSIBILITIES IN DAIRYING.

By Prof. Ivan C. Weld, Durham, N. H.

In response to your cordial invitation I am glad to meet with you once more and speak to you, and discuss with you matters pertaining to our common interests as dairymen.

Coming to you at this time direct from one of the most enthusiastic meetings ever held by our Granite State Dairymen's Association, I shall hope to bring you good cheer and greater encouragement for future work. It is indeed encouraging in these days that dairymen can meet in such organizations as we now have and work together for a common object.

The upbuilding of our industry has required much toil and study and represents the best work of many men, and today we can look forward with confidence to the future, realizing that possibilities will eventually become realities if the present rate of progress is only maintained. We cannot, however, by the stroke of a pen increase the productive capacity of our farms or dairy animals, neither can we improve the quality of our products, or lessen the expense of production. These things can only be brought about by patient study and toil. It has been said that "Curiosity is the mother of all knowledge," but be that as it may we do know that "Knowledge is power."

I have not come to this meeting, however, with the expectation of being able to impart any new and wonderful truths, but I have come "nurturing a hope" that I will be able to say something that may cause some to think—think of their present condition and standing as dairymen, and think of some way by which they will overcome the obstables in their pathway, some way in which they *can* and *will* improve their methods and thereby improve their farms and increase their profits. There is a vast amount of difference between what a man *can* do and what a man *will* do. When a man has been successful for a series of years in any given line of work there is always something to be learned from studying his peculiar methods. There is no such thing as permanent success without a reason for it.

We do not stumble into the right way of doing things nor do men build a permanent structure without a wise plan. He who has made steady progress and large attainment in any line of dairy work has done so through the judicious use of well chosen instrumentalities. What he did and how he did it, what things he used and how he used them, are points well worth considering by those who would achieve like results in a similar field. Yet, with all this, every man if he would have success must finally be himself, and do his own work in his own way. No other man's methods should blind one in his own work. The advantage to be gained from a study of the methods and helps of others is in *considering* their suggestions, not in following them blindly.

In speaking to you at this time I have chosen to speak of the possibilities in dairying, because as human beings we are not disposed to push on to higher attainments in any department of work unless we have first formed in our mind the vision of that for which we will strive. We must also see better things in store for us as a result of our effort. We must first become familiar with ourselves, and be able to judge impartially and fully. We must know our own strength and then seek to develop every faculty, always having in mind the pattern or plan of that which is to be. We never set ourselves to repair a fence or remodel a house unless we are in some way dissatisfied with its condition, or see the need of the proposed change. To be sure we can start over and build a new fence or a new house if occasion demands it, but we cannot begin life on this earth a second time and hence if we desire better things, if we desire better farms, better cattle, and better conditions for our families, we must, as dairymen, mend ourselves, as well as our fences.

It may be necessary to lay a new foundation, put on another story, or cut through the walls and make room for more light and sunshine, or otherwise remodel our individuality, so that we as well as our houses may conform to new and improved conditions. When we have as examples herds of cows that are producing 350 or more pounds of butter per year, per cow, when we have as possibilities cows that produce two and three times that amount and then come down to the plain cold averages which even in our New England states is less than 200 pounds per cow, there is need of something that will set our dairymen thinking. Most of us are dissatisfied with our present condition and desire better things. Notwithstanding the fact that our dairymen were never more prosperous than they are today, we see how we could use a larger income to excellent advantage. The demands were never so great as at the present time and the question of how we shall meet them is the one for each of us to answer. We cannot complain of low prices for milk, cream, butter, or any of the by products like beef, veal or pork; not for years has the number of domestic animals been so small in proportion to the population of our country as it is at the present time, and with the increase in exports, the increase in population and the fact that the West is fast filling up and grazing lands are become centers of population, it would seem that we are assured of good prices for an indefinite period. A matter of special interest to dairymen is found in the fact that the last census shows an increase in population of the United States of over twenty per cent during the ten years preceding while the increase in the number of milch cows for the same period was only about four per cent. It is gratifying to know that New England's increase was about eight per cent or double that of any or all other sections of the country. We can congratulate ourselves that we are still ahead of the other fellow and yet at the present time we can only find fault with ourselves because we have not more of these products for sale. Our farms are capable of producing more, and we are slow to admit that we are not capable of managing a larger business. We are thoroughly convinced there is a splendid opportunity and that the possibilities in dairying in New England were never so good as at the present time. But the question is, What are we going to do about it? Are we to slacken the pace while we look over our shoulders to see how far behind the other dairy sections are? Shall we let our neighbors reap the benefit of the favorable conditions or are we prepared to arouse ourselves to still greater activity and greater usefulness? If so we may begin to plan *wisely* and *hopefully* for the future. We do not want our boys to grow up to manhood surrounded with excellent opportunities, but with no definite aim in life. We expect them to make their mark in the world and achieve greater success than the sons of our neighbors. Let us suppose we have a farm of about 102 acres, which is the average size of farms in New England. About forty acres of this is improved land, and the average income is $878. The demands are such that we must increase this income. This farm will keep about four cows and two horses for work and pleasure. Those four cows cost about fifty dollars a year and they average 200 pounds of butter each, or a total of 800 pounds. Let us suppose it sells at twenty-five cents and that the income is therefore $200. We are not any more than meeting expenses, and right here many men have said dairying does not pay, and have tried swapping horses or something else that did not require effort on their part. But we have decided if others can and do make money it is our own fault if we do not. We do not want it said we are not as smart as our neighbor or acquaintance who has a fine herd that pay him a handsome profit. We must find the remedy.

If we are to make any success of life, we must have high ideals and some definite object in view.

The object of a dairy may be three-fold,—the production of milk for wholesale dealers, mainly confined to the farms on the line of some railroad and to those farms in the vicinity of large towns where a mixed husbandry is followed, the production of butter, chiefly confined to farms at a distance from the towns and cities, and the manufacture of cheese carried on to some extent under conditions similar to butter production.

These different objects should therefore be kept in view in selecting cows for dairy purposes. Animals which would be profitable in a butter dairy might prove a poor investment for milk or *vice versa*—a fact which should be more carefully considered.

The productiveness of a cow does not depend so much upon breed as it does upon her food management, her temperament and health and the activity and energy of the organs of digestion and secretion. These organs, it is true, are far better developed and more permanently fixed in some breeds than in others, and in selecting a herd one cannot be too particular to get cows of good dairy type and large capacity. Milk, like all other animal products, is derived from food. Its secretion stands almost unrivaled as an example of the rapid, extensive and continuous transformation of food into animal compounds. The secretion of milk is carried on in the udder or mammary gland, and is directly affected by the health of the animal, its food, or any condition which affects the nervous temperament.

To what extent can we control these conditions and to what extent shall we hold the cow responsible? We must establish a standard of at least 5,000 pounds of milk per cow or 250 pounds of butter, or continue to do business at a loss. We must then determine what each individual cow in the herd is producing and keep a record of her work. At the end of a period of time, depending somewhat on conditions as regards its length, you will have become satisfied regarding the desirability of continuing the cow in the herd, and the observations and experience gained will prove a valuable factor in the work of the year which follows.

The matter of selection, breeding, feeding and care of dairy animals may form a lifelong study. I have in mind a young and successful New Hampshire dairyman, a graduate from our four years' agricultural course, who after graduation returned to his father's farm and in due course of time has established for himself a herd of thirty pure bred Jerseys. He began this work with one cow and has steadily followed the plan which he adopted before taking up the work. Eventually the father retired, selling to the son the ancestral acres. Steadily and surely the young man has continued gradually increasing the size of his herd, and increasing the individual productive capacity of the cows at the same time. Last year the thirty cows, every one of which was bred and raised on the farm, averaged him 340 pounds of butter per cow. Should you meet him tomorrow he could tell you just the amount of milk and butter each one of those thirty cows produced, as well as the cost of the food required to produce it. He makes his own butter on the farm, using the skim-milk and buttermilk in raising his young stock and pigs. His farm is one of those side hill farms, such as are often found in New Hampshire, but it is a model of neatness and one can but feel a higher regard for agriculture and dairying as a business, after having inspected its various departments.

Wherever we find system and order we are almost sure to find contentment and prosperity. We find examples, occasionally, examples from which the great majority may well take pattern. The dairymen of Maine have many such examples and conspicuous among them is that of the Honorable President of this Association, whose farm and herd are indeed models of neatness, and whose productive capacity has been increased to a high degree through his intelligent efforts and hard work.

The prize winning herd of Jerseys bred and owned by S. M. King of South Paris, and those of your Secretary at Cumberland Centre afford abundant evidence that you, as Maine dairymen, are not lacking in object lessons. It required ambition, study and hard work to get these herds together and bring them to this present standard of excellence. It is the result of a careful and intelligent plan, on the part of each individual owner and breeder. Not one of those gentlemen are in the business for their health, they are in it because they love their work and because they see in it the source of a substantial and permanent income, and I assure you, dairymen of Maine, if these and other dairymen could achieve such results with the markets in the unsatisfactory conditions which have characterized them during the last ten or fifteen years, then with these attainments as your examples and with your University at Orono as a guide and teacher, there is little you may not hope to accomplish if you continue to study, and work.

OFFICERS OF AGRICULTURAL SOCIETIES.

Name of Society.	President.	P. O. Address.	Secretary.	P. O. Address.	Treasurer.	P. O. Address.
Maine State Agricultural	I. Pompilly	Auburn	George H. Clarke	Auburn	E. G. Eveleth	Auburn.
Eastern Maine Fair Association	F. O. Beal	Bangor	Ezra L. Sterns	Bangor	S. D. Benson	Bangor.
Maine State Pomological	Z. A. Gilbert	North Greene	D. H. Knowlton	Farmington	Charles S. Pope	Manchester.
Maine State Poultry and Pet Stock Association	Geo. M. Twitchell	Augusta	A. L. Merrill	Auburn	H. C. Day	Auburn.
Androscoggin County	J. L. Cummings	Livermore Falls	J. L. Lowell	Auburn	I. B. Clary	Livermore Falls.
Androscoggin, Durham	Rufus Parker	Durham	J. H. Williams	Auburn	S. B. Libby	Durham.
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Aroostook, South	T. B. Bradford	Golden Ridge	Isaac Cushman	Sherman Mills		
Aroostook, Madawaska	Eloi Albert	Up'r Madawaska	Remi A. Daigle	Up'r Madawaska	A. K. Cyr	St. David.
Cumberland County	J. L. Robinson	South Windham	E. H. Smith	Westbrook	F. D. Scamman	Gorham.
Cumberland, North	Q. M. Chute	Harrison	J. Orin Ross	Harrison	George P. Carsley	Harrison.
Cumberland Farmer's Club	M. W. Pearson	Cumberland Cen.	H. B. Clough	Cumberland Cen.	N. M. Shaw	Cumberland Cen.
Cumberland, Gray Park Assoc'n	B. F. Skillings	Gray	John W. Stevens	Gray	John W. Stevens	Gray.
Cumberland, Bridgton Farmers' and Mechanics' Association	I. S. Webb	Bridgton	J. S. Ames	Bridgton	F. A. Webb	Bridgton.
Cumberland, New Gloucester and Danville	Geo. Sparrow	Upper Gloucester	John Witham	Upper Gloucester	Geo. W. Haskell	New Gloucester.
Cumberland, Lake View Park	Arthur Dyer	Sebago	A. L. Brackett	East Sebago	J. P. Fitch	East Sebago.
Franklin County	J. H. Crowell	Farmington	R. S. Sampson	Farmington	G. M. Currier	Farmington.
Franklin, North	D. D. Graffam	Phillips	M. S. Kelley	Phillips	A. E. Bunnell	Phillips.
Hancock County	F. P. Merrill	Bluehill	C. S. Snowman	Bluehill	M. P. Hinckley	Bluehill.
Hancock, North	H. T. Silsby	Aurora	J. H. Patten	Amherst	J. H. Patten	Amherst.
Hancock County Fair Association	H. E. Davis	Ellsworth	H. F. Whitcomb	Ellsworth	H. J. Joy	Ellsworth.
Hancock, Eden	Aaron S. Bunker	West Eden	Ephraim Alley	Eden	W. L. Alley	Eden.
Kennebec County	E. R. Mayo	Manchester	J. Henry Moore	Winthrop	Chas. H. Stevens	Readfield.
Kennebec, South	Chas. F. Achorn	Cooper's Mills	A. N. Douglass	Gardiner, R. No. 4	Jasper S. Gray	South Windsor.
Kennebec, Pittston Agricultural and Trotting Park Association	J. H. Bailey	East Pittston	A. E. Marson	East Pittston	C. C. Libby	East Pittston.
Knox, North	E. E. Thurston	Union	G. C. Hawes	South Union	H. L. Grinnell	Union.
Lincoln County	A. M. Card	Headtide	B. A. Woodbridge	North Newcastle	F. M. Rafter	Damariscotta.
Lincoln, Bristol	A. C. Fossett	Bristol	Geo. A. Huston	Damariscotta	C. B. Woodward	Damariscotta.
Oxford County	W. J. Wheeler	South Paris	A. C. T. King	South Paris	A. C. T. King	South Paris.
Oxford, Riverside Park Association	H. S. Hastings	Newry	L. A. Hall	Bethel	L. C. Rowe	Bethel.
Oxford, West	J. A. Farrington	Lovell	B. W. McKeen	Fryeburg	W. R. Tarbox	Fryeburg.
Oxford, Androscoggin Valley	J. W. Thompson	Canton	H. T. Tirrell	Canton	D. W. Goding	East Peru.

Oxford, North	George O. Huse	Andover	John F. Talbot	Andover	Owen Lovejoy	Andover.
Penobscot, West	B. P. Hubbard	Stetson	F. E. Jewett	Exeter	F. W. Hill	Exeter.
Penobscot, North	S. T. Mallett	South Springfield	B. D. Averill	Prentiss	E. A. Read	North Lee.
Penobscot, East Eddington Farmers' Club	A. H. Pond	East Eddington	Royden Bearce	East Eddington	J. H. Comins	East Eddington.
Penobscot, Orrington	Albert G. Dole	South Brewer	N. A. Nickerson	Orrington	N. A. Nickerson	Orrington.
Piscataquis County	W. E. Parsons	Foxcroft	S. D. Weymouth	Dover	C. C. Dunham	Foxcroft.
Sagadahoc County	Harvey I. Given	Brunswick	R. W. Carr	Bowdoinham	Lyman E. Smith	Brunswick.
Sagadahoc, Richmond Farmers' and Mechanics' Club	F. J. Libby	Richmond	C. E. Dinslow	Richmond Corner	D. W. Alexander	Richmond Corner.
Somerset County	Orlando Walker	Anson	J. Frank Withee	Madison	George F. Charles	Madison.
Somerset, East	E. K. Fuller	Hartland	E. A. Webber	Hartland	Charles Rowell	Hartland.
Somerset, Central	S. W. Gould	Skowhegan	H. A. Archer	Skowhegan	E. D. Packard	Skowhegan.
Waldo County	Giles G. Abbott	Belfast	B. H. Conant	Belfast	Fred Rackliffe	Belfast.
Waldo and Penobscot	W. B. F. Twombly	Monroe	F. H. Bowden	Monroe	F. L. Palmer	Monroe.
Waldo, North	W. H. J. Moulton	Unity	E. B. Hunt	Unity	Edwin Rand	Unity.
Washington County	Albert E. Lincoln	Dennysville	Sidney A. Wilder	West Pembroke	Clifton Laughlin	Pembroke.
Washington, West	J. E. White	Columbia Falls	E. F. Allen	Columbia Falls	Willis H. Allen	Columbia Falls.
York, Shapleigh and Acton	Frank C. Staples	Shapleigh	Fred K. Bodwell	Acton	Wm. P. Ferguson	Springvale.
York, Ossipee Valley Union	R. G. Pease	Cornish	H. Lorin Merrill	East Parsonsfield	J. Merrill Lord	North Parsonsfield.
York, North Berwick	Daniel A. Hurd	North Berwick	Charles M. Boyle	North Berwick	R. H. Hurd	North 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 bulls and bull calves.	Number of grade cows, heifers and heifer calves.	Number of oxen and steers.	Number of animals for beef.	Number of cattle shown in herds.	Total number of neat stock.	Number of sheep.	Number of swine.	Number of poultry (coops).
Maine State Poultry and Pet Stock Association	-	-	-	-	-	-	-	-	-	-	-	750
Androscoggin County	62	26	55	-	64	72	24	54	235	28	19	126
Aroostook, North	78	22	49	6	43	12	-	53	132	46	2	39
Aroostook, Madawaska	28	-	-	5	4	13	-	-	22	15	-	-
Cumberland County	22	20	47	4	11	46	2	-	130	42	18	118
Cumberland, North	53	3	15	2	65	70	4	48	207	7	10	10
Cumberland Farmers' Club	19	5	33	-	33	68	8	16	163	4	-	25
Cumberland, Gray Park Association	28	1	3	6	23	58	-	-	91	6	28	55
Cumberland, Bridgton Farmers' & Mechanics' Asso.	39	10	38	5	24	68	8	24	177	11	18	41
Cumberland, New Gloucester and Danville	42	6	13	4	42	18	2	12	97	14	22	21
Cumberland, Lake View Park	1	1	3	2	4	14	4	-	28	-	-	-
Franklin County	73	37	82	26	98	155	26	95	519	217	18	112
Franklin, North	39	7	36	4	70	104	16	24	261	63	32	42
Hancock County	17	2	5	7	40	65	40	-	136	15	11	10
Hancock, North	18	-	-	3	14	4	-	-	21	1	8	4
Hancock County Fair Association	17	10	12	2	25	10	-	-	59	16	10	40
Hancock, Eden	4	1	6	-	10	-	-	-	17	-	10	10
Kennebec County	50	14	35	10	122	164	42	58	445	40	42	65
Kennebec, South	36	10	21	12	56	176	13	45	333	13	45	18
Knox, North	33	6	12	6	26	50	6	17	105	48	3	22
Lincoln County	42	6	17	7	29	62	10	20	151	1	22	32
Lincoln, Bristol	11	-	6	-	5	30	-	-	41	18	-	20
Oxford County	55	47	85	-	90	77	18	60	377	143	24	74
Oxford, Riverside Park Association	37	32	38	10	40	52	16	38	120	30	30	8
Oxford, West	75	20	40	-	15	175	20	50	270	25	32	45
Oxford, Androscoggin Valley	40	9	7	5	30	80	6	8	145	14	1	42
Oxford, North	15	5	6	1	17	36	2	6	73	26	28	12

Penobscot, West	32	21	47	-	42	30	-	18	158	65	10	31
Penobscot, North	41	1	2	14	50	18	-	7	62	14	12	12
Penobscot, East Eddington Farmers' Club	18	-	-	7	12	-	-	12	31	23	2	4
Penobscot, Orrington	12	1	11	3	4	-	-	4	23	9	2	4
Piscataquis County	75	10	12	9	115	18	18	24	206	30	17	23
Sagadahoc County	39	42	129	-	135	136	6	80	528	57	42	215
Sagadahoc, Richmond Farmers' & Mechanics' Club	19	4	21	-	27	27	5	20	104	-	2	23
Somerset County	29	6	9	2	97	48	16	-	178	110	1	3
Somerset, East	82	16	26	6	130	66	32	129	405	153	66	77
Somerset, Central	30	6	16	-	57	32	2	-	113	16	40	25
Waldo County	40	5	16	5	12	32	4	18	92	21	24	15
Waldo and Penobscot	70	27	55	6	63	84	64	78	377	79	11	16
Waldo, North	35	5	6	7	23	16	8	12	77	28	9	4
Washington County	38	6	22	-	37	10	-	30	75	26	16	22
Washington, West	44	6	20	-	28	36	-	-	90	81	8	52
York, Shapleigh and Acton	8	-	-	1	27	100	6	-	134	4	1	19
York, Ossipee Valley Union	16	8	16	-	30	120	6	6	186	12	6	13
York, North Berwick	30	5	12	3	19	50	4	12	105	-	-	12
Total	1,592	469	1,084	190	1,908	2,502	438	1,078	7,299	1,571	702	2,311

ANALYSIS OF AWARDS.

Name of Society.	Amount of premiums paid trotting bred stallions.	Amount of premiums paid trotting bred brood mares.	Amount of premiums paid draft stock stallions.	Amount of premiums paid draft stock brood mares.	Amount of premiums paid family horses.	Amount of premiums paid gentlemen's drivers.	Amount of premiums paid matched carriage horses.	Amount of premiums paid colts.	Amount of premiums paid horses for draft.
Androscoggin County	$22 00	$9 00	$10 00	$10 00	$9 00	$10 00	$12 00	$48 00	$27 00
Aroostook, North	3 00	7 50	7 50	7 50	5 50	10 00	-	37 00	9 00
Aroostook, Madawaska	4 50	4 50	-	-	-	-	4 50	6 00	3 00
Cumberland County	17 00	10 00	-	-	19 00	15 00	-	5 00	16 00
Cumberland, North	-	-	3 00	6 00	3 00	6 00	6 00	9 00	80 00
Cumberland Farmers' Club	3 00	3 00	-	-	-	10 00	-	4 50	-
Cumberland, Gray Park Association	-	5 00	-	-	4 00	15 00	5 00	14 50	-
Cumberland, Bridgton Farmers' and Mechanics' Association	10 00	7 00	-	-	7 00	9 00	15 00	15 00	40 00
Cumberland, New Gloucester and Danville	5 00	5 00	3 00	-	3 00	8 00	5 00	11 00	8 00
Cumberland, Lake View Park	3 00	-	-	-	-	-	-	-	20 00
Franklin County	7 00	7 00	7 00	-	20 00	20 00	13 00	15 50	42 00
Franklin, North	-	4 50	2 50	4 50	-	7 00	3 50	13 30	-
Hancock County	5 00	4 00	-	4 00	-	3 00	2 00	21 00	-
Hancock, North	-	2 25	-	-	4 00	-	-	4 00	23 50
Hancock County Fair Association	19 00	6 00	-	-	-	-	4 50	18 00	-
Hancock, Eden	-	-	-	-	-	-	-	-	23 00
Kennebec County	12 00	19 00	15 00	10 00	9 00	25 00	5 00	15 00	18 00
Kennebec, South	6 00	3 75	-	-	1 50	3 00	-	17 50	12 50
Knox, North	5 00	3 00	-	3 00	3 00	1 50	3 50	11 00	36 50
Lincoln County	5 00	4 50	-	-	3 00	-	7 00	9 25	12 00
Lincoln, Bristol	-	-	-	-	-	-	-	-	11 00
Oxford County	55 00	27 00	-	-	-	31 00	15 00	37 00	59 00
Oxford, Riverside Park Association	12 35	6 00	-	-	-	-	-	10 77	60 00
Oxford, West	28 00	7 00	-	-	7 00	25 00	9 00	24 00	44 00
Oxford, Androscoggin Valley	12 00	8 00	-	-	-	10 00	-	16 00	30 00
Oxford, North	3 00	3 75	3 00	-	-	-	-	5 95	33 00

Penobscot, West	3 50	9 00	-	6 00	-	6 00	-	17 00	22 00
Penobscot, North	-	-	-	2 50	3 00	1 50	-	18 50	3 50
Penobscot, East Eddington Farmers' Club	-	2 25	-	2 25	-	2 50	-	4 50	-
Penobscot, Orrington	-	-	-	5 00	-	4 50	-	6 00	-
Piscataquis County	21 00	15 00	13 00	5 00	3 00	2 00	2 00	14 00	16 00
Sagadahoc County	9 00	5 00	9 00	8 00	-	15 00	-	30 00	42 00
Sagadahoc, Richmond Farmers' and Mechanics' Club	-	1 65	75	-	90	75	-	12 35	10 25
Somerset County	-	2 00	-	3 00	3 50	3 50	3 50	10 50	20 00
Somerset, East	19 50	7 50	14 25	6 25	-	4 50	2 00	14 25	109 00
Somerset, Central	8 00	6 00	1 50	-	-	2 00	-	6 00	-
Waldo County	2 00	3 00	2 00	2 00	-	-	3 00	12 50	11 00
Waldo and Penobscot	49 00	12 00	10 00	12 00	12 00	12 00	14 00	41 00	54 00
Waldo, North	16 50	5 00	5 00	5 00	4 50	6 00	3 00	11 00	6 00
Washington County	4 90	6 30	-	4 90	-	-	2 80	14 00	8 40
Washington, West	16 00	-	-	-	5 00	75 00	-	34 00	52 00
York, Shapleigh & Acton	-	2 00	-	-	3 00	3 50	-	-	-
York, Ossipee Valley Union	10 00	-	-	3 00	3 00	6 00	3 00	8 00	14 00
York, North Berwick	-	-	-	-	-	3 00	5 00	-	-
Total	$396 25	$233 45	$106 50	$109 90	$135 90	$356 25	$148 30	$621 87	$975 65

ANALYSIS OF AWARDS—Continued.

Name of Society.	Amount of premiums paid thoroughbred bulls and bull calves.	Amount of premiums paid thoroughbred cows, heifers and heifer calves.	Amount of premiums paid grade bulls and bull calves.	Amount of premiums paid grade cows, heifers and heifer calves.	Amount of premiums paid herds.	Amount of premiums paid working oxen and steers.	Amount of premiums paid matched oxen and steers.	Amount of premiums paid trained steers.	Amount of premiums paid beef cattle.	Amount of premiums paid town teams.	Amount of premiums paid oxen and steers for draft.
Androscoggin County	$60 00	$92 00	-	$95 00	$20 00	$37 00	$30 00	$9 00	$13 00	$68 00	$65 00
Aroostook, North	58 50	119 50	$3 25	20 25	12 00	-	13 00	4 00	-	-	-
Aroostook, Madawaska	-	-	2 50	6 75	-	4 50	4 25	-	-	-	2 25
Cumberland County	60 00	75 00	-	24 00	24 00	25 00	22 00	-	4 00	20 00	78 00
Cumberland, North	12 00	10 00	5 50	9 00	40 00	5 00	25 00	14 00	5 00	15 00	84 00
Cumberland Farmers' Club	19 00	26 00	-	35 00	20 00	32 00	23 00	2 00	13 75	28 00	27 00
Cumberland, Gray Park Association	3 00	4 00	5 50	30 00	-	-	10 00	-	-	33 00	21 00
Cumberland, Bridgton Farmers' & Mechanics' Assoc.	76 00	57 00	-	35 00	10 00	12 00	46 00	7 00	13 50	42 00	60 00
Cumberland, New Gloucester and Danville	9 50	16 00	4 50	44 00	10 00	5 00	5 00	5 00	3 00	10 00	5 00
Cumberland, Lake View Park	-	-	4 00	9 00	-	-	9 00	-	3 00	-	-
Franklin County	61 50	96 00	21 50	65 75	68 50	18 00	23 50	-	19 50	41 50	48 00
Franklin, North	7 65	20 15	-	16 10	13 00	3 50	6 60	1 50	7 25	32 00	6 00
Hancock County	8 00	15 00	13 00	45 50	-	20 00	-	-	10 00	-	26 00
Hancock, North	-	-	2 25	10 25	-	1 00	-	-	-	-	-
Hancock County Fair Association	32 75	24 75	6 00	29 50	-	20 75	-	-	-	-	-
Hancock, Eden	2 00	-	-	15 00	-	-	-	-	-	-	-
Kennebec County	31 00	35 50	-	40 00	21 00	34 00	15 00	6 00	22 00	60 00	40 00
Kennebec, South	19 50	40 75	11 25	28 90	21 50	22 00	29 50	3 50	10 25	49 00	26 00
Knox, North	7 00	12 50	6 00	13 50	9 00	9 75	9 00	-	5 50	15 00	20 00
Lincoln County	12 00	23 50	7 50	8 50	7 50	9 00	27 00	20 00	6 50	28 00	47 00
Lincoln, Bristol	-	-	-	7 50	-	-	-	-	-	-	7 00
Oxford County	195 00	182 00	-	189 00	42 00	136 00	62 00	-	22 00	112 00	121 00
Oxford, Riverside Park Association	131 25	80 00	38 50	36 00	24 00	14 25	9 37	5 00	9 00	24 00	34 00
Oxford, West	84 00	33 00	-	25 00	20 00	24 00	31 50	7 00	21 00	74 00	68 00
Oxford, Androscoggin Valley	18 00	16 00	4 00	19 50	6 00	37 00	35 00	6 00	9 00	18 00	31 00
Oxford, North	6 50	-	1 00	13 12	8 00	8 60	9 00	2 50	-	7 00	8 00

Penobscot, West	60 00	107 50	-	65 25	24 00	53 00	-	-	-	-	-
Penobscot, North	2 50	-	11 00	20 00	5 00	7 50	-	-	-	-	-
Penobscot, East Eddington Farmers' Club	-	-	4 25	9 00	9 00	-	-	-	-	-	-
Penobscot, Orrington	3 00	7 00	1 50	3 50	5 00	-	-	-	-	-	-
Piscataquis County	28 50	27 00	13 00	33 75	10 00	10 50	3 00	-	10 00	20 00	3 00
Sagadahoc County	107 75	181 25	-	162 25	51 00	68 50	30 00	10 00	9 00	39 00	42 50
Sagadahoc, Richmond Farmers' and Mechanics' Club	2 00	5 15	-	7 60	3 00	2 70	2 65	1 00	1 00	-	75
Somerset County	5 00	8 00	2 00	42 50	-	11 25	11 50	1 00	9 25	14 00	5 00
Somerset, East	24 00	-	6 75	53 00	15 00	17 50	4 50	5 55	12 25	18 00	15 00
Somerset, Central	9 50	19 25	-	40 00	-	21 25	3 50	-	3 00	-	8 00
Waldo County	11 00	18 50	-	19 50	12 00	11 00	5 00	3 00	3 00	-	14 00
Waldo and Penobscot	79 00	107 00	-	95 00	115 00	30 00	15 00	12 00	63 00	59 00	42 00
Waldo, North	17 00	16 00	14 00	18 00	10 00	14 00	11 00	-	12 00	-	-
Washington County	10 50	11 90	-	17 50	22 40	10 15	-	-	-	-	-
Washington, West	42 00	57 00	-	68 00	-	62 00	-	-	-	-	42 00
York, Shapleigh and Acton	-	-	1 50	14 25	-	5 00	32 75	-	6 00	45 00	12 00
York, Ossipee Valley Union	14 00	40 00	-	39 00	6 00	31 50	25 50	10 00	10 00	44 00	25 00
York, North Berwick	5 00	9 00	3 00	9 00	20 00	5 00	5 00	-	5 00	16 00	5 00
Total	$1,334 90	$1,593 20	$193 25	$1,588 22	$683 90	$839 20	$594 12	$135 05	$340 75	$931 50	$1,038 50

ANALYSIS OF AWARDS—Concluded.

Name of Society.	Amount of premiums paid sheep.	Amount of premiums paid swine.	Amount of premiums paid poultry.	Amount of premiums paid grain and root crops.	Amount of premiums paid fruit and flowers.	Amount of premiums paid bread and dairy products.	Amount of premiums paid honey, sugar and syrups.	Amount of premiums paid agricultural implements.	Amount of premiums paid household manufactures and needle work.	Amount of premiums paid objects not named above.	Total amount of premiums and gratuities paid.
Maine State Pomological	-	-	-	-	$407 00	-	-	-	-	-	$407 00
Maine State Poultry and Pet Stock Association	-	-	$1,102 50	-	-	-	-	-	-	-	1,102 50
Androscoggin County	$20 00	$18 00	96 00	$85 00	76 00	$33 50	$13 50	$8 00	$104 30	$265 00	1,365 30
Aroostook, North	40 50	7 00	28 00	56 55	52 75	10 80	8 50	2 00	43 75	122 07	689 42
Aroostook, Madawaska	6 00	-	-	8 70	2 00	-	-	-	6 00	-	65 45
Cumberland County	21 00	10 00	92 50	30 00	27 00	34 00	-	-	-	97 50	726 00
Cumberland, North	3 00	6 00	10 00	20 25	19 50	9 00	5 00	2 50	38 70	50 00	501 45
Cumberland Farmers' Club	2 00	-	14 25	29 25	27 05	8 45	-	-	26 50	7 75	361 50
Cumberland, Gray Park Association	5 00	9 00	38 25	13 25	7 65	6 05	1 25	-	16 45	14 50	261 40
Cumberland, Bridgton Farmers' & Mechanic' Asso	18 00	13 00	23 00	69 50	-	11 00	-	11 00	28 50	27 00	662 50
Cumberland, New Gloucester and Danville	6 00	15 00	10 00	17 75	22 15	9 65	5 25	-	28 95	40 50	320 25
Cumberland, Lake View Park	-	-	75	5 85	14 95	1 00	2 25	-	18 25	-	91 05
Franklin County	157 50	15 00	72 25	11 25	55 25	20 50	3 25	8 00	67 90	65 25	1,071 40
Franklin, North	27 00	5 05	19 55	10 85	9 20	4 50	2 00	-	27 79	-	254 99
Hancock County	16 00	5 00	7 50	51 25	27 25	7 25	4 25	-	30 25	4 50	329 75
Hancock, North	50	1 00	1 85	19 60	18 40	4 25	1 00	-	34 60	13 35	141 80
Hancock County Fair Association	18 00	17 50	33 25	63 50	34 75	22 50	6 25	-	51 35	6 00	414 35
Hancock, Eden	3 00	8 00	5 00	35 00	20 00	3 00	-	-	6 00	-	120 00
Kennebee County	30 00	21 00	38 00	103 00	85 00	35 00	9 00	-	91 00	6 00	850 50
Kennebec, South	9 00	1 75	11 00	21 00	28 15	11 55	1 50	-	65 60	-	455 95
Knox, North	18 75	5 00	11 65	12 65	25 35	8 00	9 00	-	29 35	40	293 90
Lincoln County	1 50	5 50	21 25	37 75	3 00	8 50	4 25	-	27 75	14 40	361 15
Lincoln, Bristol	5 00	-	9 00	24 50	9 40	4 75	1 15	-	29 65	3 50	112 45
Oxford County	94 00	21 00	37 00	50 75	51 75	55 00	18 35	8 00	33 15	256 75	1,910 75
Oxford, Riverside Park Association	24 00	10 50	12 50	6 25	16 00	9 15	4 00	-	19 85	170 00	766 74
Oxford, West	27 00	30 00	21 00	32 00	24 25	25 40	16 75	-	25 00	106 25	839 15

Oxford, Androscoggin Valley	12 00	2 00	15 10	21 80	24 55	10 75	3 25	3 00	20 10	33 50	421 55
Oxford, North	12 00	9 75	4 75	16 25	11 92	8 35	2 55	1 00	20 00	2 45	201 44
Penobscot, West	25 00	9 00	20 20	21 15	27 86	16 00	-	-	137 63	194 52	824 61
Penobscot, North	4 75	3 00	5 50	5 00	7 25	4 75	3 00	-	7 50	-	115 75
Penobscot, East Eddington Farmers' Club	6 25	2 50	2 50	21 15	15 15	5 75	5 75	-	8 20	5 75	106 75
Penobscot, Orrington	6 00	4 50	1 00	12 00	24 25	3 00	3 00	-	26 15	10 00	125 40
Piscataquis County	18 50	21 00	14 25	4 00	19 25	5 00	2 50	-	11 25	-	345 50
Sagadahoc County	28 00	30 00	108 25	125 60	124 00	70 00	5 00	-	53 25	272 34	1,635 69
Sagadahoc, Richmond Farmers'& Mechanics' Club	-	80	3 75	14 40	12 25	1 80	25	-	7 05	4 60	97 40
Somerset County	26 25	75	1 25	7 25	1 25	1 40	50	-	12 75	-	206 90
Somerset, East	52 00	7 55	33 00	15 00	6 25	10 40	3 30	-	31 00	-	507 30
Somerset, Central	9 50	5 00	19 50	5 25	9 25	3 00	1 00	-	6 00	3 00	189 50
Waldo County	11 00	3 00	8 00	3 25	13 75	4 00	-	1 00	33 20	7 00	216 70
Waldo and Penobscot	70 00	37 00	14 25	44 00	46 75	38 50	1 00	-	114 45	3 50	1,202 45
Waldo, North	21 00	5 00	2 00	23 25	12 75	16 50	10 50	-	16 50	-	281 50
Washington County	14 70	8 40	12 08	34 13	14 53	16 56	1 23	-	30 98	-	246 36
Washington, West	123 00	13 00	37 25	126 00	66 75	27 25	6 75	-	119 85	51 35	1,024 20
York, Shapleigh and Acton	3 50	1 50	18 50	70 00	40 00	15 00	10 00	-	25 00	77 75	386 25
York, Ossipee Valley Union	6 00	4 00	12 00	20 00	-	-	49 05	-	-	30 00	413 05
York, North Berwick	-	-	6 00	14 25	3 00	5 00	-	-	50 00	-	168 25
Total	$1,002 20	$392 05	$2,055 18	$1,419 18	$1,544 56	$605 81	$225 13	$44 50	$1,581 50	$1,966 48	$23,193 25

FINANCES.

Name of Society.	Amount received from State.	Receipts from membership.	Receipts from loans.	Receipts from entry fees for trotting purses.	Receipts from all other sources.	Total receipts.	Amount expended in improvements.	Amount expended in trotting purses.	Expenses during the fair.	Amount expended for all other purposes.	Total amount paid out including premiums and gratuities.	Value of property belonging to the society.	Amount of liabilities.
Maine State Pomological	$1,000 00	$79 00	-	-	$106 75	$1,185 75	-	-	-	$838 84	$1,245 84	$1,600 00	$100 00
Maine State Poultry and Pet Stock Association	312 72	82 00	-	-	1,366 70	1,761 42	$100 00	-	$350 00	-	1,552 50	750 00	-
Androscoggin County	467 00	78 00	$500 00	$365 00	1,578 00	2,988 00	110 00	$750 00	746 00	-	2,971 30	1,000 00	600 00
Aroostook, North	167 67	53 75	-	390 00	2,750 75	3,362 17	550 00	1,006 75	420 00	195 00	2,861 17	5,000 00	2,116 00
Aroostook, Madawaska	21 81	30 00	-	-	15 64	67 45	-	-	2 00	-	67 45	20 00	-
Cumberland County	246 48	-	-	457 50	2,428 98	3,132 96	54 59	1,050 00	652 90	634 47	3,117 96	4,000 00	750 00
Cumberland, North	133 87	100 00	-	-	277 48	511 35	25 00	-	45 00	27 00	598 45	2,500 00	107 00
Cumberland Farmers' Club	121 10	12 00	-	132 50	849 27	1,114 87	65 15	375 00	164 00	216 70	1,182 35	3,000 00	275 00
Cumberland, Gray Park Asso	99 54	-	-	212 50	608 77	920 81	-	520 00	300 00	22 00	1,103 40	9,000 00	-
Cumberland, Bridgton Farmers' and Mechanics' Association	200 60	-	-	225 00	1,507 15	1,932 75	125 00	575 00	138 30	422 29	1,923 09	2,800 00	-
Cumberland, New Gloucester and Danville	77 22	-	-	72 67	598 45	748 34	50 00	400 00	136 67	125 00	1,031 92	2,000 00	-
Cumberland, Lake View Park	39 72	-	-	15 00	229 15	283 87	48 00	86 50	40 13	15 00	280 68	800 00	70 00
Franklin County	254 04	729 00	-	525 00	2,643 83	4,151 87	202 24	1,150 00	1,162 25	268 50	3,854 39	10,000 00	-
Franklin, North	88 32	320 00	-	90 00	567 76	1,066 08	50 00	400 00	221 00	172 48	1,098 47	3,851 50	2,623 23
Hancock County	-	-	-	88 75	1,239 42	1,328 17	221 05	411 25	358 95	38 84	1,359 84	4,000 00	-
Hancock, North	58 88	2 00	-	-	580 77	641 65	112 25	-	239 66	178 39	672 10	250 00	30 45
Hancock County Fair Association	178 48	-	-	135 00	1,745 30	2,058 78	150 00	665 00	613 53	327 50	2,170 38	10,000 00	572 27
Hancock, Eden	33 37	-	-	-	574 72	608 09	150 00	-	122 00	203 00	595 00	1.000 00	270 00
Kennebec County	297 67	2 00	-	218 75	1,835 35	2,353 77	75 00	600 00	450 00	168 72	2,144 22	3,500 00	1,397 00
Kennebec, South	128 34	30 00	-	118 75	1,697 76	1,974 85	312 56	582 50	274 86	432 45	2,058 32	2,500 00	-
Knox, North	104 10	319 50	1,000 00	115 00	1,071 13	2,609 73	137 48	502 50	318 69	2,003 25	3,255 82	2,000 00	900 00
Lincoln County	130 02	14 00	175 00	6 75	1,071 12	1,396 89	250 00	425 00	375 00	144 70	1,555 85	1,500 00	350 00
Lincoln, Bristol	44 06	2 00	190 00	-	341 17	577 23	286 76	-	114 69	58 02	571 92	1,200 00	175 00
Oxford County	560 47	26 00	-	267 00	4,813 53	5,667 00	-	915 00	569 09	2,060 81	5,455 65	10,000 00	-

Oxford, Riverside Park Asso. ...	173 50	-	-	187 50	422 63	783 63	100 00	1,050 00	190 00	125 00	2,231 74	2,000 00	794 87
Oxford, West........................	272 45	80 00	500 00	336 50	3,425 77	4,614 72	618 14	850 00	172 67	2,565 64	5,045 60	8,500 00	600 00
Oxford, Androscoggin Valley	111 38	14 00	-	355 00	1,794 35	2,274 73	150 00	1,000 00	200 00	433 73	2,205 28	2,500 00	2,400 00
Oxford, North	67 14	5 00	-	120 00	569 30	761 44	50 00	322 50	75 00	85 00	733 94	3,000 00	-
Penobscot, West...........	262 11	17 00	-	400 00	1,520 50	2,199 61	200 00	950 00	225 00	-	2,199 61	6,000 00	3,500 00
Penobscot, North	25 55	-	-	-	150 25	175 80	10 00	-	30 00	5 00	160 75	-	-
Penobscot, East Eddington Farmers' Club...	24 04	-	-	-	315 55	339 59	-	-	78 26	-	185 01	1,500 00	-
Penobscot, Orrington	41 09	-	-	37 50	401 49	480 08	-	120 00	100 00	88 21	433 61	1,100 00	325 00
Piscataquis County...	117 60	129 00	-	137 00	-	383 60	100 00	275 00	-	-	720 50	-	-
Sagadahoc County.....	541 29	391 00	1,886 66	722 50	5,273 02	8,817 47	2,500 00	1,530 00	1,000 00	2,151 78	8,817 47	7,000 00	2,550 00
Sagadahoc, Richmond Farmers' and Mechanics' Club	25 35	50	-	-	117 59	143 44	13 99	-	20 00	41 12	172 51	100 00	29 07
Somerset County	68 19	-	-	110 00	574 38	752 57	-	275 00	138 56	19 00	639 46	1,150 00	-
Somerset, East..........	91 70	50 00	-	230 00	701 88	1,073 58	200 00	575 00	275 00	-	1,557 30	2,000 00	1,300 00
Somerset, Central	91 70	10 00	-	170 00	1,015 23	1,286 93	-	437 50	247 57	429 00	1,303 57	2,000 00	800 00
Waldo County	71 83	6 90	-	166 50	801 08	1,046 31	45 00	605 00	199 88	196 43	1,263 01	3,500 00	-
Waldo and Penobscot.	250 00	-	-	255 25	3,288 97	3,794 22	50 00	1,062 56	736 94	739 35	3,791 30	3,500 00	50 00
Waldo, North	99 83	37 00	-	247 75	728 10	1,112 68	-	412 50	254 54	-	948 54	164 14	-
Washington County	52 36	-	-	160 00	737 90	950 26	-	375 00	165 48	186 21	973 05	1,700 00	1,000 00
Washington, West.................	371 54	2 00	246 25	275 00	2,660 74	3,555 53	106 10	975 00	650 00	317 01	3,072 31	2,715 22	1,349 13
York, Shapleigh and Acton.......	129 67	212 00	60 00	-	20 54	422 21	-	-	11 00	15 25	412 50	2,000 00	-
York, Ossipee Valley Union......	200 00	-	-	360 00	1,415 10	1,975 10	202 69	960 00	-	399 31	1,975 05	6,500 00	1,275 00
York, North Berwick	-	-	-	108 75	1,017 43	1,126 18	200 00	475 00	350 00	101 18	1,294 43	8,000 00	5,475 00
Total	$7,856 80	$2,833 65	$4,557 91	$7,814 42	$57,450 75	$80,513 53	$7,621 00	$22,664 56	$12,934 62	$16,451 18	$82,864 61	$147,200 86	$31,784 02

EXTRACTS FROM CATTLE COMMISSIONERS' REPORT.

In 1901 and 1902 there were 661 cattle and horses destroyed, of which 545 were cattle and 116 horses, costing on an average $11.30 each for destroying, condemning and disinfecting and making visits where no cases were found. The cattle owners received on an average $22.60 per head. During the years of 1899 and 1900, 363 cattle and horses were destroyed, while in 1901 and 1902, 661 cattle and horses were destroyed, which shows the large increase in the business done. We can only say concerning the causes of this that tuberculosis is either increasing among our herds, or the people are better informed in regard to the disease and do not hesitate so much as formerly to call upon the commissioners for an examination of their herds. Cattle owners do not seem to be afraid of the commissioners and have come to the conclusion that they are doing more good than harm. The business seems to be regular and satisfactory. Unfortunately we have been obliged to ask people to wait for their pay since March 1, this having been caused by deficiency from last year's business of $3,282.63, which was paid from the 1902 appropriation, leaving only $4,260.75 to pay for cattle destroyed and expenses thereof during the year of 1902.

Thirty-one horses were destroyed during the year of 1901, which was about the usual number. In 1902 there were 85 horses destroyed, this being a large increase from former years, the disease being found principally among Western team horses. This has caused an increased expense on account of disinfecting and burial expenses. We find some complaints on account of appraisals, owners claiming that $50 as a limit is too small for a horse worth $200. In no case can an owner get over $25 for his horse, no matter how valuable the animal may be. The disease among horses has been found in different sections of this State and the public should realize more clearly the importance of stamping out this disease, as it is considered more dangerous to man than tuberculosis. It should not be given a chance to spread.

FOOT AND MOUTH DISEASE.

November 17, 1902, I received the following from Austin Peters, Chief of the Cattle Bureau of the Board of Agriculture in Massachusetts: "There are symptoms of a disease similar to foot and mouth disease and which seems to be very contagious, and which has made its appearance in Massachusetts and Rhode Island."

On November 18, notice was served on all railroads, express companies, steamships and other common carriers that no more permits should be granted persons wishing to ship cattle, sheep and swine into Maine from any other state.

Up to the writing of this report there is no foot and mouth disease in Maine, and we consider the dairymen and cattle owners in our State extremely fortunate.

When we take into consideration that there are 290,000 cattle in Maine and 90 per cent are cows and heifers, we have ample proof of the fact that during the last twenty years the State has all the while been growing more and more a dairy State. And while this change has been going on the farmers and breeders have been raising a finer bred dairy cow. By their experience the Commissioners find that these finer bred animals are more susceptible to disease than ordinary non-milk-producing breeds. And as time goes on and these animals become more numerous it will be more difficult to keep our herds healthy.

In the early part of 1902 the Commissioners were called upon to investigate several large herds which were found to be badly diseased, using nearly all of the unexpended balance of the 1902 appropriation. This caused us to stop paying for cattle and horses after March 1. This state of affairs is a hardship to those who are unfortunate in having diseased cattle and horses and also very unpleasant to the Commissioners while doing the business. Yet it was no fault of the Legislature because it appropriated the amount requested by the Commissioners and at that time the Commissioners thought that $15,000 would be sufficient to meet all expenses in carrying on the work of 1901 and 1902. It must be borne in mind that the Commissioners are bound by the law, which does not say that they shall stop when their appropriation is exhausted. We hardly think that the law will excuse the Commissioners for not doing what was necessary on account of the lack of funds.

The Commissioners in performing their duties see tuberculosis in all of the different forms and stages of the disease; and in many instances have tracked the ancestors of some diseased cow from some town in Maine back to the Jersey islands or the plains of Holland, proving the fact that the disease is carried along for generations in some families. Once it was thought by many that the Jerseys were responsible for tuberculosis. To be sure they are not quite as tough and hardy, a little more delicate, yet we have come to the conclusion that whenever an animal is allowed to remain in the herd all through the different stages of the disease, it has no respect for breeds, and in our opinion tuberculosis should be charged to no particular breed, being contracted by animals the same as by the human race, by a chain of circumstances and conditions.

LAWS RELATING TO CONTAGIOUS CATTLE DISEASES, AS AMENDED.

AN ACT TO EXTIRPATE CONTAGIOUS DISEASES AMONG CATTLE.

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

SECT. 1. That for the purpose of facilitating and encouraging the live stock interests of the State of Maine, and for extirpating all insidious, infectious and contagious diseases, now or that may be among cattle, horses and sheep, and especially tuberculosis, the governor of the State is hereby authorized and required, immediately after the passage of this act, to appoint a board of cattle commissioners consisting of three persons of known executive ability, who shall be charged with the execution of the provisions of this act, and who shall be known and designated as the State of Maine Cattle Commission and whose powers and duties shall be those provided for in this act, and whose tenure of office shall be at the option of the governor. The compensation of said commissioners shall be at a rate of three dollars per day during the time they are actually engaged in the discharge of their duties as commissioners. The said commissioners shall respectively take an oath to faithfully perform the duties of their office, and shall immediately organize as such commission by the election of one of their number as president thereof, and proceed forthwith to the discharge of the duties devolved upon them by the provisions of this act.

SECT. 2. That it shall be the duties of the said commissioners to cause investigation to be made as to the existence of tuberculosis, pleuro-pneumonia, foot and mouth disease, and any other infectious or contagious diseases. And such commissioners or their duly constituted agent, are hereby authorized to enter any premises or places, including stock yards, cars and vessels within any county or part of the State in or at which they have reason to believe there exists any such diseases, and to make search, investigation and inquiry in regard to the existence thereof. Upon the discovery of the existence of any of the said diseases, the said commissioners are hereby authorized to give notice, by publication, of the existence of such disease, and the locality thereof, in such newspapers as they may select, and to notify in writing the officials or agents of any railroad, steamboat or other transportation company, doing business in or through such infected locality, of the existence of such disease; and are hereby authorized and required to establish and maintain such quarantine of animals, places, premises or localities as they may deem necessary to prevent the spread of any such disease, and also to cause the appraisal of the animal or animals affected with the said disease, in accordance with such rules and regulations by them as hereinafter authorized and provided, and also to cause the same to be destroyed, and to pay the owner or owners thereof one-half of their value, as determined upon the basis of health before infection out of any moneys appropriated by the legislature for that purpose; provided, however, that no appraised value shall be more than one hundred dollars for an animal with pedigree recorded or recordable in the recognized herd-books of the breed in which the animal destroyed may belong, nor more than fifty dollars for an animal which has no recordable pedigree; provided, further, that in no case shall compensation be allowed for an animal destroyed under the provisions of this act, which may have contracted or been exposed to such disease in a foreign country, or on the high seas, or that may have been brought into this State within three years previous to such animals showing evidence of such disease, and the owner or owners shall furnish satisfactory evidence as to the time such animal or animals shall have been owned in the State; nor shall compensation be allowed to any owner who in person, or by agent, knowingly and wilfully conceals the existence of such disease, or the fact of exposure thereto in animals of which the person making such concealment, by himself or agent, is in whole or part owner.

SECT. 3. That the said commissioners are hereby authorized and required to make record, and publish rules and regulations providing for and regulating the agencies, methods and manner of conducting, and the investigations aforesaid, regarding the existence of said contagious diseases; for ascertaining, entering and searching places where such diseased animals are supposed to exist; for ascertaining what animals are so diseased, or have been exposed to contagious diseases; for making, reporting and recording descriptions of the said animals so diseased or exposed and destroyed, and for appraising the same, and for making payment therefor; and to make all other needful rules and regulations which may, in the judgment of the commissioners, be deemed requisite to the full and due execution of the provisions of this act. All such rules and regulations, before they shall become operative, shall be approved by the governor of Maine and thereafter published in such manner as may be provided for in such regulations and after such publication said rules and regulations shall have the force and effect of law, so far as the same are not inconsistent with this act and other laws of the State, or United States.

SECT. 4. That any person or persons who shall knowingly and wilfully refuse permission to said commissioners, or either of them, or their duly constituted agent to make, or who knowingly and wilfully obstructs said commissioners, or either of them, or their duly constituted agent in making all necessary examinations of, and as to animals supposed by said commissioners to be diseased as aforesaid, or in destroying the same, or who knowingly attempts to prevent said commissioners, or either of them, or their duly constituted agent from entering upon the premises and other places hereinbefore specified where any of said diseases are by said commissioners supposed to exist, shall be deemed guilty of a misdemeanor, and, upon conviction thereof, or of either of the acts in this section prohibited, shall be punished by fine not exceeding one hundred dollars, or by imprisonment, not exceeding ninety days, or by both fine and imprisonment, at the discretion of the court.

SECT. 5. That any person who is the owner of, or who is possessed of any interest in any animals affected with any of the diseases named in section two of this act, or any person who is agent, common carrier, consignee, or otherwise is charged with any duty in regard to any animal so diseased, or exposed to the contagion of such disease, or any officer or agent charged with any duties under the provisions of this act, who shall knowingly conceal the existence of such contagious disease, or the fact of such exposure to said contagion, and who shall knowingly and wilfully fail, within a reasonable time, to report to the said commissioners their knowledge or their information in regard to the existence and location of said disease, or of such exposure thereto, shall be deemed guilty of a misdemeanor, and shall be punishable as provided in section four of this act.

SECT. 6. That when the owner of animals, decided under the provisions of this act, by the proper authority, to be diseased, or to have been exposed to contagion, refuses to accept the sum authorized to be paid under the appraisement provided for in this act, it shall be the duty of the commissioners to declare and maintain a rigid quarantine as to the animals decided, as aforesaid, to be diseased or to have been exposed to any contagious or infectious disease, and of the premises or places where said cattle may be found, according to the rules and regulations to be prescribed by said commissioners, approved by the governor, and published as provided in the third section of this act.

SECT. 7. That no person or persons owning or operating any railroad, nor the owner or owners, or masters, of any steam, sailing, or other vessels, within the State, shall receive for transportation, or transport from one part of the State to another part of the State, or bring from any other state or foreign country any animals affected with any of the diseases named in section two of this act, or that have been exposed to such diseases, especially the disease known as tuberculosis, knowing such animals to be affected, or to have been so exposed; nor shall any person or persons, company or corporation, deliver for such transportation to any railroad company, or to the master or owner of any vessel, any animals, knowing them to be affected with, or to have been exposed to, any of said diseases; nor shall any person or persons, company or corporation, drive on foot, or transport in private conveyance, from one part of the State to another part of the State, any animal, knowing the same to be affected with, or to have been exposed to, any of said diseases. Any person or persons violating the provisions of this section, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished by fine not exceeding the sum of two hundred dollars, or by imprisonment not exceeding six months, or by both fine and imprisonment.

SECT. 8. That it shall be the duty of the several county attorneys to prosecute all violations of this act, which shall be brought to their notice or knowledge by any person making the complaint under oath; and the same shall be heard in any supreme judicial court having jurisdiction in the county in which the violation of this act has been committed.

SECT. 9. That the said commissioners are hereby authorized to appoint or elect one of their number as secretary of said board, who shall receive a reasonable compensation for his services during the time in which, under the provisions of this act, the services of the said commissioners shall be required. The said commissioners shall make and preserve a full record of all rules and regulations promulgated under the provisions of this act, of all payments and expenses hereunder incurred, and all other transactions performed by said commissioners in the discharge of their duties as herein provided; and the said commissioners shall, on or before the first Wednesday in January of each year, during their continuance in service, and at other times as they may deem conducive to the public interests, or as they may be required by the governor of State, report to said governor full and accurate accounts of their expenditures, and other proceedings under the provisions of this act, and of the condition of said diseases, if any, in the State, to be communicated by him to the legislature. Whenever the functions of said commission shall be suspended or terminated, it shall turn over to the secretary of state, all its books, papers, records, and other effects, taking his receipt therefor, and he shall remain the custodian of the same until such time as the functions of said commission may be restored.

SECT. 10. That the commissioners shall have power, and are hereby authorized to employ skilled veterinarians, and such other agents and employes as they may deem necessary to carry into effect the provisions of this act, and to fix the compensation of the person or persons so employed, and to terminate such employment at their discretion; and they are authorized out of the moneys by this act appropriated, to make such expenditures as may be needed for the actual and necessary traveling expenses of themselves and their said employes, stationery, expense of disinfecting premises, cars and other places, destroying diseased and exposed animals, and paying for the same, and such other expenses and expenditures as they may find to be actually necessary to properly carry into effect the provisions of this act.

SECT. 11. That the moneys appropriated by this act shall be paid over to the secretary of said commission, from time to time, as the same may be found to be needed, upon requisition made by the said commissioners, and shall be disbursed by the said secretary of said commission only upon vouchers approved by said commissioners or a majority of them. The said secretary shall before entering upon the duties of his office, take an oath to faithfully discharge the duties thereof, and shall enter into a bond to the State of Maine, with sureties to be approved by the treasurer of State, in such sum as he may designate, for the faithful accounting of all moneys received by the said secretary of the commission, under the provisions of this act.

SECT. 12. That for the purpose of carrying into effect the provisions of this act, the sum of five thousand dollars, or so much thereof as may be necessary, is hereby appropriated out of any moneys in the treasury not otherwise appropriated.

SECT. 13. That all acts and parts of acts inconsistent or in conflict with the provisions of this act be, and the same are hereby repealed.

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FEEDING CHICKENS FOR GROWTH.

By G. M. Gowell.

COOPS vs. HOUSE AND YARD.

This test is a continuation of work reported in Bulletin No. 64 where small coops, holding four chickens each, were compared with small pens containing 20 birds of the same age and size. The purpose was to learn if close confinement in small numbers, gives better results than where larger numbers are kept together without close crowding.

The English and French chicken fatteners, who make a specialty of the business, fattening many thousands each year, use small coops holding four or five birds each and claim advantages for the method. This plan of fattening has been adopted by the Canadian government and illustrated by it at various places, for the purpose of encouraging the use of better methods by the people. The work has been favorably noticed by the poultry journals of this country and under this encouragement the method seemed likely of adoption by our poultrymen and farmers. The coops we used are similar in size and form to theirs and our food was prepared and fed in the same way as theirs, but it was of different composition, as theirs was made largely from finely ground oats and tallow, while we used corn meals, wheat middlings and ground beef scrap, with small quantities of finely ground oats in the earlier tests. That our gains with the birds in small coops were as great as those made by the foreigners is shown by the reports which they have published.

The coops that we used had each a floor space 16 by 23 inches. They were constructed of laths with close end partition of boards. The floors were of laths placed three-fourths of an inch apart, and one inch from the walls, so that they might be kept clean by the moving about of the birds. The coops were made, two together, without cutting the laths. The laths ran lengthwise of the coops on bottom, top and back, but on the front they were placed upright, and two inches apart, so that the chickens could feed through between them readily. V-shaped troughs with three inch sides were placed in front of and about two inches above the level of the floor of the coops.

FEEDING TEST NO. 4.

On July 25th 20 Plymouth Rock cockerels that were 95 days old, and even in size and thrift were put in five of the coops and fed twice daily for 28 days on porridge made from a mixture of 100 pounds of corn meal, 100 pounds of wheat middlings, and 40 pounds of animal meal mixed up with cold water. They were fed all they would eat twice each day. On the same day that these birds were cooped, 68 of their mates, of the same age and quality, were put in a chicken house 9 by 11 feet in size, with an attached yard 15 by 20 feet. There were no green plants in this yard. These birds were fed in the same way, and on the same material as their mates in the small coops. The results are shown in the tables that follow:

CHICKENS IN SMALL COOPS.

FEED MIXED WITH WATER.

Coop.	Group 1.	Live Weights during Test.					Increase.	
		July 25.	August 1.	August 8.	August 15.	August 22.	Lot.	Each.
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1	Four Plymouth Rock cockerels.......	12.6	14.4	15.8	17.7	19.1	6.5	1.62
2	Four Plymouth Rock cockerels........	13.8	15.4	16.4	16.9	18.5	4.7	1 17
3	Four Plymouth Rock cockerels....	13.7	15.1	16.2	17.4	18.4	4.7	1.17
4	Four Plymouth Rock cockerels	14.0	16.0	17.3	17.8	18.6	4.6	1.15
5	Four Plymouth Rock cockerels........	14.8	17.1	18 5	20.0	21.2	6.4	1.60
	Total weights	68.9	78.0	84.2	89.8	95.8	26.9	1.34
	Increase each week.........................	....	9.1	6.2	5.6	6.0		

Pounds of dry meal mixture used, 240.
Pounds of mixture required to produce a pound of gain, 8.92.
Age of chickens at commencement of test, 95 days.

SIXTY-EIGHT CHICKENS (MATES TO THOSE IN GROUPS 1 AND 2) CONFINED IN SMALL HOUSE AND YARD, AND FED 28 DAYS ON SAME FOOD AS THOSE IN GROUP 1.

Live Weights.		Increase in Weights.	
July 25.	August 22.	Lot of 68.	Each.
199.3 pounds	296.8 pounds....	97.5 pounds.	1.43 pounds.

Pounds of dry meal mixture used, 513.
Pounds of mixture required to produce a pound of gain, 5.26.

FEEDING TEST NO. 5.

The conditions under which this test was made were like those in No. 4 except in the composition of the food. The chickens were from the same hatch and of like quality with the others; both trials were made at the same time and the food was prepared and fed in the same manner in both cases. In this test the food was from a mixture of 100 pounds of corn meal, 100 pounds of wheat middlings and 33 pounds of meat meal, mixed as used with cold skim-milk. Two pounds of the skim-milk was used with one pound of the mixed meal.

The following tables show the work as it progressed and the results:

CHICKENS IN SMALL COOPS.

FEED MIXED WITH MILK.

Coop.	Group 2.	Live Weights during Test. July 25.	August 1.	August 8.	August 15.	August 22.	Increase. Lot.	Each.
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
6	Four Plymouth Rock cockerels.........	13.3	14.2	16.2	18.0	19.2	5.9	1.47
7	Four Plymouth Rock cockerels.........	14.8	16.6	18.1	19.5	21.4	6.6	1.65
8	Four Plymouth Rock cockerels....	12.4	14.1	16.0	17.4	18.8	6.4	1.60
9	Four Plymouth Rock cockerels.........	15.0	17.6	19.8	22.0	23.4	8.4	2.10
10	Four Plymouth Rock cockerels..... ..	12.1	14.4	15.8	17.6	18.5	6.4	1.60
	Total weights................	67.6	76.9	85.9	94.5	101.3		
	Increase in weights	......	9.3	9.0	8.6	6.8	33.7	1.68

Pounds of dry meal mixture used, 231.
Pounds of skim-milk used, 465.
Pounds of dry mixture required to produce a pound of gain, 6.85.
Age of chickens at commencement of test, 95 days.

SIXTY-EIGHT CHICKENS (MATES TO THOSE IN GROUPS 1 AND 2) CONFINED IN SMALL HOUSE AND YARD, AND FED 28 DAYS, ON SAME FOOD AS THOSE IN GROUP 2.

Live Weights.		Increase in Weights.	
July 25.	August 22.	Lot.	Each.
202.9 pounds.... ...	319.4 pounds.....	116.5 pounds..........	1.713 pounds.

Pounds of dry meal mixture used, 469.5.
Pounds of skim milk used, 934.
Pounds of dry mixture required to produce a pound of gain, 4.03.

FEEDING TEST NO. 6.

The purposes and conditions were the same as with No. 4 excepting that the chickens were 160 days old. This test was continued 21 days. The results are given in the following tables:

CHICKENS IN SMALL COOPS.

FEED MIXED WITH WATER.

Coop.	Group.	Live Weights During Test.				Increase.	
		October 11.	October 18.	October 25.	November 1.	Lot.	Each.
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1	Four Plymouth Rock cockerels	17.4	18.1	20.4	22.4	5.0	1.25
2	Four Plymouth Rock cockerels	19.7	20.6	20.8	21.4	1.7	.42
3	Four Plymouth Rock cockerels	19.7	20.6	23.2	23.3	3.6	.90
4	Four Plymouth Rock cockerels	20.0	21.3	21.8	22.8	2.8	.70
5	Four Plymouth Rock cockerels	18.8	19.8	20.6	21.3	2.5	.62
	Total weights	95.6	100.4	106.8	111.2	15.6	.78
	Increase each week.................. ..	....	4.8	6.4	4.4		

Pounds of dry meal mixture used, 152.
Pounds of dry mixture required to produce a pound of gain, 9.74.
Length of feeding period, 21 days.
Age of chickens at commencement of test, 160 days.

TWENTY-FIVE CHICKENS (MATES TO THOSE IN TABLE NEXT PRECEDING THIS) CONFINED IN SMALL HOUSES AND FED 21 DAYS ON SAME FOOD MIXTURE AS THOSE IN TABLE REFERRED TO.

Live Weight.		Increase in Weights.	
October 11.	November 1.	Lot.	Each.
121.1 pounds........	132.3 pounds........	11.2 pounds	.45 pounds.

Pounds dry meal mixture used, 189.
Pounds of dry mixture required to produce a pound of gain, 16.87.

FEEDING TEST NO. 7.

The conditions were the same as with No. 6 except that the porridge was made by use of skim-milk instead of water. The results are given in the tables which follow:

CHICKENS IN SMALL COOPS.

FEED MIXED WITH MILK.

Coop.	Group.	Live Weights During Test.				Increase.	
		October 11.	October 18.	October 25.	November 1.	Lot.	Each.
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs	Lbs.
6	Four Plymouth Rock cockerels	18.5	20.5	21.0	22.0	3.5	.87
7	Four Plymouth Rock cockerels	20.2	21.4	22.6	24.4	4.2	1.05
8	Four Plymouth Rock cockerels	20.8	22.4	22.8	23.5	2.7	.67
9	Four Plymouth Rock cockerels.......	18.7	20.4	21.0	22.4	3.7	.92
10	Four Plymouth Rock cockerels......	22.0	23.3	25.2	25.4	3.4	.85
	Total weights	100.2	108.0	112.6	117.7	17.5	.875
	Increase each week	......	7.8	4.6	5.1		

Pounds of dry meal mixture used, 144.
Pounds of skim milk used, 290.
Pounds of dry mixture required to produce a pound of gain, 8.22.
Length of feeding period, 21 days.
Age of chickens at commencement of test, 160 days.

TWENTY-FIVE CHICKENS (MATES TO THOSE IN THE TABLE ABOVE) CONFINED IN SMALL HOUSE AND FED 21 DAYS ON THE SAME FOOD MIXTURE AND MILK AS THOSE IN THE TABLE REFERRED TO.

Live Weights.		Increase in Weights.	
October 11.	November 1.	Lot.	Each.
121.7 pounds	144.9 pounds.......	23.2 pounds..........	.932 pounds.

Pounds dry meal mixture used, 177.
Pounds skim milk used, 360.
Pounds mixture required to produce a pound of gain, 7.63.

CONCLUSIONS.

Small coops vs. houses and yards—Including the test reported in Bulletin No. 64, this Station has made six group trials of close confinement against partial liberty, in fattening chickens. These have comprised the use of 35 separate coops and 6 houses. Three hundred and twenty-one chickens of different ages have been fed in these 41 lots, in periods of 21, 28, or 35 days each, and the occupants of all coops have had weekly weighings.

In 11 of the coops containing 4 birds each, the gains have been greater than in the houses and yards containing from 20 to 68 birds, with which they were matched. In the 24 other coops, the gains were less than in the houses and yards with which they were similarly matched. In five of the six groups, the gains have been greater in the houses and yards, and in one of the six groups the gain has been greater in the coops.

These results show that close cooping is not necessary in order to secure the greatest gains in chicken fattening, and that the chicken made greater gains when given a little liberty than when kept in close confinement.

The labor involved in caring for birds in small numbers in coops, is greater than in caring for an equal number in a house and yard. The results are so pronounced that we regard them as conclusive.

Relation of age to fattening—The tables show plainly that with poultry the periods of cheap and rapid gains in weight come early in life. The greatest gains were made in one of the tests reported in Bulletin No. 64, where in a feeding period of 35 days, 40 chickens confined in coops gained an average of 2.23 pounds each, and 20 others of like age and condition fed in comparison in a house and yard gained 2.47 pounds each. The rations which these birds received was partly made up of ground oats, and the feeding period was 35 days in length, instead of 21 or 28 days, as in tests Nos. 4, 5, 6 and 7. These conditions probably account for the greater gains which were made.

In tests Nos. 4 and 5 the birds were 95 days old at the beginning of the feeding period, which continued 28 days. The average gain was 1.54 pounds each.

In tests Nos. 6 and 7 the birds were 160 days old at the beginning of the test, which lasted 21 days instead of 28 as in Nos. 4 and 5. They gained .75 pounds each or about one-half as much as the gain made by the chickens that were 95 days old. The matter of age was not designed as a feature of the tests when planning them, but the results are so marked that they should not be overlooked.

Skim-milk as chicken food—In tests 4 and 6 water was used in mixing the meal for feeding, and in 5 and 7 milk was used.

The composition of the mixture in which water was used was 100 pounds of corn meal, 100 pounds of wheat middlings and 40 pounds of ground beef scrap. The mixture in which milk was used was the same as the water mixture, except that it contained 33 pounds of ground beef scrap instead of 40 as in the water mixture. This difference was made so that the two rations should be equal in digestible protein. Two pounds of milk were used to each pound of the meal mixture.

The following table shows the results collectively. Compare tests No. 4 with No. 5, and No. 6 with No. 7 for results in separate coops.

Chickens 95 days old.	Feed mixed with water.	Feed mixed with milk.
	Lbs.	Lbs.
In coops, gained in 28 days each	1 34	1.68
In houses, gained in 28 days each	1.43	1.71
Chickens 160 days old.		
In coops, gained in 28 days each	.78	.87
In house, gained in 28 days each	.45	.93

The use of meat meal in chicken fattening—Late in the season 40 chickens that were 161 days old, and averaged in weight a little over five pounds each, were divided into 10 lots. Each lot of four birds was put into a small fattening coop and fed for 28 days. Those in coops 1 to 5, constituting group 1, were fed from a mixture of 100 pounds of corn meal, 100 pounds of wheat middlings and 50 pounds of meat meal. Twice daily as needed for use, porridge was made from this meal mixture with cold water. Those in coops 6 to 10, constituting group 2, were fed on porridge made from equal quantities of corn meal and wheat middlings, without meat meal. This porridge was also made with cold water.

The average increase in weight of each of the 20 birds fed without meat meal was .72 pounds, and the average increase of those fed with meat meal was .92 pounds. Where no meat meal was fed, 14.96 pounds of dry meal was required to make a pound of gain. Where meat meal was fed, 12.07 pounds of dry meal produced a similar gain.

This indicates that where one fifth of the food used was meat meal, a pound of gain in the live birds was made by the use of about one fifth less weight of food than where no meat meal was used. The mixture containing the meat meal cost 1.15 cents per pound, while the mixture without meat meal cost 1 cent per pound. Where meat meal was fed, a pound of live weight of chicken was made at a cost of 13.88 cents. Where no meat meal was used a pound of gain cost 14.96 cents.

These tests were made with birds that were advanced in age and growth, and the gains were slow and expensive. In other feeding tests that we have made with chickens that were from 100 to 130 days old, the gains have been much greater and the costs per pound as small as 5 to 8 cents per pound, when the meal used was reckoned at the same price per pound as in this test. The data of the test is shown in the tables following:

CHICKENS FED WITH MEAT MEAL IN RATION.

Coop.	Group 1.	Live Weights during Test.					Increase.	
		October 5.	October 12.	October 19.	October 26.	November 2.	Lot.	Each.
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1	Four White Wyandottes	20.2	22.3	23.3	23.6	24.6	4.4	1.10
2	Four White Wyandottes	20.1	21.9	22.1	22.4	23.4	3.3	.82
3	Four Plymouth Rocks	20.4	22.8	23.2	23.6	24.8	4.4	1.10
4	Four Plymouth Rocks	20.7	22.4	23.4	23.8	24.2	3.5	.87
5	Four White Wyandottes	21.5	22.1	23.1	23.3	24.2	2.7	.67
	Total weights..........	102.9	111.5	115.1	116.7	121.2		
	Increase in weights	.....	8.6	3.6	1.6	4.5	18.3	.915

Pounds of dry grain mixture used in the test, 221.
Pounds of mixture required to produce a pound of gain, 12.07.
Age of birds at beginning of test, 161 days.
Average weight of birds at beginning of test, 5.14 pounds.

CHICKENS FED WITHOUT MEAT FOOD IN RATION.

Coop.	Group 2.	Live Weights during Test.					Increase.	
		October 5.	October 12.	October 19.	October 26.	November 2.	Lot.	Each.
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
6	Four White Wyandottes ...	21.4	22.0	22.4	22.5	22.8	1.4	.35
7	Four Plymouth Rocks	21.4	22.1	22.4	22 4	24.2	2.8	.70
8	Four Plymouth Rocks	20.6	22.9	23.6	24.4	25.6	5.0	1.25
9	Four White Wyandottes	20.7	22.2	22.6	22.8	23.0	2.3	.57
10	Four White Wyandottes	20.3	21.6	21.8	22.8	23.1	2.8	.70
	Total weights	104.4	110.8	112.8	113.9	118.7		
	Increase in weights	.....	6.4	2.0	1.1	4.8	14.3	.715

Pounds of dry grain mixture used in the test, 214.
Pounds of mixture required to produce a pound of gain, 14.96.
Age of birds at beginning of test, 161 days.
Average weight of birds at beginning of test, 5.22 pounds.

EXPERIMENTS IN INCUBATION.

G. M. GOWELL.

TREATMENT OF EGGS BEFORE INCUBATION.

Close Cases vs. Light and Air.

Some of the influences which may affect the strength of the germs of eggs that are kept for some time before being incubated, were studied by keeping part of them shut up in the dark, in ordinary egg cases for ten days, while another lot from the same hens was kept spread out in open pans, in the light, on a stand beside the darkened case. This gave both lots practically the same temperature of 62° F. They were turned daily. It was unfortunate that the eggs were running low in fertility when all of the tests which are reported in this Bulletin were being made, but the hens had been laying very heavily for a long time, and that probably accounts for their low fertility. Two pens of hens were selected and the eggs of each individual were divided evenly into two lots by alternating them in the order in which they were laid. This was readily done as trap nests are used with all our birds and all the hens are banded and numbered. By taking each hen's eggs as laid and dividing them by placing alternate eggs in the same lots, a fair division was secured by which it was hoped to avoid the difficulties which might arise from the physical changes which are liable to take place in laying hens.

The eggs were laid between May 25th and June 2d. After 160 were obtained, they were kept for the next ten days, until June 12th and then put together into the same incubator, each egg being marked with the number of the hen that laid it, the date and its class.

The following tables show some of the details of the work and the results of the test.

DATES ON WHICH EGGS WERE LAID AND RESULTS OF INCUBATION.

Number of hens.	May 25.	May 26.	May 27.	May 28.	May 29.	May 30.	May 31.	June 1.	June 2.
641...	L. Inf..	....	D. Inf..	L. Inf..	....	....	....	L. Inf	D. Inf
642...	D. 12..	L. 12....	D. 12....	L. C'k..	D. 12....	L. 12..	D. 12..	L. C'k	D. 12
643...	....	D. C'k..	L. 12....	D. 12....	L. C'k..	D. C'k.	L. C'k	D. C'k	....
644...	L. 12....	....	....	D. 12....	....	....	....	....	......
645...	L. 12....	....	....	D. 12....	L. 12....	D. C'k.	....	L. 12..	......
646...	D. C'k..	....	....	L. 20....	D. 20....	L. 12..	D. C'k.	L. 15..	D. 12.
647...	L. 12....	D. 12....	L. C'k..	D. 12....	L. 12....	....	....	D. 12..	L. 12.
648...	....	....	....	....	....	....	D. C'k.	....	L. C'k
649...	D. C'k..	L. 12....	D. C'k..	L. 12....	D. 12....	....	L. 12..	D. 12..	L. C'k
650...	....	D. Inf..	L. 12....	D. 12....	....	L. 20..	....	D. 12..	L. 20.
652...	L. 12....	....	......	D. C'k..	....	....	....	....	....
653...	......	...	....	....	....	D. 12..	L. 20..	D. 12..	....
654...	..	....	D. C'k..	....	L. C'k..	D. 12..	L. C'k.	D. C'k	L. 12.
657...	D. C'k..	....	....	L. 12....	D. C'k..	L. 20..	D. 12..	L. 12..	....
658...	....	....	....	D. C'k..	L. C'k..	....	D. C'k.	L. 12..	D. C'k
659...	L. 12....	D. 12....	L. 12....	D. C'k..	L. 12....	....	D. 12..	L. C'k	... ...
661...	D. Inf..	L. 12....	D. 12....	L. 20....	D. 12....	....	L. 12..	D. 12..	....
662...	L. 12....	....	D. 12....	L. 12....	D. C'k..	....	....	....	L. 12
664...	D. 12...	....	L. C'k..	D. C'k..	L. 15....	....	D. 12..	L. 20..	D. C'k
665...	....	....	D. 12....	L. 12....	D. 12....	L. 12..	....	D. C'k	L. C'k
668...	....	....	...	....	L. C'k..	D. 14..	L. 14..	D. 20..	....
669...	L. C'k..	D. 12....	L. 12....	D. C'k..	L. 12....	D. C'k.	L. 12..	D. C'k	L. 20
670...	....	....	D. C'k..	L. C'k..	....	D. C'k.	....	L. C'k	D. C'k
671...	....	....	....	....	....	....	D. 20..	....	L. 12
672...	L. 12....	D. 12....	L. 12....	....	D. 12....	L. 12..	D. C'k.	L. C'k	D. 20
674...	...	....	......	....	D. C'k..	L. C'k.	D. 12..	L. 20..	D. 20
676...	D. Inf..	L. Inf..	D. Inf..	....	L. Inf..	....	D. Inf	....	....
678...	L. 12....	....	D. 12....	....	....	....	....	....	....
680...	D. Inf..	L. Inf..	D. Inf..	L. Inf..	D. Inf..	L. Inf.	....	D. Inf	L. Inf

D means that the eggs in the spaces in which it occurs were kept in the dark and the letter L means those that were in the light.

C'k means that a chick was hatched from the egg.

Inf. means that the eggs were completely infertile.

The 12 signifies that the germs stopped developing by or before the 12th day after incubation commenced, and the figures 20 indicate that development ceased between the 12th and 20th days.

SUMMARY OF RESULTS.

Method of storing eggs.	Number of eggs incubated.	Number of chicks hatched.	Number of eggs infertile.	Number of eggs in which development stopped by the 12th day of incubation.	Number of eggs in which development stopped between 12th and 20th days of incubation.
In closed cases...........	82	30	11	36	5
In open air............	77	19	9	40	9

Effects of Temperature upon Eggs while being held for Incubation.

From May 25th to June 2d all of the eggs laid by 24 hens were saved and held 10 days, until June 12th before being incubated. The eggs from each hen were divided into two lots by selecting each alternate one as laid. One of the lots was placed in a room with a temperature of 70° F. and the other lot was put in another room where the temperature was 50° F. There was about the same amount of moisture in each room, and both were equally light. The eggs were in open boxes and were turned each day. The temperatures were steadily maintained through the 10 days, at the end of which time the eggs were all put together into the same incubator where they were subject to like conditions.

The tables below show the behavior of the eggs from each individual hen, under the same, and varied temperature, as well as the results of the test.

DATES ON WHICH EGGS WERE LAID AND RESULTS OF INCUBATION.

Number of hens.	May 25.	May 26.	May 27.	May 28.	May 29.	May 30.	May 31.	June 1.	June 2.
601...	70°. Inf..	50°. Inf..	70°. Inf..	50°. Inf..	....	... ..	70°. 12.	50°. 20.	70°. 12.
604...	50°. 12...	....	70°. C'k.	50°. C'k.	....	70°. 20.	... ...	50°. 20.	....
606...	70°. 12...	....	50°. C'k.	....	70°. C'k.	....	50°. 12.	......	....
607...	50°. 20...	70°. 20...	50°. C'k.	70°. C'k.	50°. 12...	... ..	....	....	... .
608...	70°. 12...	....	....	50°. 20...	70°. 12...	50°. 12.	70°. 20	50°. C'k	70°. 12.
609...	....	....	.. ..	....	....	70°. C'k	....	50°. C'k	70°. C'k
612...	70°. 12...	50°. 20...	70°. C'k.	....	50°. C'k.	70°. C'k	50°. C'k	70°. 12.	50°. C'k
616...	50°. 20...	....	70°. C'k.	. ...	50°. 12...	... ...	....	70°. 20.	50°. 20,
617...	....	70°. C'k.	50°. C'k.	70°. 12...	50°. 20...	....	70°. 20.	50°. C'k	70°. 20.
619...	.. ..	50°. 12...	70°. 20...	50°. 12...	70°. 12...	50°. 20.	70°. 20.	50°. C'k	70°. 20.
620...	....	70°. C'k.	....	. ...	50°. 20...	....	70° C'k	50°. C'k	70°. 20.
621...	... .	50°. C'k.	70°. 20...	50°. 20...	....	70°. 20.	50°. C'k	70°. C'k	....
622...	....	....	....	.....	70°. C'k.	50°. C'k	70°. C'k	50°. 20.	70°. 12.
623...	....	....	....	50°. Inf .	.. . ...	70°. Inf.	50°. Inf.	....	70°. Inf
624...	50°. 20...	70°. 20...	50°. 12...	70°. 12...	50°. 12...	... .	70°. C'k	..... .	....
625...	....	50°. 20...	70°. 20...	50°. 20...	70°. C'k.	....	....	50°. 20.	70°. 20.
626...	70°. C'k.	50°. 20...	....	70°. C'k.	50°. C'k.	... .	....	....	....
628...	... .	70°. 12...	... .	50°. 12...	70°. 12...	.. ...	50°. 20.	....	70°. 20.
630...	... .	....	....	....	... .	....	....	70°. C'k	50°. 12.
631...	50°. 12...	.. ..	....	70°. 20...	50°. 20...	.. ....	70°. 12.	50°. 12.	70°. 12.
632...	70°. 12...	...	50°. 12...	70°. C'k.	....	50°. 12.	......	....	....
635...	50°. 20...	70°. 20...	50°. 20...	70°. 20...	....	50°. 20.	....	70°. 12.	50°. C'k
636...	....	50°. 12...	....	70°. 12...	....	... ...	....	.. ....	....
640...	70°. C'k.	50°. C'k.	....	70°. C'k.	50°. C'k.	70°. C'k	50°. 12.	....	70°. 12.

The figures 50° mark the eggs that were kept at fifty degrees of temperature and the figures 70° indicate the eggs that were held at seventy degrees.

The other instructions are explained at foot of table on page 13.

SUMMARY OF RESULTS.

Temperature at which eggs were kept.	Number of eggs incubated.	Number of chicks hatched.	Number of eggs infertile.	Number of eggs in which development stopped by 12th day of incubation.	Number of eggs in which development stopped between 12th and 20th day of incubation.
70° F	66	23	4	20	19
50° F	62	18	4	18	22

Resting Eggs after transit before Incubating them.

Poultry breeders and shippers of eggs for incubating purposes frequently instruct purchasers to rest their eggs for 24 hours after their receipt before putting them into incubators, claiming better results from eggs so treated than where incubating commenced immediately upon their arrival.

To watch the results of such treatment, all of the eggs laid by 26 White Wyandotte hens, from May 25th to June 2d, were divided into two lots by alternating them as laid by each hen. Part of the eggs laid each day were put in one lot and part in the other. This and the alternating of the eggs was done so as to secure as nearly as possible equal conditions in each lot. Both of these lots of eggs were put in an ordinary shipping egg case and sent from Orono by express, over the Maine Central and the Bangor and Aroostook Railroads to Houlton and return, and after remaining in the express office at Orono over night, the journey to Houlton and return was repeated. The eggs were on the road and waiting at the railroad stations about 36 hours, and the distance covered was 514 miles. Upon their last arrival at Orono, after transit they were immediately taken to the incubator room, and one lot put into an incubator with a temperature of 103°, while the other lot was allowed to rest 24 hours, at the end of which time they were put into the incubator together with the first lot. The day before hatching was due to commence, one lot of the eggs was removed to another machine which had the same temperature and moisture as the first one. This was done so as to avoid the difficulties which might arise from the hatching of eggs in the same machine with other eggs that were not due. The details and results are shown in the following tables:

DATES ON WHICH EGGS WERE LAID.

Number of hens.	May 25.	May 26.	May 27.	May 28.	May 29.	May 30.	May 31.	June 1.	June 2.
741	R. 12	N. C'k	....	R. 12	N. Inf	R. C'k	N. C'k	....	....
742	....	R. Inf	N. Inf	R. Inf	N. Inf	....	R. 12	N. C'k	R. 20
743	....	N. Inf	R. 20	....	N. C'k	....	R. 20	....	....
744	N. Inf	R. Inf	N. C'k	R. C'k	N. C'k	....	....	....	....
745	R. 12	N. C'k	....	R. 20	....	N. 12	R. 20	N. 20	....
747	R. Inf	N. Inf	....	R. 12	....	....	N. C'k	....	....
748	N. C'k	R. C'k	N. 12	R. C'k	....	....	....	....	....
749	R. 12	N. Inf	R. Inf	N. Inf	R. Inf	N. Inf	R. Inf	N. Inf	....
753	N. Inf	R. C'k	N. 20	R. C'k	....	....	R. 12	N. C'k	R. C'k
754	....	....	....	R. 12	....	N. 12	....	....	R. C'k
756	....	R. Inf	....	N. 12	R. Inf	....	N. 12	....	....
760	....	....	R. 12	N. C'k	....	R. 20	....	N. 12	....
762	N. C'k	....	R. 20	N. C'k	R. 20	....	N. 20	R. 12	N. C'k
763	....	N. 12	R. 12	....	N. C'k	R. C'k	....	N. 12	R. 12
764	....	....	....	R. 20	N. C'k	....	R. 12	N. Inf	R. 12
765	R. 12	N. C'k	....	R. Inf	N. Inf	R. Inf	....	N. 12	R. 12
766	....	R. Inf	N. Inf	....	....	....	....	....	....
768	....	....	....	....	N. 12	....	R. C'k	....	N. 12
770	N. 20	....	R. 20	N. 20	....	....	....	....	....
772	R. Inf	N. Inf	R. C'k	N. 12	....	....	....	....	....
774	N. C'k	....	R. C'k	....	....	....	....	....	....
776	R. Inf	....	....	N. C'k	....	R. 12	N. 12	....	R. Inf
777	N. 12	....	R. C'k	....	N. C'k	R. C'k	....	N. 12	R. C'k
778	R. 12	....	N. C'k	R. 20	N. Inf	....	R. Inf	N. 12	R. 20
779	....	....	....	N. Inf	R. 12	....	N. 12	....	R. Inf
780	N. Inf	....	....	R. 20	....	N. 20	R. 12	N. C'k	....

The letter R marks the eggs that rested and N indicates those that were not rested. The other marks in the table are explained on page 13.

SUMMARY OF RESULTS.

Treatment of eggs.	Number of eggs incubated.	Number of chicks hatched.	Number of eggs infertile.	Number of eggs in which development stopped by 12th day of incubation.	Number of eggs in which development stopped between the 12th and 20th days of incubation.
Rested	65	15	17	20	13
Not rested	63	22	18	17	6

TIME REQUIRED TO ESTABLISH FERTILITY IN EGGS.

The following experiment was undertaken to determine how soon after mating eggs become sufficiently fertile to yield chicks. For this purpose there were selected 20 Barred Plymouth Rock hens one year old, that had been laying heavily during the five to seven months preceding, but had not been in the company of male birds since they were young chicks. Late on the evening of May 25 a cockerel 12 months old was placed in the pen with them and kept there until the close of the test. The eggs laid each succeeding day until June 6th were incubated.

The eleven eggs laid May 26th were all removed after having been in the incubator eight days. Eight of them were clear and the three others showed very light traces of fertility. At the same time the eight eggs laid May 27th were examined and three of them showed clear, three were slightly cloudy and two had good strong centers and radiating lines. From these eggs two good strong chicks were hatched on the twentieth day of incubation. The best results were obtained from the eggs laid June 2d, eight days after the introduction of the male bird. From the ten eggs laid that day, eight good chicks were hatched and two eggs were completely infertile.

This test shows that eggs become fertile very soon after mating commences. As it was after dark when the cockerel was put in the pen with the hens it is not at all probable that he mated with any hen until daylight the next morning, May 26th, yet the eggs laid by two of the hens May 27th, not more than 40 hours after mating, yielded vigorous chicks.

TABLE SHOWING THE NUMBER OF EGGS SECURED FROM THE HENS EACH DAY AFTER THE INTRODUCTION OF THE COCKEREL, THE NIGHT OF MAY 25, AND THE NUMBER OF CHICKS HATCHED FROM THEM.

	Eggs laid.	Chicks hatched.
May 26	11	0
May 27	8	2
May 28	13	3
May 29	10	1
May 30	12	3
May 31	10	3
June 1	13	5
June 2	10	8
June 3	9	4
June 4	11	4
June 5	11	6
June 6	10	3

CONTINUANCE OF FERTILITY OF HENS' EGGS AFTER MATING CEASES.

To learn how long after the mating of hens and cockerels has been discontinued, the eggs remain sufficiently fertile to yield healthy chickens, 20 Barred Plymouth Rock hens were selected and the cockerel that had been mated with them since February 1st was removed on the evening of May 24th and was not returned again. The eggs laid on May 25th and on each succeeding day, to and including June 6th, were incubated and their fertility noted. Each day's eggs were kept in separate lots in the incubator so that at the completion of the period all eggs could be accounted for.

On the last day the eggs were saved—June 6th—the male bird had been removed from the pen containing the hens 13 days and the hens had had no opportunity to mate with other males, yet the eight eggs laid that day yielded three good chicks. The 27 eggs laid during the first three days after the removal of the male yielded ten chicks. The 30 eggs laid on the 11th, 12th and 13th days after the removal of the males yielded seven chicks.

TABLE SHOWING THE NUMBER OF EGGS SECURED FROM THE HENS EACH DAY AFTER THE REMOVAL OF THE COCKEREL THE NIGHT OF MAY 24 AND THE NUMBER OF CHICKS HATCHED FROM THEM.

	Eggs laid.	Chicks hatched.
May 25	11	4
May 26	5	2
May 27	11	4
May 28	10	4
May 29	9	3
May 30	12	4
May 31	10	4
June 1	11	3
June 2	6	2
June 3	10	2
June 4	12	4
June 5	10	0
June 6	8	3

While the results show somewhat diminished fertility, it is evident that longer test periods are needed in which to determine the limits of its duration after mating ceases. This work is to be continued with other pens of hens. The preceding table shows the results from each day's eggs.

FERTILITY OF EGGS OF DIFFERENT SHAPES.

To ascertain whether the shapes of eggs have any influence on their chick yielding capacities when incubated, 25 very long eggs, 25 short, ball shaped ones and 25 normal shaped ones were selected and incubated in the same machine with the following results:

	Chicks hatched out.	Died in shell when well grown.	Germ died by the tenth day.	Infertile.
Twenty-five normal eggs	8	3	5	9
Twenty-five very long eggs	9	2	2	12
Twenty-five short, roundish eggs	7	7	3	8

When undertaking this test it was the intention to carry each lot of chicks until their sex could be determined in order to learn whether the shape of the egg bears any relationship to the sex of the chick it may yield. With that aim all of the chicks were banded and recorded. A barn cat had other plans regarding them however, in the carrying out of which one night, the question of sex was not considered. Other tests bearing upon this subject will be made.

BREEDING FOR EGG PRODUCTION.

G. M. GOWELL.

For several years past the Station has been breeding Barred Plymouth Rock and White Wyandotte hens with the hope of increasing the number and improving the size and color of the eggs.

In 1898 trap nests were devised and placed in all of the breeding pens, as described in the 14th annual report of the Station. This was done so that the producing capacities of hens could be known, and selections for breeding could be made upon merit alone.

It is known that the laws of inheritance and transmission are as true with birds as with cattle, sheep and horses and when we consider the wonderful advance in egg production that the hen has made since her domestication, there is ample reason for assuming that a higher average production than the present can be secured by breeding only to those birds that are themselves large producers. It has been found in our practice with the trap nest, that with the most careful selection we could make when estimating the capacities for egg yielding, by the types and forms of birds, we were still including in our breeding pens hens that were small workers.

A study of the monthly record sheets which follow, not only show great differences in the capacities of hens but marked variations in the regularity of their work; some commencing early in November, and continuing laying heavily and regularly month after month, while others varied much, laying well one month and poorly or not at all the next. It is impossible to account for these vagaries as the birds in each breed were bred alike, and selected for their uniformity. All pens were of the same size and shape and contained the same number of birds. Their feeding and treatment were alike throughout. Many of the light layers gave evidence of much vitality, and in many instances there were no marked indications, in form or type, by which we were able to account for the small amount of work performed by them.

EGG RECORDS FOR TWO YEARS OF HENS HATCHED DURING APRIL AND MAY 1898.

Barred Plymouth Rocks.

Number of hens.	Year.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	Yields Nov. 1st, 1898, to Nov. 1st, 1899, and Nov. 1st, 1899, to Nov. 1st, 1900.	Yields in first full year of laying.
6..	1st....	18	12	7	15	18	16	15	8	14	6	12	20	161	161
	2d	10	16	10	6	5	3	....	1	1	4	5	......	61	....
10..	1st....	16	14	5	20	23	19	19	18	17	10	14	......	175	175
	2d	....	..	5	3	*	....	....	....	...	.....	.....	......	8	....
26..	1st.....	5	19	4	15	18	13	13	15	12	12	12	17	155	158
	2d	8	15	....	....	15	14	10	9	10	10	11	16	118	....
30..	1st.....	7	7	18	16	19	19	19	20	22	8	8	2	165	165
	2d	1	....	5	3	5	16	18	20	16	17	8	3	112	....
31..	1st.....	6	5	9	22	23	20	20	18	19	16	9	8	175	175
	2d	....	....	...	4	9	17	21	8	10	11	14	....	94	....
36..	1st....	....	15	9	23	23	19	16	21	19	13	15	8	181	201
	2d	20	5	9	16	15	13	14	13	14	15	14	11	159	....
45..	1st.....	....	17	22	19	22	17	15	14	13	11	7	9	142	166
	2d	13	1	....	9	6	....	...	9	17	11	11	12	89	....
51..	1st.....	....	7	14	14	20	17	16	24	24	22	18	15	191	191
	2d	....	...	....	4	9	17	21	8	10	11	14	.....	94	....
74..	1st.....	..	5	18	18	21	14	18	16	15	15	7	18	165	182
	2d	17	15	16	8	13	14	15	11	11	14	17	......	151	....
76..	1st.....	....	....	15	20	18	18	22	19	24	19	14	......	169	169
	2d	...	...	4	7	3	18	6	1	1	......	.....	......	40	....
80..	1st.....	...	...	16	22	15	7	17	17	15	19	10	12	140	160
	2d	15	5	3	16	12	6	13	8	8	9	5	3	103	....
93..	1st....	19	11	19	8	10	18	18	16	14	11	11	5	160	160
	2d	11	5	19	10	13	18	15	13	12	8	12	9	145	....
101..	1st.....	...	.	18	15	21	22	24	21	17	26	17	21	201	204
	2d	3	...	18	6	3	....	...	....	...	......	......	....	30	....
	3d	....	3	12	3	6	10	5	6	....	11	7	.....	63	....
114..	1st....	....	....	15	22	20	14	12	14	12	9	9	9	136	149
	2d	13	....	....	....	13	18	18	12	13	14	16	13	130	....
120..	1st.....	.. .	....	17	20	17	13	15	18	24	20	22	18	184	188
	2d	4	....	7	6	....	19	19	13	18	13	......	......	99	....
126..	1st....	...	....	11	12	21	19	18	20	14	11	15	11	152	180
	2d	14	14	14	15	7	16	18	14	17	15	9	9	162	....
137..	1st.....	....	..	7	19	18	18	24	21	22	19	7	...	155	155
	2d	...	....	4	7	7	12	18	15	19	19	6	9	116	....
151..	1st.....	....	....	9	20	16	8	13	19	18	12	15	5	135	155
	2d	13	5	11	16	15	12	18	14	10	19	19	9	161	....
159..	1st.....	....	...	4	25	9	13	13	14	14	12	15	18	137	175
	2d	20	18	14	10	11	15	17	13	13	13	12	12	168	....
205..	1st.....	....	...	....	21	23	12	21	22	19	19	15	13	165	191
	2d	14	1	11	14	15	18	20	15	15	14	14	14	165	....
208..	1st.....	....	...	2	22	19	11	19	22	15	15	12	14	151	169
	2d	3	....	20	7	12	12	16	9	3	......	......	......	82	....
209..	1st.....	...	....	2	20	20	18	18	13	17	17	12	17	154	180
	2d	10	10	18	15	12	16	13	.. .	....	......	.....	......	94	....
228..	1st.....	....	....	....	12	14	13	17	13	15	12	13	11	120	153
	2d	16	8	9	13	15	13	15	9	10	7	......	.....	115	....
246..	1st.....	....	....	....	14	21	17	12	21	17	22	18	1	143	143
	2d	...	...	...	....	5	11	3	6	14	6	1	......	46	....
281..	1st.....	....	....	....	12	20	15	12	16	13	17	12	12	129	167
	2d	11	18	9	8	7	9	11	8	12	12	10	10	125	....
286..	1st.....	...	....	....	14	23	15	18	24	25	23	26	23	191	206
	2d	1	. ..	14	4	2	20	23	24	26	18	16	9	147	......
	3d	...	9	2	5	6	24	23	22	20	21	*6	.....	138	....
289..	1st.....	....	....	....	8	22	20	17	19	12	20	12	21	151	181
	2d	14	7	5	16	12	22	16	10	13	13	11	11	150	....
300..	1st.....	....	...	....	19	18	11	17	14	13	17	8	21	138	175
	2d	20	17	10	...	3	18	15	13	14	14	12	12	148	....

EGG RECORDS FOR TWO YEARS—CONTINUED.

LIGHT BRAHMA.

Number of hens.	Year.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	Yields Nov. 1st, 1898, to Nov. 1st, 1899, and Nov. 1st, 1899, to Nov. 1st, 1900.	Yields in first full year of laying.
52..	1st. ...	....	11	19	20	21	20	19	20	21	18	19	1	189	194
	2d	5	....	10	4	4	7	6	14	11	4	11	2	78	....
55..	1st.....	...	....	....	1	11	9	3	10	7	8	1	.....	55	81
	2d	2	15	4	5	....	...	...	..	....	.....	......	.....	26	....
75..	1st.....	....	....	6	14	18	15	15	15	10	9	12	.....	114	130
	2d	...	12	7	....	....	....	....	....	....	.....	..	12	31	.. ..
116..	1st. ...	....	....	12	18	24	16	12	16	17	15	7	18	155	155
	2d	....	....	...	4	1	*	....	...	...	.....	.....	.....	5	.. ...
135..	1st.....	....	....	12	20	21	8	13	25	12	9	14	.....	134	155
	2d	8	13	....	16	13	22	12	10	17	17	.....	.....	128	... .
139..	1st.....	..	...	11	20	19	14	21	19	21	21	22	20	188	194
	2d	....	6	5	*	...	....	....	....	....	.. ...	.....	.....	....	... .
146..	1st....	....	...	11	17	19	12	10	15	13	11	10	13	131	151
	2d	10	3	17	15	12	14	16	7	10	11	14	.....	129	....
147..	1st. ...	....	....	12	17	20	18	18	16	14	14	13	9	151	151
	2d	....	....	.. .	....	9	17	12	11	11	15	1	.....	76	....
155..	1st. ...	....	....	....	3	18	24	20	24	14	6	19	21	149	151
	2d	2	....	....	7	3	16	21	18	18	19	19	1	124	.. ....
276..	1st.....	....	...	....	15	15	11	18	13	14	19	8	.....	113	124
	2d	....	....	11		....	....	....	....	...	.....	.....	.....	11	.... ..
279..	1st.....	...	....	....	14	20	21	20	19	10	....	... ..	.....	104	105
	2d	....	....	1	....	....	....	....	...	....	....	.....	.....	1	... .
282..	1st.....	....	....	....	14	23	21	20	20	13	17	17	.....	135	138
	2d	....	....	3	...	...	....	....	....	....	.....	.....	.....	3	. .....
285..	1st.....	....	....	.. .	19	19	20	14	19	17	12	12	20	152	161
	2d	8	....	1	3	1	15	15	9	10	7	.....	14	83	....
288..	1st.....	....	....	...	15	20	14	13	22	11	17	15	7	134	156
	2d	7	12	1	9	11	18	20	13	12	18	17	2	138	....
292..	1st.....	....	....	....	21	22	12	17	16	15	16	16	13	148	181
	2d	13	20	8	2	8	19	15	8	9	8	20	3	133	....
297..	1st....	....	....	....	14	19	19	18	23	16	10	14	16	149	149
	2d	....	....	....	6	6	15	15	12	9	3	14	.....	80	....

WHITE WYANDOTTE.

Number of hens.	Year.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	Yields Nov. 1st, 1898, to Nov. 1st, 1899, and Nov. 1st, 1899, to Nov. 1st, 1900.	Yields in first full year of laying.
3..	1st. ...	20	9	1	....	17	12	13	15	14	13	9	19	142	142
	2d	....	....	....	....	17	17	9	11	11	11	......	......	76	....
4..	1st. ...	20	....	19	16	22	13	19	22	15	21	19	15	201	201
	2d	7	...	....	7	15	21	21	10	10	17	16	16	140	....
	3d	14	2	....	6	19	16	17	11	12	9	13	11	130	....
5..	1st....	14	....	15	18	8	12	12	15	18	8	9	16	145	145
	2d	8	13	11	12	8	11	14	18	13	10	7	16	141	....
8..	1st.....	14	17	13	14	18	17	15	11	12	14	15	10	170	170
	2d	9	16	16	7	2	13	14	8	6	11	7	6	115	....
12..	1st. ..	18	10	7	14	14	13	11	12	15	15	9	9	147	147
	2d	17	6	14	13	15	7	10	9	10	13	10	13	137	......
13..	1st. ...	9	....	....	6	16	11	12	9	12	13	9	12	109	109
	2d	....	....	....	1	*	...	....	....	...	......	......	......	1	....
14..	1st. ...	21	20	24	21	19	17	10	18	14	16	15	13	208	208
	2d	18	22	21	18	15	18	5	13	10	1	....	......	141	....
	3d	....	....	....	....	2	12	14	*	....	......	......	....	28	....
19..	1st....	18	13	10	19	9	13	8	16	12	14	14	11	157	157
	2d	5	....	8	8	....	....	..	...	....	......	.....	13	34	....
47..	1st.....	...	12	19	18	19	16	19	17	19	15	14	16	184	200
	2d	13	13	15	13	7	12	18	17	16	16	14	13	167	....
50..	1st.....	..	17	19	20	17	19	14	14	13	10	13	5	165	173
	2d . ..	18	2	2	5	6	11	13	9	11	12	19	3	111	....
87..	1st.....	....	....	14	18	19	13	16	16	18	16	13	13	156	158
	2d	1	1	8	11	9	10	9	10	9	10	6	......	84	....
96..	1st.....	...	..	9	16	17	14	12	15	13	11	13	12	132	161
	2d	9	15	16	14	15	18	9	9	10	12	11	......	138	....
102..	1st.....	13	16	13	20	12	14	14	13	9	5	13	1	143	144
	2d	13	1	....	...	...	....	....	...	....	......	......	......	14	....

EGG RECORDS FOR TWO YEARS—CONCLUDED.

WHITE WYANDOTTE.

Number of hens.	Year.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	Yields Nov. 1st, 1898, to Nov. 1st, 1899, and Nov. 1st, 1899, to Nov. 1st, 1900.	Yields in first full year of laying.
105..	1st.....	..	....	15	13	18	8	11	15	15	13	11	19	138	157
	2d	8	11	....	....	9	14	13	..	....	......	......	.... .	55	....
131..	1st....	....	.	11	19	17	11	17	14	12	11	12	11	135	147
	2d	8	2	14	6	6	15	....	9	7	9	9	9	94	....
134..	1st	...	....	9	16	16	17	14	16	14	10	15	6	133	165
	2d	16	16	15	8	13	12	14	7	8	8	12	9	138	.. ....
173..	1st.....	....	....	12	20	14	12	16	16	13	6	13	12	134	153
	2d	11	7	11	14	9	11	14	11	7	10	7	4	116	....
224..	1st.....	....	...	1	19	10	16	15	14	18	16	14	8	131	167
	2d	12	14	12	8	12	12	12	13	15	11	6	12	139	....
242..	1st.....	....	....	....	15	24	13	16	16	17	14	12	14	141	167
	2d . ..	12	14	12	8	12	12	12	13	15	11	6	12	139	....
272..	1st.....	...	....	....	7	19	17	6	15	14	11	7	19	115	115
	2d	....	....	...	...	8	...	13	12	*	.....	.....	......	33	....
280..	1st. ...	...	....	....	5	1	13	23	18	21	15	21	21	138	170
	2d	17	15	9	5	11	14	9	2	....	......	......	......	82	....
287..	1st. ...	. ..	....	...	18	15	11	17	8	17	14	10	9	119	148
	2d	10	14	5	....	....	....	.. .	....	...	......	.....	9	38	....
290..	1st. ..	....	....	....	16	12	15	14	12	13	14	14	11	121	162
	2d	13	20	8	2	8	19	15	8	9	8	20	3	133	....

Every hen that has laid large numbers of eggs through the first or the first and second years, has shown much vigor and constitution. Some individuals have laid heavily for a few months and then drooped and died, seemingly because they could not stand the heavy work.

There have been two hens in the pens all of the last year that we have every reason to suppose have never laid an egg. It is possible that they may have laid, but with the close watching they have had it is not probable. They are well formed and have always been in good thrift and health so far as appearances have indicated.

In the first table following, the yields of 67 hens are given for two years forward from November 1, 1898, and the records of four of them are continued through the third year. These are not all of the hens tested in 1898, but they are the only ones retained during the second year. Some of them were the best and others among the poorer layers of that year.

Of the four that laid over 200 eggs during the first 12 months after commencing, No. 4 laid 201 eggs the first year, 140 the second and 130 the third year, and she is now on her fourth year's work. No. 14 laid 208 eggs the first year, 141 the second and 28 the third year. She moulted in July, 1900, and met with an accident in August which came very near ending her existence, but her great vitality enabled her to rally and she shed her feathers again, completely, and grew a second suit that season. She did not begin laying again until the following March when she laid 28 eggs by the close of May. At moulting time in June she died. She was an upheaded, strong hen and the first one to give us over two hundred eggs in one year. No. 101 laid 201 large brown eggs the first year; 30 the second year and 63 the third year. She is now on her fourth year's work. No. 286 was a late hatched pullet and did not commence laying until February 12, 1899. In a year forward from that date she laid 206 eggs. In the first year, commencing November 1, 1899, she laid 191 eggs, with 157 during the second, and 138 in her third year. When nearly three and a half years old she died suddenly, having laid 119 eggs during the last 160 days she lived.

With many poultry keepers and farmers the idea is prevalent that if a hen lay but few eggs the first year she is likely to do better the second year than though she laid well during the first year. The data so far secured does not show that hens that yield 120 eggs or less the first year yield satisfactorily the second year. Those that yielded in the vicinity of a hundred or less the first year yielded very light the second year. On the other hand many of those that yielded from 130 to 200 or over during the first year laid quite well the second year.

Of the 67 hens carried through two years, 10 laid more eggs during the second than the first year, and 57 laid more during the first than the second year.

The right hand column of the tables shows the number of eggs laid by each bird during the first full year after she commenced laying, and in most cases it is larger than when the year is reckoned forward from November 1st. We have found it necessary to have the pullets, of the breeds we have used, hatched by the middle of April, at the latest, in order to have them laying by the first of November. They then have a full year for work, before they are removed, the following fall, to make room for the new pullets that must be in winter quarters early, if they are to do satisfactory work. If the pullet does not commence laying until January, she does not have a full year before she has to give way to the young stock by the last of October or the first of November. This feature counts for a great deal and the two right hand columns of the tables are worthy of careful study.

RECORDS OF PULLETS, 1899-1900.

On November 1st, 1899, 180 pullets of the three breeds previously mentioned were put into winter quarters and records kept with them during the twelve months following. The pens and yards in which they were confined were the same as those occupied by the hens in the preceding test. The pens are 10 by 16 feet in size in the clear space and each one has four of the Station trap nests in it as described in the Station reports of 1897 and 1898. Twenty pullets and two cockerels were kept in each lot.

The birds were fed throughout the year, daily as follows:—Each pen of 22 received one pint of wheat, in the deep litter early in the morning. At 9.30 A. M. one-half pint of oats was fed to them in the same way. At 1 P. M. one-half pint of cracked corn was given in the litter as before. At 3 P. M. in winter and 4 P. M. in the summer they were given all the mash they would eat up clean, in half an hour.

The mash was made of the following mixture of meals:—200 pounds wheat bran; 100 pounds corn meal; 100 pounds wheat middlings; 100 pounds linseed meal; 100 pounds meat meal or fine meat scraps. Part of the year the linseed meal was omitted, and the amount of meat meal was doubled. The mash contained one-fourth of its bulk of clover leaves and heads, secured from the feeding floor in the cattle barn. The clover was thoroughly soaked with hot water. The mash was made quite dry. Cracked bone, oyster shell, clean grit and water were at all times before them. Two large mangolds were fed to the birds in each pen daily in winter, and green food in plenty in summer. Very few soft-shelled eggs are produced and we have not known of an egg being eaten by the hens during the three years in which the trap nests have been used. Fifteen birds died during the year and nine were stolen.

A few eggs had been laid in the litter on the floor but no birds have received credit for eggs not laid in the nest. By reference to the table following it will be seen that many birds did not commence laying until some two months after others were at work. They were mainly the later hatched ones and illustrate forcibly the necessity for early hatched stock if a full year's work is to be gotten from it by November first.

10,611 eggs were laid in the nests by the Plymouth Rocks to October 31st—an average of 132 to each bird. Ten of the 80 died or were stolen and did not work a full year, but no deductions are made on that account.

No. 303 laid 208 eggs, and 127 in the following year. No. 326 laid 211, and 145 during the next year. No. 318 laid 237 good brown eggs in the year, and 102 the second year. After she had laid 200 the next dozen were saved as produced and found to weigh 1 pound, 11¼ ounces.

In the same pens receiving the same treatment as the foregoing and of the same breed, were Nos. 347, 361 and 375 and they yielded respectively 32, 42 and 36 eggs in the same time that their mates were doing their greatest work.

9,844 eggs were laid by the 80 White Wyandotte hens up to October 31st. Ten of their numbers died or were stolen during the year, but no allowance is made for their short work. The 80 averaged 123 eggs each. No. 403 laid 209 eggs to October 31st and in the full year after she commenced laying she laid 219. The second year she laid 162 eggs. No. 428 laid 217 to October 31st and in the full year 219. During the second year she laid 138. No. 445 laid 208 to October 31st and 219 to the close of her full year. The next year she yielded 139 eggs. No. 480 laid 214 to Oct. 31st and 218 at the close of full year. During the next year she gave 172 eggs. The poorest laying was done by Nos. 411; 462; 474; 475 and 478, their yields being respectively 62; 22; 41; 10 and 66 to October 31st. Although these poorer layers looked well when they were pullets, as they grew older several of them showed low vitality.

The twenty Brahmas laid 2,018 eggs to Oct. 31st, an average of nearly 101 eggs each. None of them reached the two hundred limit. Four either died or were stolen in the eighth and ninth months forward from Nov. 1st. The poorest laying for the year was done by No. 485. She gave a total yield of 2 eggs. While she was not a producer there was nothing in her looks or appearance to indicate that she was a drone. As the season advanced she became fleshy but she was not of the fleshy type at the commencement or during the early months of the year.

The following tables show the work of the individual birds by months and the totals.

EGG RECORDS OF HENS HATCHED BETWEEN APRIL 1 AND MAY 16, 1899

BARRED PLYMOUTH ROCKS.

Number of hen.	1899. November.	1899. December.	1900. January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	Total.
301	16	14	16	11	9	16	†	.....	.....	.....	.....	.....	82
302	.....	7	22	14	18	17	8	24	14	13	16	14	167
303	8	17	22	5	12	20	25	26	21	21	21	16	208
304	17	20	19	7	11	20	25	3	19	17	16	1	175
305	11	22	19	14	16	5	14	15	14	16	11	14	171
306	.....	16	12	.....	.....	18	5	4	.....	.....	.....	6	61
307	2	18	21	16	18	19	20	9	12	12	15	13	175
308	.....	10	21	14	15	19	11	14	12	*	.....	.....	116
309	14	13	24	18	20	20	22	19	19	14	.....	.....	183
310	.....	2	2	.....	7	15	18	5	16	3	.....	.....	68
311	6	21	25	22	22	14	17	12	13	4	19	10	185
312	1	10	13	.....	12	*	.....	.....	.....	.....	.....	.....	36
313	.....	.....	21	10	15	19	5	.....	.....	.....	.....	.....	70
314	5	8	14	13	11	13	9	6	*	.....	.....	.....	79
315	.....	7	19	.....	6	5	13	*	.....	.....	.....	.....	50
316	8	23	24	18	21	18	22	12	22	17	13	*	198
317	6	22	25	18	19	18	†	.....	.....	.....	.....	.....	108
318	18	22	25	21	22	24	23	22	25	17	16	2	237
319	.....	12	15	2	6	14	10	.....	.....	.....	.....	.....	59
320	.....	18	7	20	13	17	12	9	10	12	7	8	133
321	.....	.....	13	16	20	18	17	22	15	21	18	10	170
322	6	8	18	3	13	7	9	4	.....	.....	.....	.....	68
323	.....	.....	11	14	20	.....	20	18	20	21	21	13	158
324	12	16	17	13	6	21	17	14	12	20	6	9	163
325	.....	15	22	15	13	11	10	3	13	7	11	.....	120
326	13	21	21	18	16	22	16	16	16	15	14	23	211
327	.....	19	22	7	4	9	13	3	2	*	.....	.....	79
328	.....	18	14	15	11	15	.....	17	12	11	9	16	138
329	.....	.....	21	10	15	20	19	15	10	11	13	.....	134
330	8	18	26	17	18	*	.....	.....	.....	.....	.....	.....	87
331	4	22	20	16	9	15	20	16	†	.....	.....	.....	121
332	.....	14	24	3	20	20	18	11	15	21	13	.....	159
333	.....	.....	14	17	22	20	22	14	7	8	11	9	144
334	2	20	23	11	12	22	20	20	22	20	8	.....	180
335	.....	.....	19	8	8	10	10	13	7	7	8	8	98
336	.....	6	19	3	17	21	23	11	17	17	3	.....	137
337	14	22	18	7	12	15	15	11	9	17	15	8	163
338	.....	15	16	2	7	24	18	12	13	23	1	.....	131
339	.....	1	23	.....	8	11	12	11	9	13	.....	.....	88
340	8	28	25	19	14	13	14	16	8	12	17	7	181
341	1	22	.....	5	13	17	18	14	14	11	5	14	134
342	.....	.....	16	11	10	21	17	12	14	12	4	8	125
343	14	24	17	14	9	20	14	16	12	17	8	13	178
344	.....	.....	13	13	14	20	22	23	17	19	19	6	166
345	12	19	20	18	19	17	13	2	11	11	11	.....	153
346	8	17	22	11	11	12	13	13	12	9	7	15	150
347	.....	.....	8	.....	12	11	1	.....	.....	.....	.....	.....	32
348	.....	.....	16	17	19	20	18	16	15	12	13	6	152
349	.....	.....	5	7	3	14	21	20	16	9	5	*	100
350	.....	19	21	17	19	14	17	15	12	17	12	15	176
351	2	22	21	1	14	10	13	14	10	9	13	.....	129
352	7	17	14	11	16	16	16	12	11	11	14	12	153
353	17	14	24	16	18	20	20	15	14	13	8	19	193
354	.....	.....	9	7	10	22	18	19	18	1	.....	.....	104
355	.....	.....	3	.....	3	17	11	13	12	7	10	.....	76
356	.....	.....	15	2	9	19	22	13	15	13	19	5	132
357	21	2	23	15	21	21	18	16	17	13	10	4	181
358	18	17	21	9	9	17	11	15	8	9	13	.....	147
359	8	2	21	17	16	17	16	15	16	16	11	16	170
360	.....	.....	18	8	16	13	10	9	11	10	11	9	115

* Dead. † Stolen.

EGG RECORDS—CONTINUED.

BARRED PLYMOUTH ROCKS.

Number of hen.	1899. November.	1899. December.	1900. January.	1900. February.	1900. March.	1900. April.	1900. May.	1900. June.	1900. July.	1900. August.	1900. September.	1900. October.	Total
361...	......	......	......	......	4	2	4	14	8	......	8	2	42
362...	......	......	18	8	6	19	19	15	5	......	......	......	90
363...	......	......	12	9	13	17	15	14	11	8	12	6	117
364...	4	14	11	12	11	16	22	19	20	12	18	15	174
365...	......	8	22	15	21	25	21	20	15	23	9	......	179
366...	......	5	10	......	15	16	8	8	11	10	6	......	89
367...	......	......	24	21	17	14	11	9	14	16	10	5	141
368...	15	16	22	7	16	15	16	3	8	9	14	5	145
369...	9	18	10	4	9	14	21	9	10	15	......	16	135
370...	4	23	21	7	4	8	11	2	......	......	......	......	80
371...	9	18	22	21	24	21	11	7	2	11	2	1	149
372...	......	......	2	......	1	13	24	......	10	5	......	......	55
373...	......	......	14	......	10	17	24	20	21	21	12	2	141
374...	11	16	16	7	16	18	16	14	9	8	8	3	139
375...	......	......	19	16	......	......	6	1	......	......	......	......	36
376...	......	20	22	2	17	11	12	10	9	11	12	2	128
377...	6	20	15	......	11	16	16	15	15	13	10	6	143
378...	5	15	24	19	22	21	17	15	14	13	2	......	163
379...	......	......	15	10	7	21	11	18	13	14	14	......	129
380...	......	......	......	1	2	5	11	16	16	16	18	15	100
381...	......	......	9	14	15	21	22	20	15	20	19	14	169

WHITE WYANDOTTES.

Number of hen.	1899. November.	1899. December.	1900. January.	1900. February.	1900. March.	1900. April.	1900. May.	1900. June.	1900. July.	1900. August.	1900. September.	1900. October.	Total
401...	......	12	20	16	9	17	16	11	16	11	......	......	128
402...	12	1	11	22	17	19	†	......	......	......	......	......	82
403...	4	25	26	17	21	18	21	16	13	14	16	18	209
404...	3	24	12	......	13	16	12	10	16	9	13	15	142
405...	*	......	......	......	......	......	......	......	......	......	......	......	......
406...	17	22	16	13	20	13	17	14	12	10	12	......	166
407...	......	......	8	......	11	19	19	16	11	6	5	9	104
408...	6	22	22	15	9	22	17	16	14	17	11	8	179
409...	......	16	21	11	9	15	†	......	......	......	......	......	72
410...	8	15	23	20	24	22	13	19	17	......	16	19	195
411...	6	14	14	3	14	11	......	......	......	......	......	......	62
412...	8	16	16	19	15	18	18	9	14	17	13	19	178
413...	*	......	......	......	......	......	......	......	......	......	......	......	......
414...	4	17	19	16	18	12	13	13	11	11	7	8	149
415...	5	19	18	10	15	9	22	16	16	3	11	11	155
416...	14	2	13	10	12	19	11	15	11	9	3	10	129
417...	......	12	22	15	7	11	†	......	......	......	......	......	67
418...	......	17	20	1	21	13	13	15	14	7	7	......	128
419...	......	......	15	11	21	15	17	5	11	9	9	......	113
420...	......	......	1	17	22	18	20	5	......	......	......	......	83
421...	7	13	18	6	10	5	12	9	11	16	11	......	108
422...	11	21	14	11	14	17	15	11	12	3	*	......	129
423...	......	4	19	9	12	20	20	15	9	1	10	1	120
424...	......	......	11	13	15	15	16	14	11	16	4	......	115
425...	......	13	24	21	22	22	24	10	10	11	16	......	173
426...	......	9	20	17	13	13	15	12	13	10	3	......	125
427...	......	......	3	14	19	16	15	11	12	10	......	......	100
428...	13	22	21	19	21	24	25	14	14	18	5	21	217
429...	2	16	15	16	16	17	10	1	......	......	......	......	93
430...	......	......	21	16	18	20	16	*6	......	......	......	......	97
431...	3	18	23	18	10	19	20	15	18	14	7	17	179
432...	......	......	15	12	14	10	16	2	*	......	......	......	69
433...	9	22	5	13	15	16	10	15	15	4	18	6	147
434...	2	20	18	16	13	16	11	14	13	10	11	......	144
435...	......	......	19	18	13	23	17	13	14	9	24	14	164
436...	......	2	14	8	6	17	21	20	7	12	......	......	107

* Dead. † Stolen.

EGG RECORDS—CONTINUED.

WHITE WYANDOTTES.

Number of hen.	1899.		1900.										Total.
	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	
437...	.....	.....	7	17	21	22	21	21	14	7	18	8	156
438...	2	18	6	5	13	11	15	8	7	6	8	...	99
439...	6	22	21	9	19	15	16	14	19	6	6	15	163
440...	15	24	18	20	21	22	22	11	*	.....	.....	....	153
441...	.....	.....	16	12	11	11	13	7	13	.....	16	18	117
442...	8	12	15	10	15	18	18	16	19	16	16	8	171
443...	.....	.....	13	11	8	8	19	21	16	16	17	16	142
444...	....	.....	4	19	11	19	14	12	13	13	3	19	126
445...	7	23	25	21	13	21	19	12	19	17	11	20	208
446...	2	23	15	.....	9	16	15	12	15	16	11	20	153
447...	.....	6	20	8	.....	5	10	9	9	11	10	10	98
448...	10	11	23	19	20	15	18	11	13	13	15	7	175
449...	.....	.....	10	12	14	15	11	12	15	7	8	.....	104
450...	.....	.....	12	12	1	12	11	8	10	7	12	2	87
451...	5	23	23	19	13	19	22	12	18	23	14	5	196
452...	.....	.....	15	9	15	14	16	4	10	11	13	.....	107
453...	.....	.....	6	13	9	6	8	10	9	....	.....	.....	61
454...	16	26	5	13	6	2	.....	.....	.....	....	.....	.....	68
455...	12	22	23	18	15	18	17	12	16	9	15	16	193
456...	13	18	18	3	16	13	17	10	.....	13	4	12	136
457...	.....	.....	14	14	9	7	10	8	8	8	.....	.....	78
458...	3	21	20	15	15	5	13	12	8	8	.....	....	120
459...	.....	16	22	19	16	22	16	12	12	16	10	19	180
460...	.....	12	20	13	13	10	13	12	12	11	....	10	126
461...	9	23	7	14	18	19	17	11	13	10	14	23	178
462...	.....	.....	10	1	.....	11	.....	.....	.....	.....	.....	.....	22
463...	.....	.....	12	16	18	9	....	8	14	5	15	11	108
464...	.....	.....	10	3	10	.....	5	16	14	6	4	.....	68
465...	.....	21	12	.....	14	14	13	10	11	10	11	3	119
466...	.....	.....	16	18	23	9	†	.....	.....	.....	.....	.....	66
467...	.....	21	23	15	9	14	9	5	5	12	7	10	130
468...	.....	.....	7	19	18	19	17	19	19	12	19	22	171
469...	12	22	22	11	.....	3	.....	11	9	14	12	11	127
470...	.....	.....	20	12	19	20	15	14	22	8	7	4	141
471...	.....	.....	17	19	.....	16	13	14	5	3	.....	.....	87
472...	.....	.....	3	13	17	16	11	8	10	.....	.....	.....	78
473...	.....	18	19	...	13	12	17	10	8	10	7	4	118
474...	.....	.....	6	13	12	.....	8	2	.....	.....	.....	.....	41
475...	.....	.....	3	.....	.....	2	3	.....	....	1	.....	1	10
476...	.....	3	24	12	12	20	14	14	11	12	5	5	132
477...	3	20	22	11	17	13	14	9	12	10	13	13	156
478...	.....	.....	10	5	19	.....	16	16	.....	.....	.....	.....	66
479...	.....	14	23	18	13	13	20	12	16	9	14	17	167
480...	16	24	23	19	17	21	17	20	17	15	15	10	214

LIGHT BRAHMAS.

481...	.....	21	21	7	2	17	19	13	11	6	11	10	138
482...	7	17	3	17	4	14	9	5	11	.....	15	12	114
483...	.....	18	9	12	5	11	15	3	10	.....	.....	.....	83
484...	4	21	16	14	9	17	23	18	14	7	.....	.....	143
485...	.....	.....	1	.....	.....	.....	1	.....	...	....	....	....	2
486...	7	16	12	4	4	16	16	12	17	10	14	10	138
487...	.....	19	20	10	10	16	14	6	12	.....	14	6	127
488...	.....	10	18	.....	.....	.....	.....	11	21	18	12	.....	90
489...	.....	.....	4	9	1	16	19	9	11	12	14	.....	95
490...	4	22	19	7	7	17	6	5	†	.....	.....	.....	87
491...	2	18	18	16	8	17	16	20	19	19	10	1	164
492...	.....	15	15	3	4	.....	17	13	13	16	3	.....	99

* Dead. † Stolen.

EGG RECORDS--CONCLUDED.

LIGHT BRAHMAS.

Number of hen.	1899.		1900.										
	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	Total.
493...	......	......	4	13	5	16	10	13	13	14	7	12	107
494...	......	18	18	5	10	18	11	*	......	.....	.....	......	80
495...	13	20	4	6	1	18	13	1	†	. . .	... .	.....	76
496...	......	4	14	4	15	7	11	7	*	....	.....	......	62
497...	......	13	13	15	12	16	12	12	8	8	9	......	118
498...	......	......	2	2	.....	......	2	2	....	3	7	.....	18
499...	... ..	8	7	3	6	17	22	22	17	17	10	18	147
500...	14	21	18	.....	14	11	12	8	14	2	9	7	130

* Dead. † Stolen.

RECORDS OF PULLETS, 1900-1901.

On November 1, 1900, 100 April and May hatched Barred Plymouth Rock pullets, and 90 White Wyandotte pullets hatched at the same time were put into the house previously described and treated in the same manner that their predecessors had been during the two preceding years.

Fourteen of the Rocks and 17 of the Wyandottes died during the year. There was no evidence of disease among them. Up to October 31, 1901, the hundred Plymouth Rocks laid 13,200 eggs; an average of 132 to each bird. Six birds yielded from 200 to 234 eggs each to October 31st, and in the same pens were six of their mates that laid only between 23 and 70 eggs each. There were six others that yielded over 200 eggs each before the first year of their laying was completed, making 12 hens that each laid 200 eggs or over, during the first year, out of the 100 put in to the test at the commencement of the year. The best work by any hen since we have been selecting the breeding stock by the present method was done this year by No. 617 who gave her first egg November 29, 1900, and to November 28, 1901, she had laid 251 eggs.

The ninety White Wyandottes laid 11,184 eggs to Oct. 31, an average of 124 to each one. Six birds yielded from 203 to 233 eggs each. The six poorest layers gave yields between 36 and 65 eggs each. The following tables show the monthly yields for this year.

EGG RECORDS OF HENS HATCHED DURING APRIL AND MAY, 1900.

Barred Plymouth Rocks.

Number of hen.	1900.		1901.										Total.
	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	
601...	5	15	7	16	20	21	22	21	11	2	4	2	146
602...	.....	7	22	24	25	25	11	3	....	.....	.....	.....	117
603...	16	24	23	20	16	20	.....	17	13	23	4	20	196
604...	.....	....	.....	1	24	22	20	20	19	9	17	5	137
605...	.....	7	12	19	10	25	†	.....	.....	.....	....	.....	73
606...	1	18	2	7	18	8	14	1	6	.....	1	.....	76
607...	2	4	9	9	23	23	23	16	15	17	20	9	170
608...	.....	.....	.....	2	27	28	24	27	24	26	22	15	195
609...	13	17	20	21	21	20	6	19	16	20	20	7	200
610...	....	5	12	10	9	8	2	*	.....	.....	....	.....	46
611...	.....	.....	13	21	26	17	21	18	19	18	14	18	185
612...	11	15	22	18	19	22	23	21	10	21	18	9	209
613...	6	20	23	18	15	19	12	.....	.....	1	....	1	115
614...	.....	6	16	.....	7	....	1	*	.....	....	....	...	30
615...	.....	....	.....	13	13	23	7	.....	...	.....	.....	....	56
616...	.....	11	18	4	5	24	20	21	13	12	8	.....	136
617...	1	19	22	22	23	23	23	18	17	24	21	21	234
618...	16	19	20	15	8	16	20	17	16	15	21	8	191
619...	15	12	9	21	13	26	24	21	13	12	17	13	199
620...	1	4	18	7	9	16	15	10	20	12	13	13	138
621...	....	16	23	18	20	24	19	18	20	17	15	.....	190
622...	.....	.....	15	4	16	13	12	15	10	8	6	.....	99
623...	10	14	22	11	12	23	24	22	24	7	9	5	183
624...	4	18	16	16	17	20	14	9	10	8	13	.....	145
625...	.....	2	21	19	22	19	23	22	15	15	19	1	178
626...	.....	6	1	13	17	15	15	11	11	9	.....	4	107
627...	.....	.....	10	19	7	3	2	6	6	3	5	.....	61
628...	.....	.....	.....	5	19	16	19	22	20	19	12	.....	132
629...	1	22	18	1	19	13	.....	*	.....	....	...	.....	74
630...	18	24	24	21	24	13	17	16	17	15	6	18	213
631...	5	25	12	19	21	19	9	13	13	9	19	1	165
632...	.....	3	22	15	19	22	20	20	16	8	21	19	185
633...	.....	16	15	12	11	23	16	11	18	15	8	.....	145
634...	....	.....	7	7	18	11	10	10	10	7	8	4	92
635...	9	24	24	22	20	22	12	11	13	16	15	2	190
636...	.....	....	8	17	19	16	12	.....	17	2	*	.....	91
637...	.....	....	.....	2	14	1	*	....	.....	.....	.....	.....	17
638...	....	.....	15	10	17	16	13	11	7	5	6	....	100
639...	.....	....	19	12	20	9	*	.....	.....	.....	....	.....	60
640...	.....	21	17	15	15	12	18	12	8	.....	11	.....	129
641...	.....	.....	.....	5	22	25	21	21	17	17	15	12	155
642...	7	23	21	15	12	20	17	20	9	17	11	7	169
643...	.....	9	14	19	16	13	17	11	8	15	9	.....	131
644...	.....	.....	13	15	8	18	11	7	2	.....	.....	.....	74
645...	...	14	18	22	21	22	16	25	22	13	8	.....	181
646...	9	16	4	20	22	20	14	19	9	14	15	4	166
647...	1	.....	5	9	5	18	23	23	19	19	15	9	146
648...	15	18	19	15	19	16	8	18	13	17	17	7	182
649...	.....	22	19	6	20	24	22	21	14	17	8	17	190
650...	.....	.....	20	14	23	22	20	17	18	2	3	.....	139
651...	.....	15	9	10	18	24	19	13	18	18	22	4	170
652...	.....	.....	4	1	17	21	19	9	16	7	16	.....	110
653...	.....	14	17	15	24	22	10	21	13	12	*	.....	148
654...	.....	10	18	16	17	25	20	24	24	20	15	.....	189
655...	17	22	21	11	13	7	.....	.....	.....	.....	.....	.....	91
656...	.....	.....	1	2	24	19	14	10	17	.....	6	2	95
657...	.....	15	19	9	4	14	21	22	18	18	19	18	177
658...	.....	.....	5	17	20	20	14	17	18	16	15	2	144
659...	7	19	20	16	18	19	22	17	14	4	2	.....	160
660...	.....	...	16	20	21	11	15	11	9	13	13	8	137

* Dead. † Stolen.

EGG RECORDS—CONTINUED.

BARRED PLYMOUTH ROCKS.

Number of hen.	1900.		1901.										
	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	Total.
661...	......	......	10	15	20	11	17	11	7	10	12	10	123
662...	......	......	1	16	20	20	22	5	......	1	*	......	85
663...	17	19	20	16	8	13	9	10	16	17	10	......	155
664...	5	21	5	12	9	24	20	21	20	16	18	......	175
665...	21	20	10	18	16	15	13	9	15	9	17	11	174
666...	......	......	......	20	8	17	13	14	13	14	13	3	115
667...	......	......	3	16	17	3	*	......	......	......	......	......	39
668...	......	2	1	15	20	13	13	16	13	1	......	1	94
669...	......	3	19	20	26	23	19	18	14	19	17	1	179
670...	......	6	13	5	22	12	20	21	24	19	21	4	167
671...	5	20	6	22	18	21	16	16	18	15	10	......	167
672...	3	22	20	18	23	21	13	16	16	16	12	20	200
673...	......	13	3	9	7	14	16	9	19	15	......	......	105
674...	......	......	16	18	22	14	14	16	16	15	5	18	154
675...	......	......	3	6	8	......	6	......	......	......	......	......	23
676...	8	13	27	21	25	24	16	14	17	13	21	10	209
677...	......	......	9	15	14	8	......	......	8	......	......	......	54
678...	4	1	......	17	19	14	23	17	14	9	11	......	129
679...	......	......	8	17	23	14	1	......	7	......	......	......	70
680...	1	10	13	17	21	26	22	23	14	8	3	......	157
681...	......	9	13	16	19	21	14	15	15	12	11	4	149
682...	......	......	9	5	11	8	1	*	......	......	......	......	34
683...	1	17	20	19	22	26	12	*	......	......	......	......	117
684...	......	......	3	2	23	21	23	22	25	23	22	6	170
685...	9	......	23	15	15	20	14	10	11	8	12	2	139
686...	......	......	......	5	1	......	8	11	2	10	......	14	51
687...	......	......	4	19	9	17	15	*	......	......	......	......	64
688...	......	......	2	21	16	12	10	9	8	7	2	......	87
689...	......	......	10	22	27	25	24	22	20	19	12	......	181
690...	......	......	11	14	20	19	17	10	13	16	2	15	137
691...	......	......	9	21	20	21	14	19	16	21	16	20	177
692...	......	......	6	20	22	20	10	8	14	13	10	18	141
693...	......	......	......	16	11	19	1	......	......	......	......	......	47
694...	......	......	8	12	6	3	3	9	*	......	......	......	40
695...	......	......	19	11	12	24	22	16	16	15	2	......	137
696...	......	......	14	22	20	22	30	23	22	27	9	*	189
697...	......	......	16	8	6	15	16	8	......	3	......	......	72
698...	......	......	23	24	24	15	20	19	17	21	21	8	192
699...	......	......	5	9	6	16	14	20	18	9	12	1	110
700...	......	......	8	21	26	19	14	14	......	18	5	7	132

WHITE WYANDOTTES.

Number of hen.	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	Total.
701...	12	21	17	......	7	7	3	*	......	......	......	......	67
702...	......	10	15	16	19	20	21	12	14	14	12	3	156
703...	......	......	17	15	4	21	19	17	10	......	......	......	103
704...	10	21	17	14	12	12	7	13	12	10	......	......	128
705...	12	4	19	17	18	15	14	11	13	......	14	5	142
706...	15	15	3	18	16	21	22	15	15	20	18	3	181
707...	12	11	23	11	11	19	17	14	15	12	12	2	159
708...	......	......	14	4	13	8	9	12	7	14	......	......	81
709...	......	18	19	19	21	12	16	12	15	12	15	8	167
710...	5	2	22	20	8	22	12	12	12	16	7	......	138
711...	......	20	19	1	15	10	6	......	......	......	1	......	72
712...	......	......	18	19	17	19	18	11	11	10	7	1	131
713...	10	15	18	11	13	14	14	13	10	12	13	1	144
714...	......	3	22	17	15	14	15	13	......	11	7	7	124
715...	......	......	17	15	10	14	13	12	8	11	9	12	121
716...	......	......	15	15	14	20	19	20	13	11	5	......	132
717...	13	15	18	12	15	9	17	8	12	6	12	7	144

* Dead.

EGG RECORDS—CONTINUED.

WHITE WYANDOTTES.

Number of hen.	1900.		1901.										Total.
	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	
718...	4	21	9	18	15	11	13	14	15	12	11	11	154
719...	......	......	16	4	6	......	......	......	2	8	6	10	52
720...	18	5	23	17	20	13	1	11	5	......	......	......	113
721...	7	21	23	18	13	17	9	......	......	......	......	......	108
722...	......	7	18	16	16	13	5	......	......	1	*	......	76
723...	......	4	20	21	21	15	16	18	12	12	22	......	161
724...	18	20	19	18	16	20	10	19	15	16	9	15	195
725...	9	5	17	10	3	3	*	......	......	......	......	......	47
726..	......	14	14	4	8	5	14	2	3	......	......	......	64
727...	7	14	14	15	13	15	10	14	7	6	1	8	124
728...	1	17	19	16	18	21	24	17	16	*	......	......	149
729...	5	16	20	20	20	24	7	20	9	25	22	15	203
730...	9	8	21	15	14	4	......	7	8	......	14	7	107
731...	......	......	16	14	4	*	......	......	......	......	......	......	34
732...	4	......	13	14	12	8	5	11	13	......	......	......	86
733...	14	18	19	13	1	......	1	*	......	......	......	......	66
734...	12	20	21	15	12	8	*	......	......	......	......	......	88
735...	......	2	20	21	26	21	14	14	15	14	11	18	176
736...	7	20	22	15	8	7	*	......	......	......	......	......	79
737..	......	13	2	8	15	*	......	......	......	......	......	......	38
738...	3	3	12	19	24	19	16	16	6	16	9	20	163
739...	......	6	11	17	3	18	19	2	18	18	10	17	139
740...	1	7	10	3	1	*	......	......	......	......	......	......	22
741...	......	3	22	8	13	17	13	10	13	18	12	7	136
742..	2	21	21	17	18	19	23	22	21	20	12	......	208
743...	10	14	13	7	13	12	10	8	7	9	7	12	119
744...	23	4	21	21	10	19	16	10	16	18	13	2	173
745...	......	3	17	15	19	21	21	19	19	18	7	......	159
746...	......	......	9	4	18	11	9	*	......	......	......	......	51
747...	6	18	19	14	14	17	22	18	21	12	15	10	186
748...	......	......	11	16	19	13	7	5	8	6	6	9	90
749..	7	19	23	19	20	23	22	8	15	9	*	......	165
750...	......	......	19	15	13	10	*	......	......	......	......	......	57
751...	5	5	18	17	18	18	19	14	18	8	16	10	166
552...	8	13	20	14	13	12	7	......	......	......	......	......	87
753...	20	13	22	21	19	21	13	20	14	22	9	23	217
754...	10	5	16	7	13	9	10	8	12	9	......	......	99
755...	9	9	11	13	11	7	2	......	......	......	......	......	62
756...	......	......	15	12	12	18	13	13	14	15	10	12	134
757...	......	......	20	16	19	19	1	10	20	13	13	10	141
758...	......	......	10	1	13	1	......	9	1	12	......	7	54
759...	9	7	16	1	......	3	......	......	......	......	......	......	36
760...	17	17	14	9	8	20	14	10	1	......	9	......	119
761...	......	15	11	6	14	12	11	12	14	10	13	......	118
762...	19	5	21	2	10	19	21	24	18	20	19	8	186
763...	9	3	18	17	18	20	19	18	12	......	6	19	159
764...	......	3	18	6	20	15	15	13	......	......	......	......	90
765...	16	22	18	4	15	21	23	23	22	23	19	20	226
766...	13	14	17	8	7	17	19	16	12	21	19	10	173
767...	16	23	16	11	9	3	......	......	......	......	......	......	78
768...	4	2	18	12	11	10	12	16	10	12	8	4	119
769...	10	15	10	6	8	18	13	14	13	15	12	12	146
770...	18	21	23	19	17	19	17	15	16	8	15	19	207
771...	......	13	19	3	11	11	8	......	......	......	......	......	65
772...	10	19	11	19	16	19	14	10	11	10	14	8	161
773...	13	......	14	13	12	18	5	4	3	*	......	......	82
774...	12	......	6	16	18	19	10	*	......	......	......	......	81
775...	16	20	22	13	23	17	8	8	7	*	......	......	134
776...	18	3	17	9	12	15	13	14	14	13	12	......	140
777...	18	22	22	20	16	21	22	16	16	23	21	16	233

* Dead.

EGG RECORDS—CONCLUDED.

WHITE WYANDOTTES.

Number of hen.	1900.		1901.										Total.
	November.	December.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	
778...	4	11	20	10	4	20	10	18	15	17	21	13	163
779...	15	8	22	15	10	16	20	23	11	18	16	9	183
780...	17	15	15	14	14	13	13	8	15	16	17	9	166
781...	11	14	10	19	2	14	2	6	5	3	1	......	87
782...	7	13	21	20	18	12	18	15	12	15	2	.....	153
783...	12	19	10	13	14	11	16	12	16	15	12	11	161
784...	......	8	14	20	14	4	......	.....	.....	.....	.....	......	60
785...	15	16	12	2	12	16	7	.....	.....	.....	.....	......	80
786...	22	19	14	13	5	12	11	12	4	13	11	14	150
787...	.....	17	21	21	17	23	13	*	.....	......	.....	....	112
788...	10	11	13	14	9	7	17	12	15	11	9	.....	128
789...	....	13	16	3	13	25	17	19	11	11	19	18	165
790...	.....	12	19	15	4	14	10	10	1	*	.....	......	85

* Dead.

CONCLUSION.

This report does not deal with results, for sufficient time has not yet elapsed since beginning the test to breed birds and test their laying qualities.

During the three years in which we have been selecting breeding stock by use of the trap nests we have found 30 hens that laid between 200 and 251 eggs each in a year. Twenty-six of them are now in our breeding pens and constitute —until other additions are made to them—the "foundation stock" upon which our breeding operations are based. Males for our use have been raised from them during the last two years. The number of the foundation stock, now secured, makes practicable the avoidance of inbreeding, and this is to be strictly guarded against, as it is doubtful if the inbred hen has sufficient constitution to enable her to stand the demands of heavy egg production.

All of the other breeding stock we are now carrying are tested hens that have laid over 180 eggs in a year; pullets whose mothers laid over 200 eggs in one year and whose fathers' mothers laid over 200 eggs in a year; and pullets sired by cockerels whose mothers and grandmothers laid over 200 eggs in one year. The size and color of the Plymouth Rock eggs are very fine. The eggs from the Wyandottes are of good shape and size, but as yet too light in color.

ORCHARD NOTES.

W. M. Munson.

As noted in previous reports of the Experiment Station, there have been several attempts to disseminate certain varieties of fruit which should prove hardy in some of the more trying localities, and to encourage the cultivation of fruit for home use and for market throughout the State. Although Maine is pre-eminently suited to apple growing, there is a very general neglect of this most important fruit.

In 1899 cions of the most promising varieties of apples were sent to leading orchardists in various parts of the State for the purpose of studying the adaptability of these varieties to the different conditions. The following year fifty-four Russian varieties were obtained from Professor Budd of the Iowa Agricultural College, and were sent to parties in Rangeley, Houlton, and northern Aroostook with the understanding that written reports were to be returned from time to time. With few exceptions these reports have been very meager and unsatisfactory. A personal examination of the trees has been made, however, and notes upon their condition and value made from time to time.

In 1891, and for two or three years following, a special effort was made to introduce some of the newer fruits mentioned into the northern part of Aroostook county, where, until the advent of the Oldenburg and the Wealthy, all attempts at apple culture had failed. In accordance with this plan arrangements were made with Mr. James Nutting of Perham to test such varieties as might be sent him and report upon the same each year. Until the death of Mr. Nutting, in 1894, this plan was carried out and promising results were obtained.—See Annual Report 1891, p. 97; 1892, p. 90. The writer has made several visits to the orchard and recorded the behavior of the several varieties. At the Station orchard duplicates of most of the varieties obtained have been grown for purposes of study and for dissemination if thought desirable. The present report is based upon the observations made in the several localities.

HARDY APPLES IN MAINE.

As above noted, the Experiment Station has since 1890 had under observation several apples of Russian origin, and other varieties originating either in the colder parts of Maine or in the northwest. All of these varieties are hardy and most of them are productive. Very few of them, however, are worthy of general dissemination in those parts of Maine where the well known varieties of English and American origin will thrive. In the northern part of the State some of them are valuable and some are worthy of culture under any conditions. The accompanying table gives a concise description and estimate of the value of the several varieties tested, both for the northern counties and for the general apple growing sections of the State. The most promising sorts are treated more in detail.

The widely varying conditions existing in different parts of Maine render a general statement as to the value of any given variety only approximately correct. Some varieties which are considered specially valuable in Aroostook county are unknown in the southern counties; while others, which are of merit for the south, are not sufficiently hardy for the northern portion. In the accompanying list separate columns are assigned for the value of each variety in the northern and southern parts of the State. The first column marked "north" includes Aroostook, and the northern parts of Piscataquis, Somerset, Penobscot and Washington counties. The column marked "south" includes Oxford, Kennebec, Waldo and all of the southern counties. The numbers in parentheses are the important numbers of Prof. Budd.

The value of any given variety is indicated thus: Two stars (**) indicate a variety of special merit, one to be recommended for general culture. One star (*) shows that the variety is worthy of cultivation, though not of superior merit. A dagger (†) indicates a variety not fully tested in the region designated. A dash (—) shows that the variety has been tried and is not considered worthy.

The abbreviations used in characterizing the several varieties are fully explained below. As an example of their interpretation take the Alexander. As will be seen, the variety is described as a large, striped apple of roundish-conical form and moderately good quality in season during the autumn. It is of Russian origin and is worthy of general planting.

CATALOGUE OF THE HARDIEST APPLES.

Abbreviations used:—Size—l, large; m, medium; s, small. Form—c, conical; ob, oblate; r, roundish. Color—g, green; r, red; g y, greenish-yellow; y r, yellow and red; r s, red striped; rus, russetted. Flavor—a, acid; s a, sub-acid; s, sweet. Flesh—b, breaking; d, dry; j, juicy; c, crisp; t, tough. Season—E A, early autumn; L A, late autumn; W, winter.

Variety.	Description.							Value.		Remarks.
	Size.	Form.	Color.	Flavor.	Flesh.	Season.	Origin.	North.	South.	
Alexander	l	r c	g r	a	j	A	Rus.	**	*	A popular market sort.
Anisim (18m)	s	c	r	a	j	A	Rus.	**	*	Of the Jonathan type, very productive.
Aport (252)	l	c	g r	a	j	A	Rus.	**	*	Of Alexander type.
Arabka (257)	m	r c	g r	a	d	W	Rus.	*	—	Dry, insipid, but very handsome, resembling Blue Pearmain.
Arctic	m	r c	y r	s a	c j	W	N. Y.	**	*	"A hardy Baldwin."
Arthur	s	r c	g r	a	j	W	N. Y.	†	...	Very hardy, promising north.
Bethel	m	r	r s	a	c j	W	Vt.	*	*	Promising for the north.
Borsdorf (356)	s	r ob	y	s a	c	W	Rus.	*	*	Small but hardy, productive, and keeps well.
Cross (413)	m	r c	r s	a	j	A	Rus.	*	—	Good for cooking.
Daisy	m	r c	y r	a	c j	L A	Rus.	†	†	Handsome, promising.
Duchess No. 8	m	r c	r s	a	c j	L A	Minn.	†	†	Promising seedling of Oldenburg.
Dudley	l	r ob	r y	a	b j	E W	Me.	**	*	Widely planted in northern Maine.
Early Scarlet	m	r c	r	a	c j	E A	Can.	**	†	Good. Of Astrachan type.
Early Sweet	m	c	y	j	s	E A	Rus.	†	†	
Excelsior	m	ob c	r g	a	c j	A	Minn.	†	†	Scabs badly.
Gideon	m	r ob	y r	a	j	A	Minn.	....	—	Rots at core.
Gideon No. 6	m	c	y r	a	c j	A	Minn.	†	...	A large, handsome crab; seedling of Gideon.
Golden Reinette	m	c	y r	a	j	A	Rus.	†	....	Promising.
Green Crimean (399)	l	c	g	a	j	A	Rus.	*	—	Good for cooking.
Harry Kaump	s	r ob	y	a	d	W	Eu.	†	†	Small, hardy, good keeper.
Hayford Sweet	m	c	g r	s	c	W	Me.	**	....	"The best sweet apple for the north."
Hibernal (378)	l	ob c	r s	a	c j	A	Rus.	*	*	Good for cooking.

CATALOGUE OF THE HARDIEST APPLES—CONTINUED.

Variety.	Description. Size.	Form.	Color.	Flavor.	Flesh.	Season.	Origin.	Value. North.	South.	Remarks.
Iowa Blush	m	c	y r	a	c	W	Ia.	†	....	
Koursk Anis		......	. ..	...	...	......	....	†	....	
Koursk Reinette (20M)	l	ob c	g	a	c	L A	Rus.	†	†	Good for cooking.
Lead (3M)	l	ob c	g r	a	c j	A	Rus.	†	†	Good for cooking.
Longfield (161)	m	c	y r	a	c j	L A	Rus.	*	*	A profuse annual bearer of good quality.
Losouka (4Orel) ..	m	c	r s	a	j	A	Rus.	†	—	Drops badly.
Malinda	m	c	g r	a	j	W	Minn.	†	....	
Malett	m	ob c	g r	a	j	A	Rus.	†	†	
McMahon..	l	ob c	y r	a	c j	A	Wis.	†	...	Large, handsome, promising north.
N. W. Greening....	l	c	g	a	t j	W	....	*	*	Handsome, prolific; a late keeper.
North Star.........	m	c	y r	a	c	L A	Ia..(?)	†	....	
October	m	ob	y r	a	j	E A	Minn.	†	†	One of Gideon's crab seedlings.
Okobena	m	ob c	r s	a	b j	L A	....	†	....	Promising north.
Oldenburg.	l	ob	r s	a	b j	E A	Ger.	**	*	The standard autumn variety, north.
Ostrakoff (4M)	m	ob	r s	a	j	W	Rus.	†	...	Promising north.
Patten's Greening	m	c	g	a	c j	E W	Ia.	†	....	Seedling of Oldenburg.
Peter.	m	c	g r	a	j	A	Minn.	....	†	Very productive; shows crab parentage.
Pink Anis	s	c	y r	s a	j	A	Rus.	*	*	Very prolific.
Prolific Sweeting.	m	c	y	s	d	A	Rus.	**	*	The best sweet Russian.
Repka Aport (261).	l	r c	g r	a	j	A	Rus.	**	*	Similar to Alexander.
Royal Table (5M)..	m	c	y r	a	b j	L A	Rus.	*	..	Promising for Aroostook.
Russian Gravenstein (135M)......	m	c	r s	s a	b j	E A	Rus.	*	*	Promising, but drops rather badly.
Sandy Glass (24M)	l	c	g	a	j	A	Rus.	†	...	Drops badly.
Saunkernaty	s	c	g	a	j	W	Rus.	...	—	Small, drops badly, poor quality.
Severs	m	c	y r	a	b j	E A	....	†	†	Of the Astrachan type.
Shiawassee	m	ob	r	s a	j	E W	Mich.	**	**	Should be more widely planted both north and south.
Silken Leaf (75M).	m	c	g r	a	j	E W	Rus.	...	—	Good for cooking.
Sklanka	m	c	g y	a	j	A	Rus.	...	—	Drops badly; of poor quality.
Skruischapfel (42 Vor.)	s	c	g r	a	c	A	Rus.	....	—	Small, poor; drops badly.

CATALOGUE OF THE HARDIEST APPLES—CONCLUDED.

Variety.	Description.							Value.		Remarks.
	Size.	Form.	Color.	Flavor.	Flesh.	Season.	Origin.	North.	South.	
Striped Winter....	l	c	r s	a	j	A	Rus.	....	...	Coarse, poor in quality; drops badly.
Switzer............	m	c	r s	a	j	A	Rus.	†	....	Poor quality.
Table Apple.	s	r ob	g	a	j	A	Rus.	†	†	
Tetofsky...........	s	c	r s	a	j	EA	Rus.	*	....	Too soft and poor in quality.
Thompson 26.......	m	c	g y	a	c	W	Minn.	†	†	Hardy seedlings from Jewell Nursery Co., Lake City, Minn.
Thompson 29......	..	......	....	...	....	......	Minn.	†	†	
Thompson 43......	....	......	...	...	...	.....	Minn.	†	†	
Thompson 24.... ..	l	c	r s	a	j	A	Minn.	†	†	
Tiesenhausen......	....	......	....	....	...	.....	Rus.	...	—	Small, worthless.
Titovka...........	l	ob c	y r	a	b r	A	Rus.	†	—	Showy but coarse.
Titus	l	ob c	r s	a	c j	A	Rus.	†	—	Showy but coarse; drops bably.
Vargulek (12 M)...	m	c	r s	a	j	A	Rus.	†	—	Drops badly.
38 Voronesch......	m	ob c	r s	sa	b j	EA	Rus.	†	—	Similar to Duchess. A little earlier.
Wealthy......	m	ob c	g r	sa	j	EW	Minn.	**	**	A good general purpose sort.
Wolf River.........	l	c	r s	a	j	LA	Minn.	†	†	Coarse, showy.

Attention is again called to the fact that the varieties here named do not constitute a complete list of the hardy apples of Maine but, as stated, only the newer and a few of the well known ironclad sorts are considered. Of the list, those of greatest value are described below.

MOST VALUABLE RUSSIANS.

Of the fifty or more varieties of Russian apples which have been planted in the Station orchard, very few are worthy of general recommendation for planting in Maine. Most of them, as grown in this section of the State, are autumn varieties which, though exceedingly productive and perfectly hardy, are of inferior quality, keep poorly and drop badly before maturity. Of the list but three—Alexander, Longfield and Yellow Transparent—can be recommended for general culture in competition with apples of American and West European origin, and the number to be advised for the colder sections of the State is not large. The most promising, in addition to the varieties already named, are Anisim, Arabka, Borsdorf, Cross, Green Crimean, Hibernal, Koursk Reinette, Pink Anis, Prolific Sweeting, Repka Aport, Russian Gravenstein. Many others thrive but, as noted, are inferior. Below is given a condensed description of the varieties named:

Alexander. Fruit large, roundish-conical, greenish-yellow, washed and splashed with crimson; calyx large, open, set in a deep often russetted basin, stem short, stout, inserted in a deep cavity. Flesh yellowish, rather coarse grained, juicy, sub-acid. Good. Season, October and November. Tree hardy, vigorous, spreading, productive.

The good form, large size and bright color of this fruit attract attention in any market and it is one of the best of the autumn varieties for the kitchen. The chief objections to it are its short season and the fact that it decays very quickly if even slightly injured. The Alexander is one of a race or family of Russian apples (the *Aport* family) which is represented in the Station orchard by two other varieties—Repka Aport and No. 252.

Anisim. Fruit small to medium, roundish-conical, greenish-yellow almost completely overlaid with rich dark crimson; calyx small, in a medium basin; stem slender, in a rather deep cavity. Flesh white, crisp, juicy, sub-acid. Good. Season October to February.

This variety, which has been called the "Jonathan of the North" is very hardy, productive and prolific. Unless the fruit is thinned it is likely to be small.

Arabka. Fruit large, oblate-conical, greenish, washed with purple and covered with a dense bloom; calyx large in a moderately deep, slightly corrugated basin; stem medium inserted in a deep cavity. Flesh greenish white, juicy but rather tough, sharp acid and lacking in richness. Season, January to April.

This is a very handsome apple, somewhat resembling Blue Pearmain. It is very hardy, productive, and an excellent keeper for the northern sections, but its quality is inferior.

Borsdorf. Fruit small, oblate, yellow, sometimes with blush cheek in the sun; calyx large, open, in broad shallow basin; stem slender, in a medium cavity. Flesh yellowish, firm, juicy, sub-acid. Good. Season, January to April.

But for its rather small size, this variety would be specially good for the colder sections of the State. It is of the Rhode Island Greening type, is of good quality, and an excellent keeper.

Cross. Fruit medium, oblate-conical, greenish-yellow washed and splashed with crimson. Flesh white, crisp, juicy, brisk acid. Good for cooking. Season, September to November.

The tree is hardy, vigorous and productive. The fruit, which resembles Haas, is inclined to drop badly, however, and it is not recommended for any except the most trying sections of the State. There is some doubt as to the identity of this variety as growing in the Station orchard.

Green Crimean. Fruit large, conical, yellowish-green changing to yellow at maturity; stem medium, cavity deep; calyx open; basin shallow, corrugated. Flesh greenish-white, tender, juicy, acid. Good. Season, October to December.

The tree is vigorous, spreading, hardy, productive. A good autumn variety for cooking.

Hibernal. Fruit medium to large, oblate-conical, greenish-yellow washed and splashed with bright red; stem short, stout, inserted in a deep, rather broad, russetted cavity; basin medium, slightly corrugated; calyx open. Flesh yellowish, crisp, tender, juicy, acid; core, small. Good. Season, October to December.

Tree very hardy, of strong, low, spreading habit; vigorous; productive. Although not a dessert apple this variety is valuable for cooking, and on account of its hardiness and productiveness is one of the best of the newer Russian sorts.

Longfield. Introduced from Russia in 1870. Fruit medium, roundish-conical, pale yellow with light red cheek; stem slender, inserted in a deep, very narrow, slightly russetted cavity; basin medium, wrinkled; calyx partly open. Flesh white, crisp, very juicy, tender, brisk sub-acid. Good for cooking and dessert. Season, September to January.

The tree is very hardy and productive, and unless the fruit is thinned it is liable to be undersized. In common with most Russian sorts it drops badly, but on account of its good quality, its hardiness and productiveness it is one of the best of its class.

Pink Anis. Fruit small to medium, conical, golden washed and splashed with carmine. Flesh yellowish, crisp, very juicy, mildly acid. Good. Season, September to December.

The tree is vigorous, upright, spreading, productive. The fruit drops rather badly, but otherwise it is a good autumn variety. It was received under the name of Golden Reinette and was described under that name in a former report.

Prolific Sweeting. Fruit medium, conical, somewhat irregular, pale yellow, usually russetted in the rather deep cavity. Flesh white, crisp, rather dry, sweet. Good. Season, September and October.

This variety, imported in 1870, is the most valuable fall sweet apple for the northern part of the State. It is planted largely in northern Vermont and was regarded very highly by Dr. Hoskins. In size and color it resembles Yellow Transparent.

Russian Gravenstein. Fruit medium to large, conical, somewhat angular; greenish-yellow washed, striped and splashed with crimson; stem set in a deep cavity; calyx open, in a broad rather shallow basin. Flesh yellowish, tender, breaking, juicy, subacid. Good for cooking or dessert. Season, September.

The tree is hardy, vigorous, spreading, and productive. It does well in northern Aroostook, but will not supersede the Oldenburg, which it somewhat resembles.

Yellow Transparent. Fruit medium, roundish-oblate, slightly conical; clear pale yellow; stalk medium, slender, in a rather large greenish cavity; calyx closed, in a medium, slightly corrugated basin. Flesh white, crisp, tender, juicy, sprightly subacid. Good. Season, August.

This variety is now well known and recognized as a valuable early summer apple suitable for any locality. The principal objection to it is its very delicate color. The slightest bruise is evident.

The reason for discarding most of the Russian apples tested may be summed up in a very few words, Viz.: *Poor quality, early season, habit of dropping before maturity.*

SOME OTHER GOOD VARIETIES.

Besides the Russian apples, there are many of the older varieties of American origin which are perfectly hardy over a large portion of the State. Some of these are the standard market varieties of central and southern Maine; others, like those mentioned below, are valuable but not generally known. The varieties here named are all growing in the Station orchard and are commended only after careful personal observation.

Arctic. This variety was fully described in a former report.* It is attracting considerable attention in the State and is worthy of trial where Baldwin will not succeed. It has been characterized as a "hardy Baldwin," though averaging larger than the older variety and being of a milder flavor.

Boiken. Fruit large, oblate, rich greenish-yellow overlaid with carmine, sprinkled with numerous white dots. Stem set in deep slightly russetted cavity; calyx large, open, set in a broad, rather deep slightly corrugated basin. Flesh white, crisp, juicy, slightly acid. Good. Season late winter.

The tree is very vigorous, spreading and productive. A promising variety of the Rhode Island Greening type.

Doctor. Fruit large, roundish oblate, yellow washed and splashed with red, with numerous grayish dots. Stalk medium, deeply set; calyx large open, set in a wide, slightly corrugated basin. Flesh yellowish, tender, juicy, breaking, aromatic, subacid. Good to very good. November to April.

This variety was sent to the Station by the U. S. Dept. of Agriculture under the name of "Newby," but has since been identified as above. It is a Pennsylvania apple; said to be a rather indifferent grower, but, as top-worked on Alexander, has given excellent results in the Station orchard. The variety is promising for New England.

Hurlbut. Though an old variety, this apple is not as well known as its merits deserve. It is hardy, productive, of excellent quality and keeps until late in the spring. March 1 not one of the specimens placed in the cellar had begun to decay.

Milding. The Milding* well deserves its reputation as a valuable early winter variety. It is of good size, hardy, productive and is highly prized for family use, and for market where known. The trees are among the best in the Station orchard.

Munson Sweet. This old Massachusetts variety is justly popular wherever known, but is not so widely planted as it should be. The tree is vigorous, spreading, and an annual and abundant bearer. Fruit medium oblate, pale yellow, often with

* Rep. Maine Exp. Sta. 1896, 70.

† See Rep. Maine Agr'l Exp. Sta. 1896, 71.

a blush. Stem short, inserted in a rather large cavity; calyx closed, basin small. Flesh yellowish, tender, juicy, sweet. Good to very good. September to February.

Of 100 average specimens placed in the cellar October 15, but two showed signs of decay on January 22, and the flavor and texture were still normal. The tree is vigorous, productive and hardy as far north as Perham.

Northwestern Greening. Tree vigorous, spreading, hardy. Fruit large, conical, clear yellowish-green sprinkled with lighter dots. Stalk medium, cavity rather deep, russetted; calyx partly open, basin slightly corrugated. Core very large. Flesh greenish-white, coarse grained, juicy but tough, mildly acid. Good. Season, late winter.

Rolfe. This variety, which was commended in the previous report,* still thrives and bears well in protected localities in northern Aroostook. It is a valuable sort for family use wherever grown.

Shiawassee. Fruit medium, oblate, greenish-white overlaid with crimson, with stripes and splashes of a deeper shade. Flesh firm, white, tender, juicy, brisk sub-acid. Very good. Season October to February.

This seedling of Fameuse, originating in Shiawassee county, Michigan, is larger and altogether finer than its parent. It possesses more character and keeps longer than Fameuse. The tree is vigorous, productive and perfectly hardy as far north as Perham.

Wealthy. This variety, which originated with Peter M. Gideon of Excelsior, Minn., from seed said to have been taken from Maine, is too well known to need description; though its full value is not appreciated. It is hardy in northern Aroostook, is of good color, excellent habit and is very productive. It is an autumn variety in southern Maine, but with improved shipping facilities, it may readily be put upon the markets of London and Liverpool where it is always in good demand. Growers too often make the mistake of allowing this variety to overbear and thus produce undersized fruit.

Westfield. The old "Seek-no-further," long popular in New York and Michigan, is being more widely planted and better

* Rep. Maine Agr'l Exp. Sta. 1896, 71.

known as a valuable hardy winter apple. It is yielding well in the Station orchard and is hardy in Perham. Its color is not equal to Baldwin, but for family use it is excellent and when known will find a ready market.

York Imperial. Many inquiries have been received concerning the York Imperial. As top-worked upon a Russian variety in the Station orchard the tree is hardy, upright, of very vigorous habit, but has only just begun to bear. The few specimens produced the past season have kept well and are of good quality, but the high color for which Maine growers usually look is wanting.

SOME MAINE SEEDLINGS.

The most valuable fruits for any difficult climate are usually those of local origin or those from regions having similar climatic conditions. While the Russian varieties have wrought a revolution in the possibilities of fruit production in the northwest, we have already seen that comparatively few of them are of special value in Maine. There are, however, many seedlings of local reputation which are worthy the attention of our fruit growers—particularly those who are located in the rich agricultural section of northern Maine. A few of the most important of these are mentioned below and a complete list of Maine seedlings is at present being worked up.

Aroostook. "A sweet golden russet of medium size which keeps without any trouble until July 1."

The tree originated about thirty years ago on the farm of Silas S. Stiles, Mapleton, Aroostook county. It has a good local reputation and is worthy of wider dissemination. Its parent was "some kind of a Greening raised in Cumberland county."

Dudley. (Dudley's Winter, North Star). A seedling of Oldenburg, grown by J. W. Dudley, Castle Hill, Aroostook county.

Tree very vigorous, spreading, hardy and productive, with large, roundish-oblong, greenish-yellow fruit, washed and splashed with crimson. Stem medium, inserted in a deep cavity; calyx partly open, basin large. Flesh yellowish, crisp, breaking, rather coarse, brisk sub-acid. Good. September to January—later in Aroostook county.

This variety is, perhaps, more widely known than any other of the newer sorts originating in New England. It is being disseminated by a New York nursery firm under the name "North Star"—an unfortunate circumstance as there is another very different variety bearing that name by right of priority. It is a valuable acquisition as a winter fruit for the northern parts of the State, but as grown at Orono it is decidedly a fall variety.

Rolfe. Originated in the town of Guilford about 1820.

Fruit medium to large, oblate, often angular, yellowish, shaded and striped with red. Stalk short, inserted in a large cavity; calyx large, closed, in a rather large, regular basin. Flesh white, fine-grained, tender, juicy, sub-acid; core small. Good to very good. November to January.

Though comparatively an old variety, the Rolfe is not as widely known as it should be. The variety originated on high land in the town of Guilford, about a mile from the Piscataquis river. The seed from which it sprang was brought from Western Maine to that place by a Mr. Rolfe. About 1820 the original tree, together with several other young seedlings was given to Elder Macomber—hence the name *Macomber* applied to this variety by Downing. A sprout from the original tree is still standing on the Macomber farm and produces annual crops of fruit. H. L. Leland of East Sangerville, has more than a hundred trees of this variety in his orchard and says: "The Rolfe in our local markets, sells better and at bigger prices than any other variety that we grow. It sells well as a shipping apple, though not much known." As already noted, the variety is hardy in sheltered locations as far north as Presque Isle, and it is regarded highly wherever known.

Stowe. Originated in Perham, Aroostook county, about 1875. Tree vigorous, spreading, very hardy, an annual bearer.

Fruit medium to large, roundish conical, greenish-yellow with blush cheek, and with many small whitish dots. Stem short, slender, inserted in a medium cavity. Flesh yellowish, tender, juicy, sub-acid. Core small. Good. February to May, in Aroostook.

This variety has never attracted the attention of nurserymen, but has had a good local reputation for several years. It is well worthy of general dissemination as a valuable "ironclad" variety. Its history, as given in the report of the Maine Pomological Society for 1895, is essentially as follows: Seed was brought to Perham from Massachusetts by Francis Stowe about 1862, and the variety in question was one of the resulting seedlings. The tree was isolated in 1875 and has been known locally for several years as Stowe's Winter. Mr. Rufus F. Stowe, son of the originator, writes that "it will keep longer than anything except Ben Davis and is nearly equal to that."

Other hardy local seedlings which are being more or less extensively planted in northern Maine are Hayford Sweet,—regarded as the best winter sweet—Monroe Sweet, and McIntire Sweet. Hayford Sweet is much hardier than Talman and takes the place of that variety as a late keeping sweet apple.

A SUGGESTION.

The foregoing notes represent pretty nearly the present status of the hardy apples which have been tried in Maine. The multiplicity of varieties may, however, be confusing to some who purpose growing fruit for market. To such the oft repeated advice, "for market plant few varieties," is most strongly urged. Over a large portion of Maine any of the more prominent commercial varieties will thrive, but in those sections where the standard of hardiness is marked by Oldenburg and Wealthy it is well to make a virtue of necessity and for commercial purposes plant only those sorts which have a recognized commercial value or those which are of such conspicuous merit that a market is assured. The varieties named are hardy, productive, attractive and have an established reputation in Boston and in English markets, a fact which assures ready sale for all choice fruit. English buyers are at the present time urging the more extensive planting of Wealthy in southern Maine to supply the demand for fall fruit in London and Liverpool, and will welcome the hundreds of barrels that every year waste for want of local buyers in the northern portion of the State. Really choice Oldenburgs frequently net three dollars (sometimes more) per barrel in Boston, yet every year hundreds of barrels of this fruit lie on the ground and decay. Alexander, also, is always in demand at good prices. The need of fruit growers in northern Maine is not so much new hardy varieties which will compare with Baldwin, Greening and Northern Spy as it is a better appreciation of the merits of the varieties already known to thrive, a better acquaintance with markets and market demands, and more care in cultivating and managing the orchards.

For home use a wider range of varieties is desirable and a selection from the list above mentioned may be made to suit personal preferences. In no case, however, is it wise to plant too freely of untried sorts. Varieties of known value and hardiness may be planted as stocks on which the newer kinds may be topworked at will.

THE KEEPING QUALITY OF CERTAIN APPLES.

For the purpose of comparing the keeping qualities of certain varieties of apples growing in the Station orchard, several specimens of each were placed in a cool cellar and were examined from time to time through the winter. A few of the varieties—*viz:* Longfield, Munson Sweet, Sandy Glass, Koursk Reinette, Green Crimean, and Haas were harvested about two weeks before removal to the cellar, and were kept in the potting shed at the greenhouse. The remainder were placed in the cellar after two days. Some of the varieties—notably Golden Russet, Talman and Winesap—were harvested a little too early for the best results and shrivelled badly early in the season.

The following table shows in detail the condition of the several varieties at various times during the winter. A record was kept of the number of specimens of each variety which was worthless at each examination and the number only slightly decayed or "specked." In the table, however, all affected specimens are referred to as decayed.

The fruit was placed in the cellar October 9. Critical examination of all specimens was made as indicated in the table.

Variety.	Whole number specimens.	NUMBER DECAYED.					Remarks.
		November 19.	December 18.	January 22.	March 1.	March 22.	
Anisim	76	2	4	6	10	—	Should be used by Jan. 1. Flavor badly impaired Jan. 22.
Arctic	40	....	....	1	2	....	One of the best. In excellent condition at last examination.
Bethel	6	....	....	....	....	....	This variety and the next are firm as when put in the cellar.
Boiken	5	...	....	....	....	...	
Borsdorf	86	1	...	8	6	—	Inclined to shrivel. Loses flavor by the last of January.
Cross	48	4	1	3	12	....	Soft and shrivelled in Jannary. Quality still good. All worthless March 1.
Doctor	75	1	...	2	4	3	All remaining specimens in excellent condition at close of test.
Dudley	47	10	7	12	—	—	Should be used by January 1. Flavor lost.
Golden Russet	57	....	....	....	1	2	Picked too early. Shrivelled badly early in the season, but retained flavor well.
Green Crimean	44	5	2	22	—	—	A fall variety; worthless after January 1.
Haas	44	5	4	7	—	—	A December variety. All very soft when examined in Jan.
Harry Kaump	48	....	2	....	5	5	An excellent keeper, but loses flavor by March 1.
Hurlbut	45	....	....	...	....	9	One of the best. Begins to break down in March.
Koursk Reinette	45	10	10	14	—	—	An autumn variety; should be used by December 15.
Large Anis.	47	...	2	2	5	—	Retains form and color but is mostly soft and worthless after January 15.
Lead Apple	42	7	3	2	7	—	Begins to soften and rot at the core in January.
Longfield	74	4	1	9	17	—	Begins to shrivel and lose flavor in January.
Mann	61	1	1	...	....	....	One of the best keepers; not of high quality.
Milding.	26	...	1	...	2	4	In excellent condition at close of test.
Munson Sweet	100	....	...	2	2	3	Form and flavor still good at close of test.
Northwestern Greening.	25	....	....	....	...	..	As firm in texture at close of test as at first. Good.
Peter	39	....	1	2	—	—	Retains form and color well, but is soft and worthless for market after January 1.
Pewaukee	41	1	...	5	1	2	Begins to shrivel in February. Retains flavor well.
Porter	21	...	....	3	3	....	Retains form and texture remarkably well. Begins to lose flavor in January.
Rall's Janet	53	...	....	....	....	....	One of the best keepers. Color is not attractive.
Sandy Glass	41	4	2	6	—	—	An autumn variety. Soft and worthless after January 1.
Shiawasse	33	..	....	3	4	2	Excellent in form and texture through the season. Begins to lose flavor by February 1.
Stark	44	..	....	....	....	....	Firm and in excellent condition at close of test.
Striped Winter	20	5	4	—	—	—	Soft and worthless after Jan. 1.

Variety.	Whole number specimens.	Number Decayed.					Remarks.
		November 19.	December 18.	January 22.	March 1.	March 22.	
Talman..........	47	....	...	....	2	1	Begins to shrivel in March.
Thompson No. 24	44	4	9	6	—	—	Limit reached about Jan. 1.
Thompson No. 26........	17	1	1	1	....	2	Keeps till April but begins to lose flavor by February 1.
Thompson No. 34.........	29	18	4	—	—	—	An early fall variety.
Walbridge.......	67	....	1	....	1	3	Keeps well but of poor quality.
Westfield	24	...	1	...	....	2	One of the best.
Winesap.....	62	...	....	....	1	2	Shrivels some, but retains flavor till spring.

An examination of the above table reveals some interesting facts concerning the varieties named. Dudley, Haas, and most of the Russian varieties are comparatively poor keepers and should be used before January. Borsdorf, Longfield, Pewaukee, Porter and Shiawassee, are at their best before the first of February, though keeping well into March. Hurlbut, Milding and Munson Sweet, begin to break down in March; the latter is in good condition from October to this date. Arctic, Bethel, Boiken, Mann, Northwestern Greening, Rall's Janet, Stark, Westfield, and Winesap are in prime condition up to April 1. Munson Sweet, Porter and Shiawassee showed most surprising results and indicate that with care these sorts may be kept much longer than is generally supposed. Peter, which became too soft for market in January, made very good pies as late as the end of March.

THE GRASS THRIPS (*Anaphothrips striata,* Osborn.)

LEWIS R. CARY.

Although the grass thrips is of much and growing economic importance, not only in this State, but in nearly all New England, it has received but little attention in this country, either from the structural or economic standpoint. Only one publication bearing upon the economic importance has been found.*

In 1880 Prof. Herbert Osborn published the description of a species of thrips under the name of *Thrips striata,* which he said caused considerable damage to the grass crop in the eastern states.

In Prof. Comstock's Introduction to the Study of Insects, which appeared in 1882, a species of thrips is described under the name of *Limothrips poaphagus.* This was reported as doing great damage to the early maturing grasses, especially June grass, *Poa pratensis.* Specimens of both of these forms sent to the Bureau of Entomology of the Department of Agriculture for identification were referred to the genus *Anaphothrips.* The specific name *striata,* given by Prof. Osborn, was retained on account of priority.

Before the question of the scientific name of the insect had been finally settled, it was the common custom to speak of it as the "grass thrips," and that name is still commonly applied to it except in strictly scientific writings.

DESCRIPTION.

A large proportion of the maturer insects are females. They vary in length from one millimeter to one and one-half millimeters and are of two forms, winged and wingless. Both forms are comparatively long and slender and taper toward each end from the region of the thorax.

* Fernald and Hinds. The Grass Thrips. Treatment for Thrips in Greenhouses Bul. 67, May, 1900. Hatch Exp. Sta., Mass. Agr. College.

The winged forms are larger than the wingless ones, brown in color, and have two pairs of long slender wings, each of which is reduced to a narrow piece, having two or three short veins, and bearing on its edges two rows of fine hairs, fig. 6, hw and fw. The hairs are placed so that the upper row on each wing crosses the lower row at an acute angle and, when the wings are extended, the hairs on the posterior edge of the fore wing overlap those on the anterior edge of the hind wing. This gives practically the same resistance as if the wings were entire. When the wings are folded they lie along the dorsal wall of the abdomen, nearly its entire length, with the anterior above the posterior pair. Their extremities are bent so that the ends of the wings on each side of the body turn away from each other.

In the wingless forms the wings may be entirely wanting, or they may be represented by small protuberances, fig. 5, wp. This form is light pink in color, and is covered with a thin soft integument. The head is small and tapers toward its anterior end. It bears two small compound eyes and three ocelli. The antennæ are placed on the extreme anterior part of the head, very near to the median line. They are about .2 mm. in length, and each is made up of eight joints. The basal joint is short and stout. The next three joints are flask shaped, the anterior enlarged end of each surrounding the neck of the succeeding joint. The fifth joint is smaller than any of the preceding. The sixth, seventh and eighth joints are fused into one long piece, the sixth being much the longest of these three joints. At the anterior end of each joint, around the rim of the cup, there is a row of rather short stiff spines. There are also a variable number of spines scattered over the surfaces of the several joints.

The mouth is situated on the ventral side of the head and, on account of the arrangement of the mouth parts, is placed so far posteriorly that it opens at a point posterior to the junction of the head and prothorax, fig. 14, mp.

The prothorax, figs. 6 and 14, is short, a little wider than the head, and nearly square in outline as viewed from the dorsal side. The ventral is very much shorter than the dorsal surface, as the head extends farther posteriorly on the ventral than on the dorsal surface, (see fig. 14). It bears along its sides a number of spines, and a few very short spines are scattered over the dorsal surface.

The mesothorax, figs. 6 and 14, msth, is, in the adult, about twice as long as either of the other thoracic somites. In the larva and pupa it is not proportionately so long. It is shaped like a barrel, except that it is thinner dorsoventrally at its anterior end. In the winged form it bears the wings, and in the wingless forms it is either smooth or bears the rudimentary wings. In the former its dorsal surface is broken up into a number of plates which allow for the movement of the wings.

The metathorax, figs. 6 and 14, mtth, is narrow in front and broadens out behind to join the abdomen. On its dorsal surface it has the appearance of being an abdominal rather than a thoracic somite.

Each of the three thoracic somites bears a pair of legs that have the usual number of joints. All of the joints, except the coxa and tarsus, are flattened laterally, fig. 16. The tarsus has at its extremity, in place of the usual claws, a bladder shaped organ, fig. 16, at the sides of which there are two small rudimentary organs that many entomologists interpret as being tarsal claws. The bladder is supposed to represent modified pulvilli.

The anterior pair of legs are quite short and stout, and are attached near the anterior part of the somite. The second pair of legs are somewhat longer and are attached to the posterior part of their somite. The third pair of legs are much the longest and slimmest of the three pairs. They are attached to the anterior part of the somite.

The abdomen is made up of eight somites. It tapers gradually from before backward, the last somite being quite slender. The first five somites are nearly alike in shape. The sixth somite is wedge shaped with its broad end placed on the dorsal surface and its edge on the ventral surface, fig. 14.

The ovipositor is attached at the junction of the sixth and seventh abdominal somites and when not in use fits into a small groove on the ventral surfaces of the seventh and eighth somites. It is made up of four valves, fig. 14, ovp, which are united so as to leave a groove on the dorsal surface, down which the eggs pass at the time of oviposition. The three angles of the ovipositor are sharply serrate, so that it will hold, while being worked into the tissues of the plant.

The males of this species, fig. 3, are not very frequently found, and it is thought that the majority of the females lay parthenogenetic eggs. The males are not as slender as the females, and they differ from them somewhat in the position and shape of parts. The eyes are placed more dorsally. The prothorax is large, and has a pair of large spines at its posterior angle on each side. The mesothorax is short, and as seen from the dorsal surface, is nearly round in outline. The small metathorax has its line of junction with the mesothorax semicircular, and its posterior outline straight. The abdomen is quite narrow in front and grows gradually wider posteriorly as far as the fourth somite. From this point it tapers gradually to the posterior end of the body. The last somite is modified to form the male copulatory apparatus. This somite bears two pairs of large, long spines.

LIFE HISTORY.

The adult insects pass the winter months in the dead vegetation at the bases of their host plants, very close to or on the ground, where they are protected by the debris. In the spring as soon as the weather has become sufficiently warm to start the grass, they come out from their winter quarters and begin to lay eggs in the tender leaves of the young grass. The eggs are deposited in the tissues of the blades near their upper surfaces. Fernald and Hind* determined by keeping insects in captivity that each female is capable of laying from fifty to sixty eggs. The first eggs laid hatch in from twelve to fifteen days. Later in the season the time required is materially reduced. In the hot dry periods of the summer they may hatch in a week.

When the larvæ are hatched they seek some sheltered place in which to pass the next stages of their development. At this period of their development they are most frequently found in the sheaths of the blades, especially those of the young stalks, near the ground. In the later stages they sometimes congregate in the upper sheaths of the stem, and then they cause the "silver top," which is the most conspicuous evidence of their work.

The larvæ, especially in the later stages, are quite active, running about the leaves inside of the sheath or even on the head, among the flowers. The pupal stage is passed in some quiet

* The Grass Thrips. Bul. 67, May, 1900. Hatch Exp. Sta., Mass. Agr. College.

place, as at the base of the sheath of some lower leaf. In this stage the insect takes no food and moves only very sluggishly.

In the early spring months a large proportion of the females produced are of the winged form. They fly about and infest new fields, so that in a very short time a large area may become badly infested with the insects. As the season advances the number of the winged forms becomes less, until in the latter part of the season, September or October, there are very few of the winged form, among all those produced.

LARVA.

The larva, fig. 1, resembles the adult in shape and color but is smaller. Compared with the adult, the head of the larva is small, the antennæ short, and there is not as much difference in the size and shape of the thoracic somites. There are very few spines on the body, a tuft on each of the last two abdominal somites being the only conspicuous ones.

PUPA.

The pupa, fig. 2, (last larval stage) has a very distinctive appearance. It is encased in an external covering, probably the last moulting case, which disguises the form of the insect to a great extent. The head is about the same shape as in the larva. The antennæ are bent back so that they lie upon the dorsal surface of the head and prothorax, and their covering shows neither joints or spines. The prothorax is shaped like that of the adult. The mesothorax is long and bears on its dorsal surface a pair of wing cases, which in the pupæ of the winged forms extend posteriorly nearly the length of the abdomen. In the pupæ of the wingless forms the wing cases are very short.

MOUTH PARTS.

Fig. 4.

The mouth parts of the Thysanoptera differ very much from those of the other orders of insects. They have, in part, the characteristics of the biting insects, and in part, those of the sucking forms. If we accept the old interpretation, and consider the piercing setæ mandibles, the typical mouth parts are all represented and are not much fused.

The labrum is triangular in shape, but quite unsymmetrical. It is longer on the right than on the left side, the greater part of the attachment of the base of the labrum being on the right side of the median line of the head.

The parts which have been described by most American writers as mandibles are slender bristle-like spines, each of which has an enlargement at its upper end. They are situated inside of the mouth, and when in use extend through the oral aperture. Sections of the head clearly show, as has been mentioned by Garman,* that the upper broad ends of these parts are joined to the maxillæ by a short round basal piece. There is a distinct joint between these two parts.

The maxillæ are elongated, triangular in shape, and placed so that they form the lateral borders of the mouth. Near their middle point there is a three-jointed palp.

The labrum is made up of two thickened portions which lie at the side of the mouth below the maxillæ, and a third ventral portion connecting the thickened parts. It bears on its lower third a pair of three-jointed palps. The palps bear spines on the distal end of each joint.

On the left side of the head there is a single unpaired organ, shaped somewhat like one of the piercing setæ, only it is stouter and has the upper portion much thicker. There is nothing on the right side of the head to correspond to this organ except, in some cases a small papilla.

Inasmuch as the piercing setæ are composed of two portions united by a joint, they are not homologous with the mandibles of other Hexopoda, which are in all cases composed of a single piece. They should rather be regarded as specialized lobes of the maxillæ.

The unpaired organ has been interpreted by some writers as an epipharynx which has been shifted to one side. Others consider it to be the left mandible, the right mandible being wanting or rudimentary.

Considering the modification of the parts, and the apparent deficiency of the right side of the head, it would seem that the latter is the most reasonable interpretation.

* Garman, H.—The assymetry of the Mouth-parts of the Thysanoptera, American Naturalist, Vol. XXX, July, 1896.

DIGESTIVE SYSTEM AND ACCESSORY GLANDS.

Fig. 7.

The alimentary canal is small and short. It is only about one and one-half times the length of the body.

The mouth is little more than a narrow tube through which the setæ project. At its upper end it widens out and joins the pharynx, which runs anteriorly for a short distance, then turns sharply back, and joins the œsophagus. The œsophagus is very narrow and has an exceedingly small lumen. It passes backward over the anterior end of the first thoracic ganglion, and runs back to the middle of the mesothorax, where it joins the mid-intestine.

The mid-intestine is the longest part of the canal. It is separated by three constrictions into four divisions. The first and second divisions of the mid-intestines are of about equal length and together they extend from the mesothorax to the fifth abdominal somite, where they join the third division. At this point there is a sharp turn and the third division runs anteriorly as far as the anterior part of the third abdominal somite. Here, again, there is another turn, and the fourth division runs posteriorly as far as the sixth abdominal somite, where it joins the hind-intestine. At this point the malpighian tubules enter the intestine.

The hind-intestine is small and somewhat convoluted. It shows no division into ileum and colon. At the posterior end it is enlarged to form the rectum.

The mouth and pharynx have a chitinous lining which is quite thick. The anterior part of the œsophagus also has a thin, flexible, chitinous lining. The outer walls of the œsophagus are very thin and delicate and have very few muscle fibers.

The walls of the mid-intestine are much thicker, and are composed of several layers. On the inside is the lining membrane, the cuticula. Just outside of this, with their apices projecting into the lumen of the intestine, is a layer of large pyramidal epithelial cells. These cells are imbedded in a basement membrane of connective tissue, outside of which there are two layers of muscle fibers, one circular and the other longitudinal. Outside of these there is a thin membranous covering.

The epithelial cells in the first two divisions of the mid-intestine are especially active as secreting cells. Part of them are filled with granules that are suspended in the protoplasm of the cell, and others are quite free from these granules. In the posterior divisions of the mid-intestine the epithelial cells are not so large or high, but the arrangement of tissues is the same.

In the hind-intestine the cuticula is very thick and the epithelial cells are small and rather flat. The three inner layers of the hind-intestine are thrown up into folds which are not very noticeable in the anterior part, but are larger in the posterior part. In the rectum the folds are very large and form the so-called rectal glands. On the outside, in the depressions between these ridges, there are six bands of longitudinal muscle fibers. The rectum is larger than the rest of the hind-intestine, and has thick muscular walls. The rectal glands probably have no function as glands but are thought to be of use in closing the intestine.

SALIVARY GLANDS.

The salivary glands, fig. 7, sg, are two in number. They are situated in the dorsal region of the anterior part of the mesothorax, just in front of the anterior end of the mid-intestine, and dorsal to the œsophagus. The glands are ovate in shape and at their anterior ends give rise to a pair of small ducts which soon unite to form a single median duct. This runs forward, just dorsal to the œsophagus, and opens into the mouth near the oral aperture. The glands are made up of a small number of large cells, which are imbedded in a basement membrane of connective tissue. The cells have large prominent nuclei, and may be seen in different stages of secretion. Some are filled with granules and others have the cell contents free from granules. The lumen of the gland is small and irregular.

The fluid secreted by these glands would seem, from the position of the opening of the duct, to have little digestive function, but rather to serve as a lubricant for the mouth parts.

EXCRETORY SYSTEM.

The excretory apparatus consists of four large malpighian tubules, fig. 7, mt, which open into the intestine at the junction of the mid- and hind-intestine and extend as far anteriorly as the first abdominal somite. They lie in the abdomen without any definite arrangement, occupying the spaces between the other organs and are richly supplied with trachee.

Each tubule is composed of large cells with prominent nuclei, that are so placed that they give it a spiral appearance. A transverse section shows from five to seven cells around the lumen of the tubule.

MUSCULAR SYSTEM.

Fig. 8.

The muscular system corresponds in its general arrangement to the segmented structure of the body; that is, most of the muscles are arranged inter-segmentally. The typical arrangement is shown in any of the anterior abdominal somites. When a transverse section is taken across one of these somites, fig. 13, four longitudinal rows, each composed of five muscles, are seen. The four rows are placed so that there are two on the dorsal and two on the ventral side.

The ends of these muscles are attached by a sort of tendon to the infolding of the integument between each two somites. In the last abdominal somite the posterior ends of the longitudinal muscles are attached to ridges in the integument. These muscles are bellied so that they are thicker in the middle than at the ends, and each is nearly square in cross section. The longitudinal muscles of the abdomen are all arranged on this plan. By this arrangement one end of the muscles of two somites being attached at practically the same point, it is possible to bring the fulcrum for any movement of the abdomen to the joint between any two somites, the combined action of the muscles of the somites anterior to this point keeping the anterior part of the abdomen rigid. The abdomen may be bent in practically any direction by means of the longitudinal bands of muscles, which may be contracted individually or in combinations, throughout the length of the abdomen, or in any part of it.

Near the middle of each abdominal somite there is, on either side, a pair of muscles which run from the dorsal to the ventral surface, fig. 8, stm. These provide for a dorso-ventral contraction of the abdomen, which is of service in respiration.

In the sixth and seventh abdominal somites there is, in addition to the typical muscles already mentioned, a set of muscles which have to do with the movements of the ovipositor. These muscles are eight in number, four on either side of the median line. They are attached at their ventral ends to the ovipositor, and run dorsally and somewhat laterally around the intestine to be attached to the dorsal wall of the abdomen. When these muscles are contracted they bring the ovipositor out from its position in the groove on the seventh and eighth abdominal somites, where it lies when not in use, to the position in which it is used in depositing eggs. In this position it is placed at an angle of about thirty degrees with the abdomen.

In the thorax the segmental arrangement of the muscles is greatly modified. On the dorsal side there are two rows of longitudinal muscles like those of the abdomen. On the median dorsal line of the mesothorax four muscles are attached. One pair of these muscles runs anteriorly and laterally and is attached to the ventral wall of the prothorax just posterior to the anterior legs. The other pair passes posteriorly and laterally and is attached just posterior to the hind legs. The arrangement of these muscles is such that when they are viewed from the dorsal side they form a cross the four extremities of which are attached to the ventral surface.

Attached to the fold of the integument that lies between the abdomen and metathorax, with their posterior ends overlapping the ventral ends of the posterior pair just mentioned, is another pair of muscles. These converge as they run forward, and are attached to a prominence on the floor of the metathorax near its anterior end. Between the posterior ends of these two sets of muscles another pair of muscles is attached. These diverge as they run forward, and are attached at the bases of the third pair of legs. From this point they converge and at the anterior end of the somite they are attached to the fold of integument between the meta- and mesothorax. Another pair of muscles is attached to the floor of the metathorax; they diverge as they run forward and are attached at the bases of the legs in the mesothorax. From this point they converge and are attached together on the floor of the posterior part of the prothorax.

In the prothorax there is a pair of muscles that has the same arrangement as the muscles last described, being attached at their posterior ends to the fold of integument between the pro- and meso-thorax and running forward to the head. These also are attached near the bases of the legs in their somite. Another pair, attached by a single head in the posterior part of this somite, diverge as they run forward, and are attached to the integumental fold between the head and prothorax. In the anterior part of this somite there are, on each side, three muscles which are attached at their ventral ends to the thorax, and at their dorsal ends to the head. In the posterior part of the head there are six muscles that are attached at their dorsal ends to the thorax and at their ventral ends to the head. These two sets of muscles cross one another at their middle points. The muscles that have to do with the movements of the mouth parts are situated in the anterior part of the head, on its ventral wall. A part of these muscles run anteriorly and dorsally to be attached to the front part of the head. The remainder run dorsally to be attached to the dorsal wall of the head.

Each leg is supplied with four muscles. One of these muscles lies along the floor of the thorax, and is attached at one end to a median ridge of the integument, and at the other end to the fold between the coxa and trochanter. This muscle serves as the flexor of the coxa. The other thoracic muscles of each leg are really the three heads of one muscle, the extensor of the coxa. These muscles are attached to the integument on the dorsal walls of the thoracic somites and at the other end to the integumental fold between the coxa and trochanter. The muscles in the next two joints of the leg (trochanter and femur) are arranged in much the same way, one of them acting as a flexor and the others as extensor. They are attached intersegmentally. In the next joint (tibia) there are only two muscles, one flexor and one extensor. Both of these muscles are continued into the tarsus by tendons. The tarsus has no muscles of its own.

In the winged forms there are, in the thorax, the muscles for the movement of the wings. These consist of two series on each side, one of which elevates and the other depresses the wings. Each series is made up of several muscles. There are two elevators and four depressors. Of these there is in each series, a single muscle that is much larger than the others and that does the greater part of the work in flight. The others serve to keep the wings in their proper position. All of these muscles are attached at one end to the ventral wall of the thorax, and at the other to the wings. The elevators are attached inside, and the depressors outside of the point which serves as the fulcrum for the movements of the wings.

NERVOUS SYSTEM.

Figs. 7 and 9.

The central nervous system is concentrated. It consists of five ganglia (morphologically pairs of ganglia), and a single large median nerve cord which passes from the posterior end of the fifth ganglion to the posterior part of the abdomen.

The cerebral ganglion, fig. 7, cg, is large and flat. It is divided superficially into halves by a cleft which is deep in front but shallow on the dorsal and ventral surfaces. Each half of the ganglion is pointed at its anterior end. The optic tracts pass out from the ganglion just posterior to these prominences. There is a slight constriction where they join the ganglion. Just posterior to the optic tract, there is on either side, a prominent swelling, the antennal lobe, from the ventral sides of which the antennal nerves pass anteriorly to the base of the antennæ. The posterior part of the ganglion is narrower and thinner than the anterior part and is continued posteriorly over the anterior end of the first ventral ganglion and the œsophagus.

The surface of the first ventral ganglion clearly indicates that it is formed by the fusion of two ganglia, the infraœsophageal and the first thoracic. A well marked constriction separates the two. The nerves which supply the mouth parts are all given off from the anterior part of the ganglion. The nerves to the first pair of legs, as well as those of the muscles and other organs of the prothorax are given off from the posterior part of the ganglion. The nerves which go to the legs are very large, and pass from the side of the ganglion, obliquely to the bases of the legs.

The second thoracic ganglion is connected with the first by a broad commissure. It is much smaller than the first, nearly circular in outline and lies in the anterior part of the mesothorax. The nerves which go to the middle legs are given off from its posterior part. These nerves come from the under side of the ganglion and run obliquely backward to the bases of the legs.

The third thoracic ganglion is small, nearly round in outline, and is connected with the second by a very short broad commissure. It lies in the extreme posterior part of the mesothorax, and sends a large nerve obliquely backward to each of the legs that are attached to the metathorax.

The fourth ganglion is the largest of any in the ventral chain, and compared with them it is long and narrow. It lies partly in the metathorax and partly in the abdomen, and is connected with the third thoracic ganglion by a long slender commissure. It gives off nerves to the organs of the somites which it occupies, and is connected with the somites lying posterior to it, by the long nerve cord passing from its posterior end.

The cord which passes from the fourth ventral ganglion, runs posteriorly to the sixth abdominal somite, where it breaks up into a number of nerve fibers. These supply the reproductive organs, the special muscles of the reproductive organs, and the other organs and muscles in the last two somites of the abdomen.

All of the ganglia correspond very closely in their minute structure. Each ganglion is enclosed in two delicate membranes. Beneath these membranes there is a layer, of varying thickness, made up of large nerve cells, which stain deeply. This layer of nerve cells is thickest at a point a little way from either end. Between these thickened portions the layer of nerve cells is much thinner, and it is entirely wanting where the ganglion narrows down to form the commissure. The nerve cells are pear shaped and a single nerve fiber passes from the smaller end of each cell.

The central part of the ganglion is made up of fibers that run, for the most part longitudinally, except where some large nerve is given off. The commissures are composed entirely of nerve fibers, together with the two envelopes that surround them. The cord which passes from the fourth ventral ganglion is composed entirely of nerve fibers.

EYES.

The compound eyes, fig. 14, ei, are comparatively small, (about .06 mm. in diameter), placed on the sides of the head just back of the antennæ, and nearly circular in outline. Each eye is made up of from one hundred to one hundred and twenty facets. The facets in the two eyes of an individual may differ in number from ten to fifteen. Each facet is irregular in outline, but approximately circular and is strongly convex on the surface, so that the exterior of the eye has a roughened appearance. The facets near the center of the eye are larger than those near the outside. Those at the center are seven microns in diameter, while those at the outside range from five to six microns in diameter.

The eyes are deeply colored with a dark brown pigment, which makes them very conspicuous. The ocelli, three in number, are placed between the compound eyes on the dorsal surface of the head, and are arranged in the form of a triangle. The anterior median ocellus is about seven microns in diameter and each posterior ocellus is about ten microns in diameter. They are not very conspicuous, as they have little pigment and are not raised much above the surrounding parts.

REPRODUCTIVE SYSTEM.

Fig. 7.

The reproductive apparatus of the female insect consists of two ovaries, each of which is made up of five ovarian tubes. Each ovarian tube is divided into three sections. First; the terminal thread, at the anterior end, by which that end of the ovary is attached to the dorsal wall of the abdomen. These threads all run together to form a single thread on each side. Second; the terminal chamber, which contains undifferentiated cell elements which give rise to the eggs. Third; the actual ovarian tubes, the chambered part of which contains the eggs.

The ovarian tubes are long and slender and extend from the fifth to the first abdominal somite. They contain no chambers of nutritive matter. At the posterior end of the ovaries there is, on each side, a very short oviduct, which soon unites with its fellow to form the common oviduct, fig. 7, ovd. This extends from the fifth to the junction between the sixth and seventh abdominal somites, where it opens to the exterior at the base of the ovipositor. There is no well marked receptaculum seminalis or accessory sac. The walls of the ovaries are thin, and are made up mostly of connective tissue. The walls of the oviduct are much thicker and well supplied with muscle fibers.

The largest eggs in the lower chambers are about .15 mm. in length and .06 mm. in thickness. They are deeply concave on the surface that is turned toward the median line of the body, and are covered with a strong membrane.

CIRCULATORY SYSTEM.

The circulatory system consists of a contractile dorsal vessel, the heart, which begins in the sixth abdominal somite and passes forward into the thorax. Here it gives rise to the aorta, which runs forward, ventral to the salivary glands to the head. The heart is very small and lies just below the dorsal wall above the intestine. In almost all of the specimens examined it was so badly collapsed that it was scarcely visible. Its walls are exceedingly thin and have very few muscle fibers. The alary muscles are very poorly developed. Four pairs of ostia were found; these were in the third, fourth, fifth and sixth abdominal somites.

RESPIRATORY SYSTEM.

Figs. 14 and 15.

There are three pairs of stigmata, one at the anterior end of the mesothorax, and one each on the first and seventh abdominal somites. The stigmata are quite large, and have a sieve-like covering to prevent the ingress of solid particles. From the stigmata on the mesothorax tracheæ are supplied to the head and its appendages, to the prothorax and fore limbs, and to the organs and appendages of the meso- and metathorax. The two stigmata on each side of the abdomen are connected by a large tracheal trunk, which runs along the abdomen near its lateral wall. From these trunks three branches are given off in each of the six anterior abdominal somites. One of these branches supplies the dorsal part of the somite, another the ventral part of the somite, and a third passes nearly straight into the body, going chiefly to the viscera. The two posterior somites of the abdomen are supplied by long tracheal branches which come from the stigmata on the seventh abdominal somite. The tracheæ are very small and thin walled, and the walls have a chitinous lining that shows spiral markings. They are supplied to the viscera very abundantly, and serve the double purpose of respiration and to keep the viscera in place.

FAT BODY.

The fat body is large in all stages of development. In the larva it fills all of the space between the viscera. It is made up of a frame-work of large cells, each of which contains a large drop-let of fatty matter. In the older stages the most of the fatty matter has been absorbed, but the cells still persist.

HABITS.

The insects usually live in some part of the grass plant where they are protected from any disturbance. When a sheath is torn down so as to disturb them, they begin to run about seeking some place in which to hide themselves. If they are unsuccessful in their search, they remain practically still and bend up the abdomen as if ready to sting the intruder.

In the act of egg laying the female arches the body so as to bring her weight to bear upon the ovipositor, which is slowly worked down through the surface of the leaf into the underlying tissue. The egg is then passed down the groove on the surface of the ovipositor and lodged just beneath the epidermis of the leaf. This process takes about one and a half minutes for its completion. After an egg has been deposited, the insect moves off and begins to feed. It frequently happens that the serrated edges of the ovipositor become so firmly fastened in the tissues of the plant that the insect is unable to free itself and finally dies.

The insect attacks a number of the common grasses during the season, but in the early months its ravages are mostly confined to the June grass, *Poa pratensis,* on which the results of its work are the most manifest. As the season advances it is found quite abundantly in timothy, *Phleum pratense,* and on several species of Panicum, Agrostis, and Festuca.

For treatment see page 82.

REFERENCE LETTERS.

ab abdomen.
abg abdominal ganglion.
ant antennæ.
antn antennal nerve.
cg cerebral ganglion.
cox coxa.
ei eye.
fbc cells of the fat body.
fem femur.
fl fore leg.
fw fore wing.
hd head.
hi hind-intestine.
hl hind leg.
ht heart.
hw hind wing.
hyp hypodermis.
ism intersegmental muscles.
lbm labium.
lhr labrum.
lm muscles of the legs.
ln nerves of the legs.
lp labial palp.
mi mid-intestine.
ml middle leg.
mp mouth parts.
mpm muscles of the mouth parts.
msth mesothorax.
mt malpighian tubules.
mtth metathorax.
mx maxilla.
mxp maxillary palp.
nc nerve cord.
oes œsophagus.
ov ovary.
ovd oviduct.
ovp ovipositor.
ovpm muscles of the ovipositor.
ovt ovarian tubes.
prth prothorax.
ps piercing setæ.
rg rectal glands.
sd salivary duct.
sg salivary gland.
st stigma.
stm sterno-tergal muscles.
tars tarsus.
thor 1 first thoracic ganglion.
thor 2 second thoracic ganglion.
thor 3 third thoracic ganglion.
tib tibia.
tr tracheæ.
troch trochanter.
trt tracheal trunk.
wc wing case.
wp rudimentary wing.

PLATE I.

Fig. 1. Larva.

Fig. 2. Pupa.

Fig. 3. Adult male.

Fig. 4. Anterior surface of head reconstructed to show the mouth parts in position.

See page 67 for reference letters.

PLATE I.

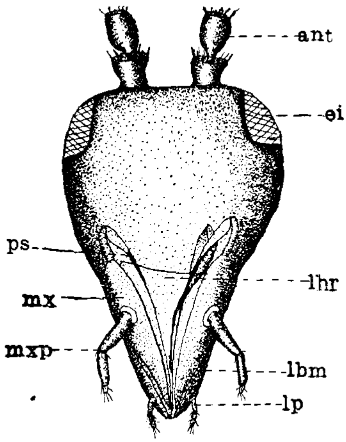


FIG. 4.

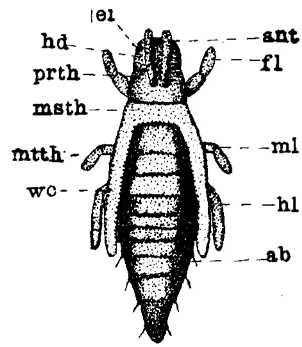


FIG 2.

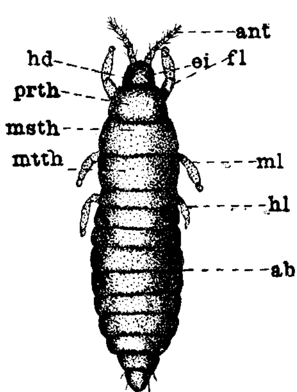


FIG. 1.

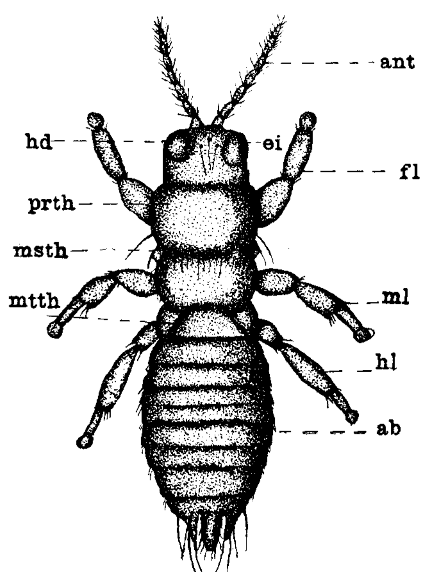


FIG. 3.

PLATE II.

Fig. 5. Adult wingless female.

Fig. 6. Adult winged female.

See page 67 for reference letters.

PLATE II.

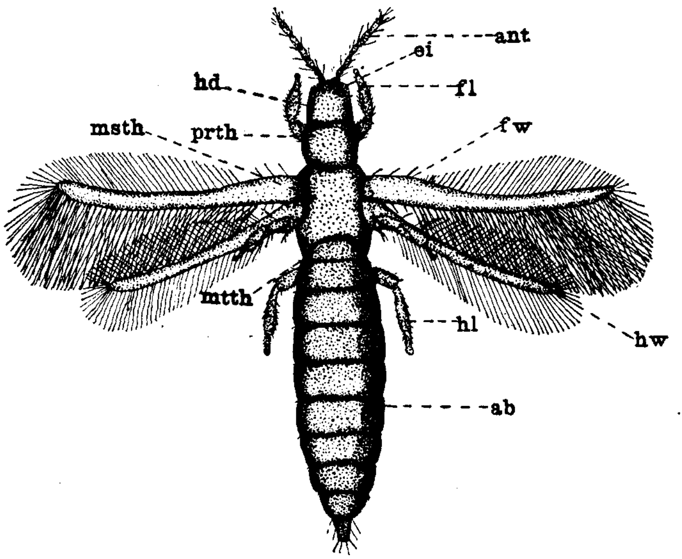


FIG. 6.

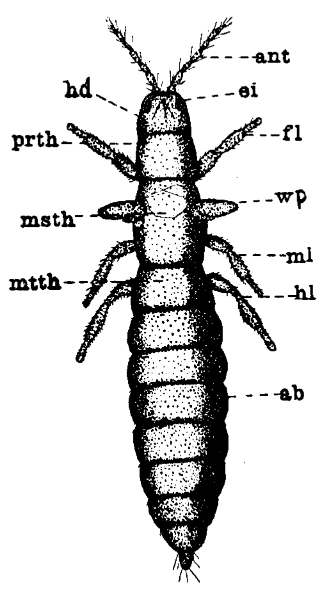


FIG 5.

PLATE III.

Fig. 7. Adult wingless female with the dorsal part of the body removed.

See page 67 for reference letters.

PLATE II

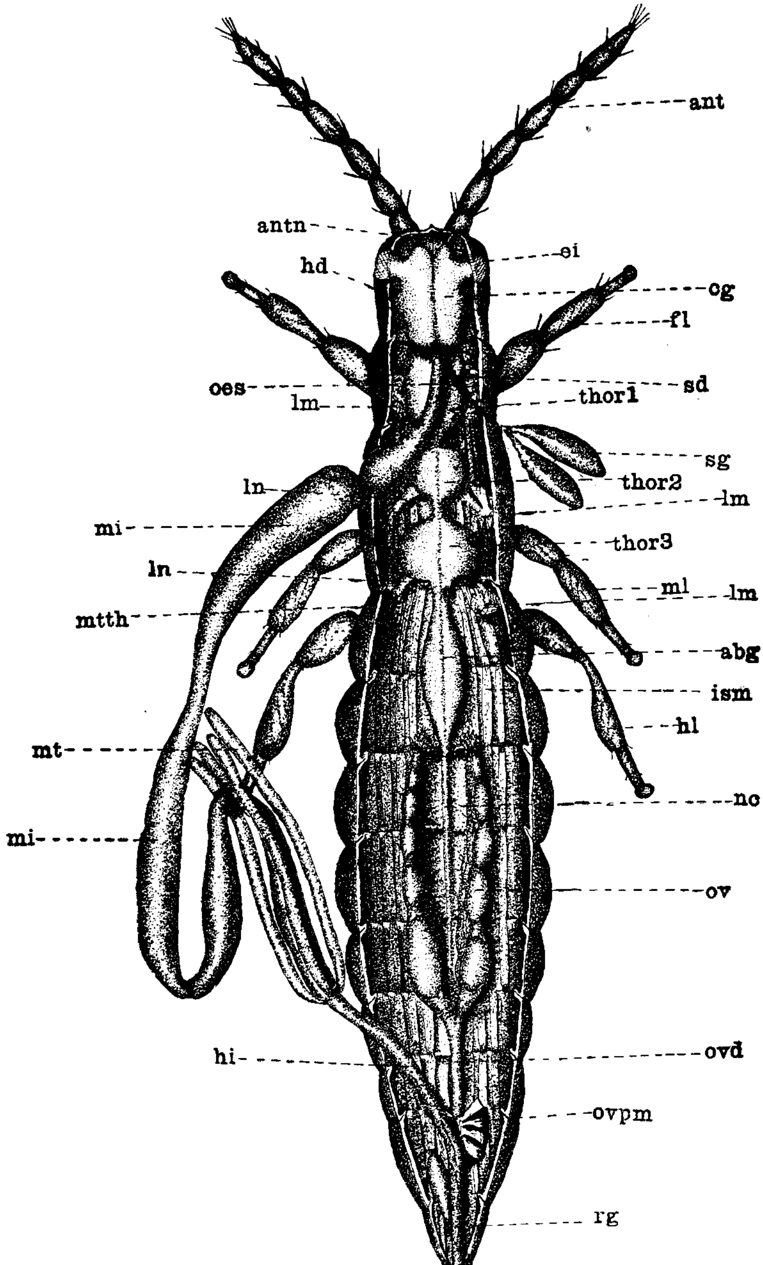


FIG. 7.

PLATE IV.

Fig. 8. Ventral wall of an adult insect showing the arrangement of ventral muscles.

See page 67 for reference letters.

PLATE IV.

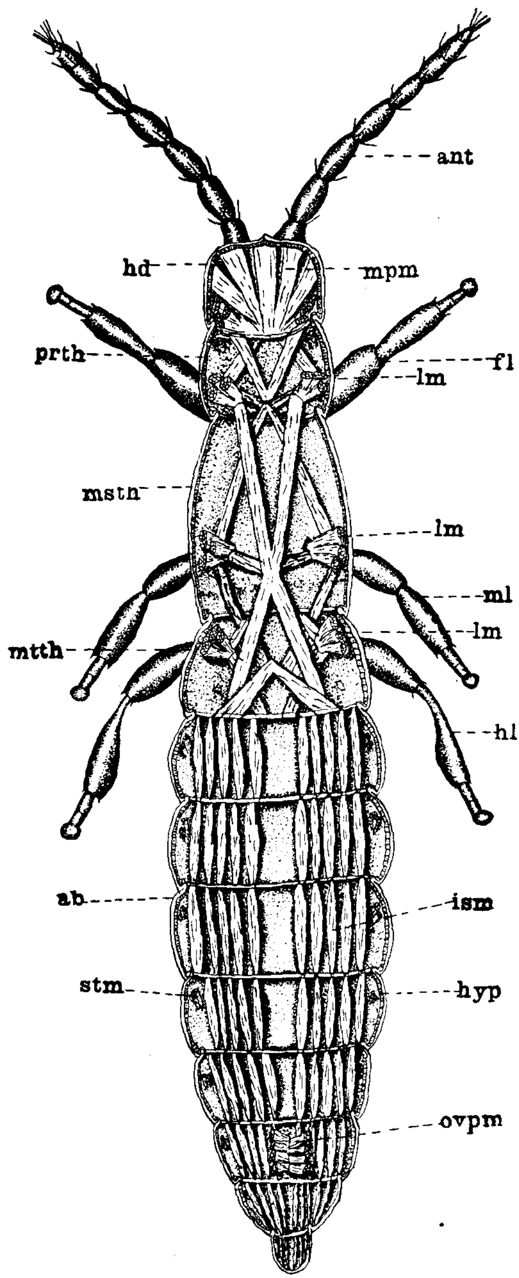


PLATE V.

Fig. 9. Sagittal section through the median plane of the body showing the arrangement of the ganglia.

Fig. 10. Sagittal section through a pupa a little to one side of the median line showing the attachment of the intersegmental muscles.

See page 67 for reference letters.

PLATE V.

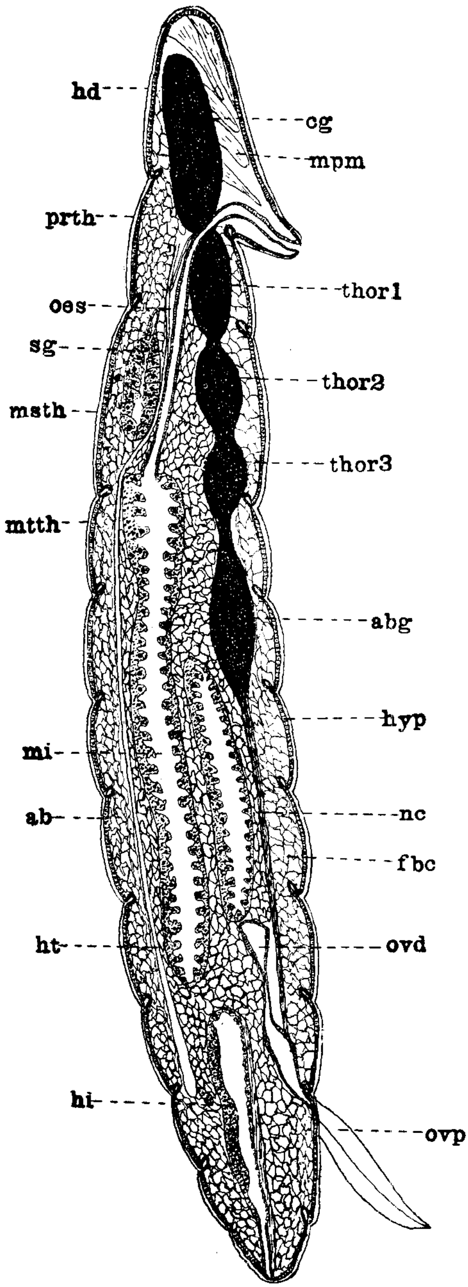


FIG. 9.

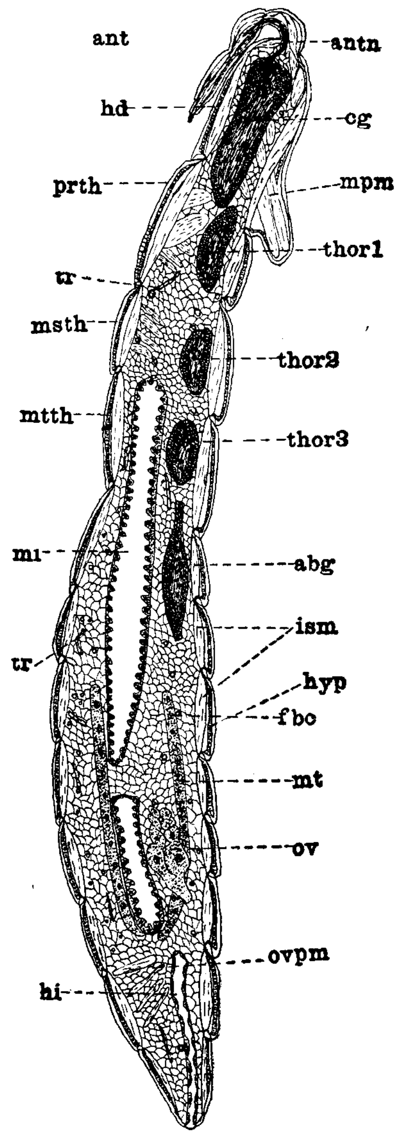


FIG 10.

PLATE VI.

Fig. 11. Transverse section through the posterior part of the head of a wingless adult female.

Fig. 12. Transverse section through the posterior part of the first thoracic ganglion.

Fig. 13. Transverse section through the fourth abdominal somite of a winged adult female.

See page 67 for reference letters.

PLATE VI.

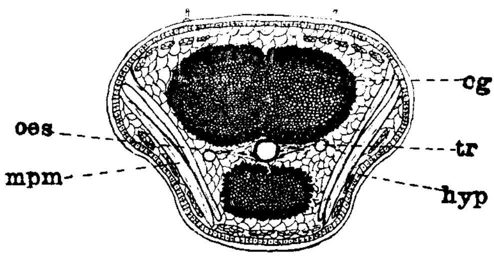


FIG. 11.

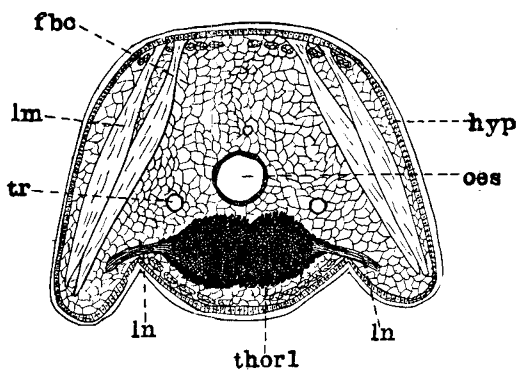


FIG. 12.

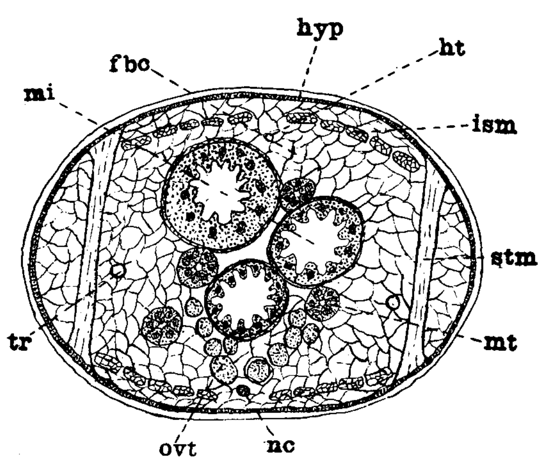


FIG. 13.

PLATE VII.

Fig. 14. Tracheal system of a wingless adult female (somewhat diagrammatic).

Fig. 15. Diagram of the distribution of the tracheæ in a typical abdominal somite.

Fig. 16. Fore leg of an adult wingless female.

See page 67 for reference letters.

PLATE VII.

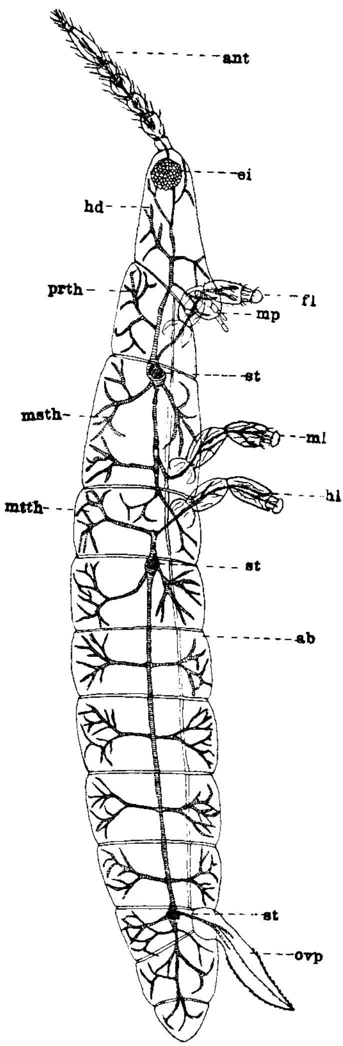


FIG. 14.

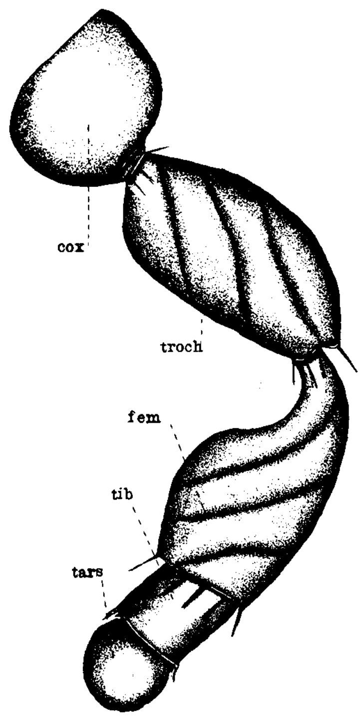


FIG. 16.

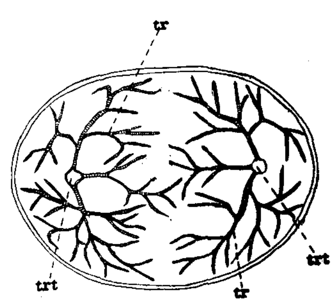


FIG. 15.

TREATMENT.

As the thrips feeds by sucking the juices of the plants, contact poisons, as kerosene emulsion, or whale oil soap, are the only ones which are of use in combating it.

Where only a small area is infested, one of the insecticides just mentioned or even a liberal application of water will prove successful in controlling the pest. When a large area is infested, the application of an insecticide is not feasible on account of the expense of materials and application. In such a case the burning of the dead stalks after the ground has frozen in the fall, so as to secure a close burn, without injuring the roots of the grass, may prove successful. With badly run out fields, which are the ones most likely to be badly infested, the best remedy is deep plowing in the fall or in the early spring before the grass has started. If this is followed by thorough cultivation, none of the insects will be able to make their way to the surface of the ground.

CEREAL BREAKFAST FOODS.

L. H. MERRILL and E. R. MANSFIELD.

Three years ago a bulletin was issued from this Station containing the analyses of about 40 cereal breakfast foods. The demand for the bulletin proved unexpectedly large and persistent and the edition was soon exhausted. In view of the growing importance of this class of foods it has seemed advisable to issue another bulletin upon the same subject, containing the analyses of those preparations which are found upon the market to-day.

THE CEREAL GRAINS.

Among the vegetable foods best adapted to the wants of man, the cereal grains occupy by far the most prominent place. The methods by which these grains are prepared for our use are so various and the manufactured products so multitudinous that it is difficult to fix the relative food value of the grains themselves. Thus it would be manifestly unwise to generalize upon the relative value of wheat and corn, if we base our conclusions merely upon the chemical composition of a patent flour on the one side, from the wholly decorticated and degerminated kernel, and that of a corn meal on the other side, in which most of the outer coating of the kernel and practically all the germ are left in the finished product. Nevertheless a comparison of the grains from the chemical standpoint is not without interest and is attempted in the following table, which includes all the cereals concerned in this bulletin. Since barley, oats and rice are always decorticated before they are eaten, the analyses of these grains entire are not given.

PERCENTAGE COMPOSITION OF BARLEY, CORN, OATS, RICE AND WHEAT.

	Moisture.	Proteids.	Ether extract.	Crude fiber.	Carbohydrates other than crude fiber.	Ash.
	Per ct.	Per ct.	Pr ct.	Pr ct.	Per ct.	Pr ct.
Barley meal *	14.83	10.89	1.23	0.47	71.85	.63
Barley, pearl *	12.82	7.25	1.15	1.36	76.19	1.23
Corn †	10.75	10.00	4.25	1.75	71.75	1.50
Oats, rolled, 20 analyses ‡	7.70	16.70	7.30	1.30	64.90	2.10
Rice, hulled, unpolished §	12.00	8.00	2.00	1.00	76.00	1.00
Rice, hulled, polished §	12.40	7.50	.40	.40	78.80	.50
Wheat †	10.60	12.25	1.75	2.40	71.25	1.75

* Knight. Food and Its Functions, p. 161.
† Wiley. Foods and Food Adulterants, Bul. 13, part 7, Div. Chem., U. S. Dept Agr., p. 1190.
‡ U. S. Dept. Agr., Office of Expt. Stations, Bul. 28 (Revised), p. 57.
§ Wiley. Foods and Food Adulterants, Bul. 13, part. 9, Div. Chem., pp. 1182-3.

Barley is not very extensively eaten in this country, where its principal use has been in broths and soups. In the so-called barley bread, a considerable proportion of wheat flour is mixed with the barley meal. According to Knight, such bread is usually heavy, rather indigestible, and somewhat laxative. The latter property is shared by many of the coarser cereal preparations and can probably be attributed to the mechanical condition, rather than to the chemical composition of the food. As barley is very generally employed in the manufacture of malt, its presence in the malted foods is to be expected.

Corn from its composition and cheapness deserves a more extended use. Although below wheat and hulled oats in the amount of protein which it contains, it is very rich in fat, ranking next to hulled oats in this respect. As corn meal, the form in which it is generally put upon our markets, it is regarded as less digestible than the other cereal products. This is probably in large part due to its coarse milling and the large amount of bran which it contains. The fat, which is largely confined to the germ, is a source of weakness, since it readily becomes rancid and the meal becomes musty. Hominy and samp, from which the germ has been removed, are free from this objection. An improved method of milling corn is now coming into use by which the kernel is degerminated before being ground, the result being a product of much better keeping qualities.

Oats. The analysis of rolled oats given in the above table may be accepted as representing the composition of the kernel when deprived of its outer woody coating. In this condition their nutritive properties are in excess of those of any other of our common cereals. They contain one-third more protein than wheat and nearly four times as much fat. On the other hand they contain less starch than wheat; but since starch possesses a much lower nutritive value than protein and fat, the oats must be considered the more nutritious.

Rice is the poorest in proteids and ash of the cereals here considered and is correspondingly rich in starch. In China and the East Indies it forms the principal food of the poorer classes and failure of the rice crop would mean famine to at least one-third of the human race. In this country it is more generally cultivated than formerly, but its consumption is still largely in excess of the domestic production.

Wheat is by far the most important of our cereals, since it is the only one of the proteids of which form a true gluten, the peculiar tenacity of which makes a leavened or "raised" bread possible. This property in itself must forever distinguish wheat as the bread-making cereal *par excellence.* Quite aside from this, however, the nutritive value of wheat must place it in the front rank of vegetable foods. In protein content it is excelled only by hulled oats.

COMPOSITION OF CEREAL BREAKFAST FOODS.

During the past few years a large number of cereal breakfast foods has been placed upon the market and the number is constantly increasing.

The composition of many of these goods is given in the tables which follow. In the first two tables, pages 86-7, are summarized the analyses of the brands collected three years ago and reported in Bulletin 55 of this Station. All the other analyses here given are of new samples collected during the past few months, for the most part in Bangor and Portland. The list does not profess to include all the goods then obtainable, though the omissions are probably few.

CEREAL FOODS ANALYZED IN 1899.

Laboratory number.	Name.	Manufacturer.
	CORN PREPARATIONS.	
6230	Crown Flakes	Crown Cereal Company
6231	Hecker's Hominy	Hecker-Jones-Jewell Milling Co
6232	H-O Company's New Process Hominy	The H-O Company
6233	Mazama	Mazama Health Food Company
	UNCOOKED OAT MEALS.	
6234	A Oat Meal	American Cereal Company
6235	C Oat Meal	American Cereal Company
6245	McCann's Finest Oat Meal	John McCann
	COOKED OAT PREPARATIONS.	
6242	Hecker's Oat Meal	
6244	Hornby's H-O Oat Meal	The H-O Company
6236	American Cereal Company's Rolled Oats.	American Cereal Company
6237	American Cereal Company's Rolled Oats	American Cereal Company
6338	Buckeye Rolled Oats	American Cereal Company
6239	Buckeye Rolled Oats	American Cereal Company
6241	Echo White Rolled Oats	Steward & Merriam
6243	Hecker's Rolled White Oats	Hecker-Jones-Jewell Milling Co
6240	Peoria Rolled Oats	Steward & Merriam
6246	Quaker Rolled White Oats	American Cereal Company
6247	Tip Top Rolled Oats	Akron Cereal Company
	WHEAT PREPARATIONS.	
6264	Fruen's Best Wheat Wafers	Fruen Cereal Company
6263	Fruen's Rolled Wheat	Fruen Cereal Company
6254	H-O Company's Breakfast Food	The H-O Company
6256	Old Grist Mill Rolled Wheat	Potter & Wrightington
6258	Pettijohn's Breakfast Food	American Cereal Company
6249	Cream of Wheat	Cream of Wheat Company
6251	Farinose	American Cereal Company
6252	Gould's Wheat Germ Meal	The Fould's Milling Company
6268	Germea	Sperry Flour Company
6250	Hecker's Farina	
6257	Old Plymouth Breakfast Food	Old Plymouth Cereal Company
6259	Pillsbury's Vitos	Pillsbury-Washburn Flour Mills
6260	Ralston Health Club Breakfast Food	Robinson-Danforth Company
6261	Wheatena	Health Food Company
6262	Wheatlet	The Franklin Mills
6265	Shredded Whole Wheat Biscuit	The Cereal Machine Company
	GLUTEN PREPARATIONS.	
6248	Cooked Gluten	Health Food Company
6253	Dr. Johnson's Glutine	Johnson's Educator Food Store
6269	Whole Wheat Gluten	Health Food Company
	MISCELLANEOUS PREPARATIONS.	
6266	Cook's Flaked Rice	American Rice Food & Mf'g Co
6229	Glen Mills Standard Crushed Barley	Johnson's Educator Food Store
6267	Grape-Nuts	Postum Cereal Company
6286	Malt Breakfast Food	The Malted Cereal Company

WEIGHTS OF NUTRIENTS, AND FUEL VALUE OF ONE POUND OF CEREAL FOODS AS FOUND IN THE MARKET.

Laboratory number.	Price paid per package.	Weight contents of package.	Weight contents of package.	Price paid per pound.	Water.	Protein.	Fat.	Carbo-hydrates.	Ash.	Heat of combustion per pound.
	Cents.	Grams.	Lbs.	Cts.	Lb.	Lb.	Lb.	Lb.	Lb.	Calo.
6230	5	400	.88	5.7	.120	.081	.009	.787	.004	1740
6231	12	1329	2.93	4.1	.110	.086	.006	.794	.004	1730
6232	13 (2 for 25c.)	1324	2.92	4.5	.120	.080	.005	.792	.003	1725
6233	15	1136	2.28	6.	.107	.086	.010	.792	.005	1770
6234	In bulk.........	....	......	4.	.067	.175	.077	.655	.026	2025
6235	In bulk.....	....	.....	4.	.079	.143	.074	.686	.019	1975
6245	55	2331	5.14	10.7	.051	.125	.101	.705	.019	2055
6242	13 (2 for 25c.)	828	1.83	7.1	.091	.189	.074	.627	.019	1990
6244	15	933	2.06	7.3	.093	.134	.080	.674	.019	1945
6236	In bulk....	....	......	4.	.077	.139	.076	.687	.021	1975
6237	In bulk.......	....	......	4.	.069	.153	.076	.683	.020	1970
6238	8 lbs. for 25c. in bulk..	....	......	3.1	.074	.149	.075	.682	.021	1955
6239	10	849	1.87	5.3	.080	.147	.075	.678	.020	1970
6241	10	895	1.97	5.1	.082	.146	.075	.677	.020	1965
6243	10	874	1.93	5.2	.086	.144	.081	.669	.019	1980
6240	4cts. per lb., 7 lbs. for 25 cts., in bulk......	....	......	4.	.068	.145	.078	.689	.020	1970
6246	13 (2 for 25c.)	851	1.88	6.9	.081	.148	.086	.666	.020	1955
6247	5	554	1.22	4.1	.091	.161	.079	.648	.020	1950
6264	13 (2 for 25c.)	857	1.89	6.9	.113	.093	.021	.754	.019	1750
6263	In bulk	.. ..	.....	4.	.106	.095	.020	.761	.017	1745
6254	10	578	1.27	7.9	.117	.101	.016	.748	.018	1765
6256	15	952	2.10	7.1	.112	.096	.019	.756	.016	1775
6258	13 (2 for 25c.)	841	1.85	7.0	.107	.119	.018	.739	.017	1780
6249	17	853	1.88	9.0	.106	.118	.010	.763	.004	1775
6251	15	936	2.06	7.3	.094	.141	.030	.720	.014	1840
6252	13 (2 for 25c.)	830	1.83	4.9	.111	.109	.023	.743	.014	1745
6268	15	795	1.75	8.6	.115	.129	.024	.719	.013	1795
6250	13 (2 for 25c.)	423	.93	14.0	.114	.105	.009	.767	.004	1760
6257	15	853	1.88	8.0	.123	.129	.022	.716	.011	1775
6259	13 (2 for 25c.)	951	2.10	6.2	.093	.119	.015	.766	.007	1815
6260	15	857	1.89	8.0	.121	.107	.014	.751	.008	1745
6261	25	992	2.19	11.4	.086	.150	.035	.712	.017	1885
6262	13 (2 for 25c.)	859	1.89	6.9	.116	.136	.019	.718	.011	1780
6265	13 (2 for 25c.)	398	.88	14.8	.108	.106	.015	.756	.015	1780
6248	25	416	.92	27.3	.089	.154	.035	.699	.022	1880
6253	25	410	.90	27.7	.102	.138	.009	.741	.011	1815
6269	55 (5 lbs. bag.)	2274	5.01	11.	.112	.159	.046	.656	.027	1865
6266	15	387	.85	17.6	.114	.079	.001	.802	.004	1725
6229	15	908	2.00	7.5	.103	.100	.009	.779	.010	1760
6267	15	428	.94	15.9	.053	.117	.011	.797	.023	1870
6286	15	675	1.49	10.1	.080	.134	.022	.750	.014	1863

CEREAL FOODS.

Laboratory number.	Name.	Manufacturer.
	CORN PREPARATIONS.	
6580	F S Granulated Hominy	American Cereal Company
6571	Hecker's Hominy	Hecker-Jones-Jewel Milling Co.
6560	H-O Company's New Process Hominy	H-O Company
6582	Nichols' Pearl Hominy	Austin, Nichols & Company
6572	Pierce's Hominy	S. S. Pierce.
6561	Ralston Hominy Grits	Purina Mills
6581	Nichols' Snow White Samp	Austin, Nichols & Company
6579	Cerealine Flakes	Cerealine Manufacturing Company
	OAT PREPARATIONS.	
6563	Banner Rolled Oats	American Cereal Company
6564	Buckeye Rolled Oats	American Cereal Company
6553	Hornby's Steam Cooked Oat Meal	H-O Company
6566	McCann's Finest Oat Meal	Beaumond Mills, Dogheda, Ireland
6567	Mother's Crushed Oats	Akron Cereal Company.
6555	Oatnuts Food	Liberty Pure Food Company
6589	Old Grist Mill Rolled Oats.	Potter & Wrightington
6568	Pillsbury's Flaked Oat Food	Pillsbury-Washburn Flour Mills Co.
6576	Quaker Oats	American Cereal Company
6556	Quaker Rolled White Oats	American Cereal Company
6557	Ralston Health Oats	Purina Mills
6578	Rob Roy Cut Oats	American Cereal Company.
6577	Rob Roy Rolled Oats	American Cereal Company
6716	Saxon Rolled Oats	American Cereal Company
	WHEAT PREPARATIONS.	
6543	California Wheatine	Empire Milling Company
6544	Cream of Wheat	Cream of Wheat Company
6545	Fould's Wheat Germ Meal	Fould's Milling Company
6570	Fruen's Best Wheat Flakes	Fruen Cereal Company.
6583	F S Parched Farinose	American Cereal Company
6584	Germea	Sperry Flour Company.
6593	Granose Biscuit	Battle Creek Sanitarium Food Co.
6591	Granose Flakes.	Battle Creek Sanitarium Food Co.
6585	Granula	Our Home Granula Company
6546	H-O Company's Breakfast Wheat	H-O Company
6587	Old Grist Mill Rolled Wheat	Potter & Wrightington
6588	Old Grist Mill Toasted Wheat	Potter & Wrightington
6548	Pettijohn's Breakfast Food	American Cereal Company
6549	Pillsbury's Vitos.	Pillsbury-Washburn Flour Mills Co.
6550	Ralston Health Breakfast Food	Robinson-Danforth Milling Co.
6573	Shredded Whole Wheat	National Food Company
6606	Sugarnuts	E. Merritt & Sons
6551	Wheatena	Health Food Company
6552	Wheatlet	Franklin Mills Company
	MALTED FOODS.	
6590	Brittle Bits	American Cereal Company
6569	Force	The Force Food Company
6558	Malt-Barley Breakfast Food	Malted Cereals Company.
6547	Malt Breakfast Food	Malted Cereals Company
6554	Malt-Oats Breakfast Food	Malted Cereals Company.
	MISCELLANEOUS PREPARATIONS.	
6562	Cook's Flaked Rice	Am. Rice Food Manufacturing Co.
6574	Cream of Cereals	Sam. W. Weidler
6575	Grape-Nuts	Postum Cereal Company
6559	Ralston Health Barley Food	Robinson-Danforth Milling Co.

CEREAL FOODS, WHERE PURCHASED AND COST.

Laboratory number.	Where purchased.	Price paid per package.	Weight contents of package.	Weight contents of package.	Price paid per pound.
		Cents.	Grams.	Lbs.	Cts.
6580	W. L. Wilson & Co., Portland	15	737	1.63	9.2
6571	A. A. Gilbert, Orono	15	1366	3.01	5.0
6560	Fred T. Hall & Co., Bangor	15	1346	2.97	5.0
6582	Geo. C. Shaw & Co., Portland	22	2231	4.92	4.5
6572	James H. Snow & Co., Bangor	In bulk	-	-	5.0
6561	Fred T. Hall & Co., Bangor	10	826	1.82	5.5
6581	Geo. C. Shaw & Co., Portland	10	2115	4.66	2.1
6579	Geo. C. Shaw & Co., Portland	15	744	1.64	9.1
6563	T. F. Cassidy & Son, Bangor	25	1945	4.29	5.8
6564	A. A. Gilbert, Orono	10	894	1.97	5.1
6553	Fred T. Hall & Co., Bangor	15	876	1.93	7.8
6566	J. C. Norton & Co., Bangor	55	2295	5.06	10.9
6567	J. C. Norton & Co., Bangor	13(2 for 25)	828	1.83	7.1
6555	Fred T. Hall & Co., Bangor	12	956	2.11	5.7
6589	Geo. C. Shaw & Co., Portland	10	825	1.82	5.5
6568	Staples & Griffin, Bangor	10	860	1.90	5.3
6576	Staples & Griffin, Bangor	In bulk	-	-	3.1
6556	Fred T. Hall & Co., Bangor	12	857	1.89	6.3
6557	Fred T. Hall & Co., Bangor	10	624	1.73	5.8
6578	A. A. Gilbert, Orono	In bulk	-	-	5.0
6577	A. A. Gilbert, Orono	In bulk	-	-	5.0
6716	T. White, Bangor	25	2002	4.41	5.7
6543	Fred T. Hall & Co., Bangor	15	857	1.89	7.9
6544	Fred T. Hall & Co., Bangor	15	771	1.70	8.8
6545	Fred T. Hall & Co., Bangor	13	802	1.77	7.3
6570	J. C. Norton & Co., Bangor	13	836	1.84	7.1
6583	W. L. Wilson & Co., Portland	12	904	2.00	6.0
6584	W. L. Wilson & Co., Portland	14	761	1.68	8.3
6593	Geo. C. Shaw & Co., Portland	12½	304	.67	18.6
6591	Geo. C. Shaw & Co., Portland	15	304	.67	22.4
6585	W. L. Wilson & Co., Portland	25	417	.92	27.2
6546	Fred T. Hall & Co., Bangor	12	558	1.23	9.8
6587	W. L. Wilson & Co., Portland	13(2 for 25)	865	1.91	6.1
6588	W. L. Wilson & Co., Portland	10	512	1.13	8.8
6548	Fred T. Hall & Co., Bangor	13	842	1.85	7.0
6549	Fred T. Hall & Co., Bangor	13	927	2.04	6.4
6550	Fred T. Hall & Co., Bangor	13	821	1.81	7.2
6573	J. C. Norton & Co., Bangor	13(2 for 25)	396	.87	15.0
6606	E. Merritt & Sons, Houlton	In bulk	-	-	5.0
6551	Fred T. Hall & Co., Bangor	25	1064	2.34	10.7
6552	Fred T. Hall & Co., Bangor	13	863	1.90	6.8
6590	W. L. Wilson & Co., Portland	13	472	1.05	12.5
6569	James H. Snow & Co., Bangor	15	413	.91	16.5
6558	Fred T. Hall & Co., Bangor	13	594	1.31	10.0
6547	Fred T. Hall & Co., Bangor	13(2 for 25)	624	1.38	9.4
6554	Fred T. Hall & Co., Bangor	13(2 for 25)	617	1.36	9.6
6562	Fred T. Hall & Co., Bangor	13	324	.71	18.2
6574	T. F. Cassidy & Son, Bangor	15	864	1.90	7.9
6575	J. C. Norton & Co., Bangor	15	466	1.03	14.6
6559	Fred T. Hall & Co., Bangor	13	858	1.89	6.9

PERCENTAGE COMPOSITION OF CEREAL FOODS CALCULATED TO WATER-FREE BASIS.

Laboratory number.	Name.	Nitrogen.	Protein. (Nitrogen x 6.25.)	Fat.	Crude fiber.	N-free extract.	Ash.	Heat of combustion per gram.
	CORN PREPARATIONS.	Pr ct.	Per ct.	Pr ct.	Pr ct.	Per ct.	Pr ct.	Cal.
6580	F S Granulated Hominy...........	1.64	10.28	.54	.32	88.62	.24	4.250
6571	Hecker's Hominy...	1.69	10.55	.36	.42	88.46	.21	4.293
6560	H-O Co's New Process Hominy...	1.57	9.83	1.05	.36	88.29	.46	4.305
6582	Nichols' Pearl Hominy	1.50	9.36	.41	.29	89.77	.17	4.240
6572	Pierce's Hominy........	1.45	9.05	.66	.39	89.54	.36	4.332
6561	Ralston Hominy Grits.............	1.53	9.58	.93	.50	88.61	.38	4.324
6581	Nichols' Snow White Samp........	1.46	9.13	.33	.49	89.77	.28	4.233
6579	Cerealine Flakes.......	1.54	9.61	.60	.40	88.86	.53	4.333
	OAT PREPARATIONS.							
6563	Banner Rolled Oats................	3.12	19.50	7.38	.97	70.05	2.10	4.688
6564	Buckeye Rolled Oats	2.56	16.03	7.16	1.00	73.86	1.95	4.660
6553	Hornby's Steam Cooked Oat Meal	2.84	17.74	7.76	.93	71.59	1.98	4.690
6566	McCann's Finest Oat Meal	2.57	16.04	8.90	.86	72.04	2.16	4.702
6567	Mother's Crushed Oats	2.77	17.30	7.79	.72	72.10	2.09	4.715
6555	Oatnuts Food.......	2.75	17.20	8.35	1.02	71.38	2.05	4.703
6589	Old Grist Mill Rolled Oats.........	2.61	16.31	8.37	1.03	72.21	2.08	4.695
6568	Pillsbury's Flaked Oat Food......	2.35	14.71	7.64	1.30	74.48	1.87	4.666
6576	Quaker Oats	2.78	17.38	8.57	1.06	71.18	1.81	4.722
6556	Quaker Rolled White Oats	3.07	19.18	7.61	1.05	70.06	2.16	4.731
6557	Ralston Health Oats	3.06	19.10	7.67	1.03	70.01	2.19	4.709
6578	Rob Roy Cut Oats...........	2.54	15.90	7.51	1.03	73.43	2.13	4.696
6577	Rob Roy Rolled Oats	2.94	18.37	7.35	1.05	71.15	2.08	4.656
6716	Saxon Rolled Oats..................	3.08	19.26	7.81	1.14	69.28	2.51	4.723
	WHEAT PREPARATIONS.							
6543	California Wheatine.......... ...	1.65	10.32	2.63	1.41	83.72	1.92	4.338
6544	Cream of Wheat...............	2.35	14.68	1.37	.29	83.14	.52	4.353
6545	Fould's Wheat Germ Meal	2.28	14.26	2.90	1.11	80.14	1.59	4.415
6570	Fruen's Best Wheat Flakes	1.70	10.59	2.15	1.99	83.51	1.76	4.299
6583	F S Parched Farinose..............	2.65	16.58	2.94	1.16	77.48	1.84	4.404
6584	Germea	1.60	9.98	1.36	.32	87.73	.61	4.292
6593	Granose Biscuit......	2.14	13.39	1.71	1.13	80.88	2.89	4.297
6591	Granose Flakes	1.97	12.34	1.16	2.21	81.07	3.22	4.217
6585	Granula..........	2.41	15.09	1.28	1.95	79.92	1.76	4.368
6546	H-O Company's Breakfast Wheat	1.78	11.13	1.07	1.77	84.17	1.85	4.281
6587	Old Grist Mill Rolled Wheat	2.13	13.31	2.16	2.18	81.20	1.15	4.339
6588	Old Grist Mill Toasted Wheat	2.76	17.22	3.39	1.27	76.58	1.54	4.447
6548	Pettijohn's Breakfast Food.......	2.10	13.16	2.48	2.32	80.43	1.61	4.418
6549	Pillsbury's Vitos.......	2.29	14.29	1.82	.69	82.21	.99	4.364
6550	Ralston Health Breakfast Food ..	2.06	12.87	1.63	1.09	83.20	1.21	4.281
6573	Shredded Whole Wheat............	2.03	12.67	1.41	2.45	82.05	1.42	4.403
6606	Sugarnuts.....	2.67	13.55	2.27	1.42	81.12	1.64	4.489
6551	Wheatena....................	2.62	16.36	3.26	1.06	77.70	1.62	4.431
6552	Wheatlet....	2.38	14.89	2.45	1.18	80.17	1.31	4.378
	MALTED FOODS.							
6590	Brittle Bits	2.42	15.11	.50	1.11	81.62	1.66	4.350
6569	Force	1.96	12.22	1.43	2.19	81.19	2.97	4.177
6558	Malt-Barley Breakfast Food......	2.20	13.74	1.16	.63	83.34	1.13	4.317
6547	Malt Breakfast Food	2.58	16.13	2.13	.87	79.70	1.17	4.428
6554	Malt-Oats Breakfast Food.........	2.86	17.90	5.72	.99	73.50	1.89	4.614
	MISCELLANEOUS PREPARATIONS.							
6562	Cook's Flaked Rice	1.55	9.67	.11	.29	89.57	.36	4.284
6574	Cream of Cereals.............	1.61	10.09	1.23	.44	87.86	.38	4.423
6575	Grape-Nuts	2.11	13.19	1.15	1.95	81.79	1.92	4.336
6559	Ralston Health Barley Food......	1.94	12.11	1.14	.72	84.87	1.16	4.306

WEIGHTS OF NUTRIENTS AND HEAT OF COMBUSTION OF ONE POUND OF CEREAL FOODS AS FOUND IN THE MARKET.

Laboratory number.	Name of food.	Water.	Protein.	Fat.	Crude fiber.	Nitrogen-free extract.	Ash.	Heat of combustion per pound.
	CORN PREPARATIONS.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Cal.
6580	F S Granulated Hominy	.094	.093	.005	.003	.803	.002	1747
6571	Hecker's Hominy	.111	.094	.003	.004	.786	.002	1732
6560	H-O Co's New Process Hominy	.104	.088	.009	.003	.792	.004	1751
6582	Nichols' Pearl Hominy	.093	.085	.004	.003	.813	.002	1745
6572	Pierce's Hominy	.109	.081	.006	.003	.798	.003	1751
6561	Ralston Hominy Grits	.107	.086	.008	.004	.792	.003	1753
6581	Nichols' Snow White Samp	.103	.082	.003	.004	.805	.003	1723
6579	Ceraline Flakes	.096	.087	.005	.004	.803	.005	1777
	OAT PREPARATIONS.							
6563	Banner Rolled Oats	.077	.180	.068	.009	.647	.019	1963
6564	Buckeye Rolled Oats	.096	.145	.065	.009	.668	.017	1912
6553	Hornby's Steam Cooked Oat Meal	.084	.163	.071	.008	.656	.018	1949
6566	McCann's Finest Oat Meal	.077	.148	.082	.008	.665	.020	1969
6567	Mother's Crushed Oats	.082	.159	.071	.007	.662	.019	1963
6555	Oatnuts Food	.084	.158	.077	.009	.653	.019	1953
6589	Old Grist Mill Rolled Oats	.081	.150	.077	.009	.664	.019	1958
5568	Pillsbury's Flaked Oat Food	.086	.135	.070	.012	.680	.017	1934
6576	Quaker Oats	.078	.177	.070	.010	.645	.020	1975
6556	Quaker Rolled White Oats	.087	.159	.078	.010	.650	.016	1960
6557	Ralston Health Oats	.077	.176	.071	.010	.646	.020	1971
6578	Rob Roy Cut Oats	.091	.167	.067	.010	.646	.019	1935
6577	Rob Roy Rolled Oats	.084	.146	.069	.009	.672	.020	1934
6716	Saxon Rolled Oats	.097	.174	.071	.010	625	.023	1933
	WHEAT PREPARATIONS.							
6543	California Wheatine	.091	.094	.024	.013	.761	.017	1789
6544	Cream of Wheat	.102	.132	.012	.003	.747	.004	1774
6545	Fould's Wheat Germ Meal	.102	.128	.026	.010	.720	.014	1798
6570	Fruen's Best Wheat Flakes	.097	.096	.019	.018	.754	.016	1760
6583	F S Parched Farinose	.080	.153	.027	.011	.712	.017	1837
6584	Germea	.098	.090	.012	.003	.791	.006	1756
6593	Granose Biscuit	.075	.124	.016	.010	.748	.027	1803
6591	Granose Flakes	.077	.114	.011	.020	.748	.030	1765
6585	Granula	.077	.139	.012	.018	.738	.016	1830
6546	H-O Co's Breakfast Wheat	.096	.101	.010	.016	.760	.017	1755
6587	Old Grist Mill Rolled Wheat	.088	.121	.020	.020	.740	.011	1792
6588	Old Grist Mill Toasted Wheat	.082	.158	.031	.012	.703	.014	1852
6548	Pettijohn's Breakfast Food	.097	.119	.022	.021	.726	.015	1810
6549	Pillsbury's Vitos	.086	.131	.017	.006	.751	.009	1810
6550	Ralston Health Breakfast Food	.091	.117	.015	.010	.756	.011	1765
6573	Shredded Whole Wheat	.073	.117	.013	.023	.761	.013	1852
6606	Sugarnuts	.119	.119	.020	.012	.715	.015	1794
6551	Wheatena	.079	.151	.030	.010	.715	.015	1851
6552	Wheatlet	.101	.134	.022	.011	.720	.012	1793
	MALTED FOODS.							
6590	Brittle Bits	.069	.141	.005	.010	.760	.015	1837
6569	Force	.054	.116	.014	.020	.768	.028	1792
6558	Malt-Barley Breakfast Food	.068	.128	.011	.006	.777	.010	1826
6547	Malt Breakfast Food	.086	.147	.019	.008	.729	.011	1836
6554	Malt-Oats Breakfast Food	.064	.167	.054	.009	.688	.018	1959
	MISCELLANEOUS PREPARATIONS.							
6562	Cook's Flaked Rice	.089	.088	.001	.003	.816	.003	1770
6574	Cream of Cereals	.108	.090	.011	.004	.784	.003	1806
6575	Grape-Nuts	.042	.126	.011	.019	.784	018	1884
6559	Ralston Health Barley Food	.108	.107	.010	.006	.758	.010	1744

AMOUNTS OF NUTRIENTS FURNISHED FOR TEN CENTS IN CEREAL FOODS AT ORDINARY PRICES.

Name of Food.	Prices per pound.	Ten cents will pay for—					Heat of combustion.
		Total food materials.	Nutrients.				
			Total.	Protein.	Fats.	Carbohydrates.	
Corn Preparations.	Cts.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Cal.
F S Granulated Hominy	9.2	1.09	.99	.10	.01	.88	1903
Hecker's Hominy	5.0	2.00	1.77	.19	.01	1.57	3464
H-O Company's New Process Hominy	5.0	2.00	1.78	.18	.02	1.58	3502
Nichols' Pearl Hominy	4.5	2.22	2.00	.19	.01	1.80	3873
Pierce's Hominy	5.0	2.00	1.77	.16	.01	1.60	3502
Ralston Hominy Grits	5.5	1.82	1.61	.15	.02	1.44	3190
Nichols' Snow White Samp	2.1	4.76	4.23	.39	.01	3.84	8200
Cerealine Flakes	9.1	1.10	.99	.10	.01	.88	1955
Oat Preparations.							
Banner Rolled Oats	5.8	1.73	1.55	.31	.12	1.12	3397
Buckeye Rolled Oats	5.1	1.96	1.72	.28	.13	1.31	3747
Hornby's Steam Cooked Oat Meal	7.8	1.28	1.14	.21	.09	.84	2495
McCann's Finest Oat Meal	10.9	.92	.83	.14	.08	.61	1812
Mother's Crushed Oats	7.1	1.41	1.27	.22	.10	.95	2768
Oatnuts Food	5.7	1.75	1.55	.28	.13	1.14	3417
Old Grist Mill Rolled Oats	5.5	1.82	1.62	.27	.14	1.21	3564
Pillsbury's Flaked Oat Food	5.3	1.89	1.68	.26	.13	1.29	3656
Quaker Oats	3.1	3.23	2.88	.57	.23	2.08	6380
Quaker Rolled White Oats	6.3	1.59	1.41	.25	.13	1.03	3117
Ralston Health Oats	5.8	1.73	1.54	.30	.12	1.12	3409
Rob Roy Cut Oats	5.0	2.00	1.76	.34	.13	1.29	3871
Rob Roy Rolled Oats	5.0	2.00	1.77	.29	.14	1.34	3868
Saxon Rolled Oats	5.7	1.75	1.51	.30	.12	1.09	3382
Wheat Preparations.							
California Wheatine	7.9	1.27	1.12	.12	.03	.97	2272
Cream of Wheat	8.8	1.14	1.01	.15	.01	.85	2023
Fould's Wheat Germ Meal	7.3	1.37	1.20	.17	.04	99	2464
Fruen's Best Wheat Flaked	7.1	1.41	1.22	.13	.03	1.06	2482
F S Parched Farinose	6.0	1.67	1.49	.25	.05	1.19	3069
Germea	8.3	1.21	1.08	.11	.01	.96	2125
Granose Biscuit	18.6	.54	.48	.07	.01	.40	973
Granose Flakes	22.4	.45	.39	.05	–	.34	794
Granula	27.2	.37	.33	.05	–	.28	677
H-O Company's Breakfast Wheat	9.8	1.02	.89	.10	.01	.78	1790
Old Grist Mill Rolled Wheat	6.1	1.64	1.44	.20	.03	1.21	2942
Old Grist Mill Toasted Wheat	8.8	1.14	1.02	.18	.04	.80	2111
Pettijohn's Breakfast Food	7.0	1.43	1.24	.17	.03	1.04	2587
Pillsbury's Vitos	6.4	1.56	1.40	.20	.03	1.17	2824
Ralston Health Breakfast Food	7.2	1.39	1.23	.16	.02	1.05	2452
Shredded Whole Wheat	15.0	.67	.60	.08	.01	.51	1213
Sugarnuts	5.0	2.00	1.71	.24	.04	1.43	3588
Wheatena	10.7	.93	.83	.14	.03	.66	1722
Wheatlet	6.8	1.47	1.29	.20	.03	1.06	2636
Malted Foods.							
Brittle Bits	12.5	.80	.72	.11	–	.61	1469
Force	16.5	.67	.60	.08	.01	.51	1201
Malt-Barley Breakfast Food	10.0	1.00	.92	.13	.01	.78	1826
Malt Breakfast Food	9.4	1.06	.95	.16	.02	.77	1947
Malt-Oats Breakfast Food	9.6	1.04	.95	.17	.06	.72	2037
Miscellaneous Preparation.							
Cook's Flaked Rice	18.2	.55	.50	.05	–	.45	974
Cream of Cereals	7.9	1.26	1.11	.11	.01	.99	2254
Grape Nuts	14.6	.69	.64	.09	.01	.54	1300
Ralston Health Barley Food	6.9	1.45	1.27	.16	.01	1.10	2529

PREPARED CEREALS.

While hominy has long been in use in certain sections of the country, the general introduction of cereal breakfast foods is comparatively recent. Oat meal is a favorite dish with the Scotch and Irish and its adoption has naturally followed the immigration of these races. Formerly both preparations were coarsely ground and required prolonged cooking. The first great advance along this line was the manufacture of rolled oats, a process which consists in softening the kernel by steaming, after which it is passed between steel rollers and dried. The resulting article was found not only to keep well, but, being partially cooked, and the cell walls ruptured by the crushing process to which it was subjected, the time required in preparing it for the table was very materially shortened. Later the same process was applied to wheat, rice and corn, yielding products which are adapted not only for breakfast foods but also for the preparation of puddings and other desserts. To-day the excellence and variety of the cereal foods should excite the gratitude of the housewife, whose chief embarrassment lies in choosing among the many. It is in the hope of assisting in this choice that this bulletin is written.

All the samples collected for analysis were guaranteed fresh goods by the dealer from whom they were purchased. In spite of this precaution a number of packages when opened were found not only musty but infested with moths or the larvæ of beetles. All such samples were rejected as not fairly representing the goods. Some method should be devised whereby such stale goods should be withdrawn from the market or replaced by fresh preparations. The interests of both manufacturers and dealers would seem to demand that the consumer should have a reasonable assurance as to the quality of the goods purchased.

Of the fifty brands recently collected only twenty-one are found in the list of those collected three years ago. There seems to be a tendency on the part of the manufacturers to substitute new and attractive names for a product that has been before the public for some time.

DISCUSSION.

It is unnecessary to explain at length the terms employed in this discussion. It may be remarked that protein occupies an especially important place among the nutrients, since it can, to a certain extent, replace the fats and carbohydrates, while neither of the latter can replace the protein. Since the foods rich in protein are among the most expensive, it will be readily seen why the percentage of nitrogen present should be considered as of prime importance.

The amount of crude fiber or woody matter present gives us some clue as to the extent to which the outer covering of the grain has been removed. Thus, the whole (undecorticated) wheat kernel contains about 2.40 per cent of crude fiber, all of which remains in graham flour. The so-called entire wheat flour, of which the Franklin Mills flour is an example, is from the decorticated kernel, and contains from .80 to 1.00 per cent of crude fiber. In the manufacture of ordinary white flour, not only the outer coatings of the wheat kernels are removed, but the inner envelopes as well, leaving only from .20 to .40 per cent of crude fiber in the finished product. In the discussion which follows, the term "decorticated grain" will be used to signify the grain from which the outer coatings only have been removed.

The methods of analysis employed are those in general use. The heats of combustion were determined by the use of Atwater's bomb calorimeter.

CORN PREPARATIONS.

The 8 samples of hominy and samp examined agree as closely in composition as could be expected. The differences in fat content are probably due to varying amounts of the chit or germ left in the process of manufacture. The Cerealine Flakes differ from the other corn preparations in that they have been previously cooked and require but little additional cooking to fit them for use, while the hominy and samp require long cooking.

Of the 8 corn preparations examined, 5 show as little variation in cost as in composition, the prices ranging from 4½ to 5½ cents per pound. The method of preparing the Cerealine Flakes may, perhaps, justify an increased price, but why F S Granulated Hominy should sell at 9.2 cents per pound and Nichols' Pearl Hominy at less than one-half that amount is not evident.

A study of the table on page 92 is recommended in this connection. It will be seen there also that in the form of Nichols' Snow White Samp at 10 cents per package, 10 cents will buy more than double the nutrients to be found at the same price in any other of these corn products.

OAT MEALS.

The analyses of 14 different brands of oat preparations are here reported. It is worthy of note that they average considerably higher in protein (16.00 per cent) than did the 14 similar preparations examined in 1899 (15.00 per cent). It is well known that the quality of the cereals vary somewhat from year to year according to the character of the growing season, and this improvement in composition is probably due to such natural causes rather than to more careful selection on the part of manufacturers or improved methods of preparation. The Banner, the Quaker and the Ralston Health Oats carry about 18 per cent of protein and the Saxon Rolled Oats over 17 per cent. The Rob Roy Cut Oats contain 16.7 per cent of protein, against 14.6 per cent for the Rob Roy Rolled Oats. Pillsbury's Flaked Oat Food was the lowest in protein (13.5 per cent) of the samples examined and was also the highest in woody fiber. The oat foods were all of good quality and bear evidence of careful preparation. The differences between them are perhaps no greater than might be expected. It is probable that the goods of different companies vary no more in composition than different samples from the same company might. For example, Hornby's Oat Meal, which in 1899 carried 13.4 per cent of protein, in 1902 carries 16.3 per cent.

For the most part the packages containing the oat preparations are free from misleading statements. The manufacturers of the Banner Oats and Saxon Oats are evidently attempting to push their sale by the "elegant piece of decorated china" enclosed in each package. It happens that the Banner Oats carry more protein than any other brand examined, while the Saxon Oats are far above the average in this respect; but this is probably accidental, as there is no reason to suppose that the American Cereal Company is making a more careful selection of oats in these goods than in the Quaker or Buckeye brands.

Hornby's H-O Oat Meal carries a guarantee that the quality of the product contained in the package is *superior* to that of any similar article. It has the composition of an average oat meal and in flavor and appearance is similar to others. It is probable, however, that the guarantee deceives but few. While the package of Hornby's Oat-Meal carried no very misleading statements, the following was taken from a package of Hornby's H-O Wheat: "Hornby's Oat-Meal is prepared by its own peculiar process under our patents so that every grain is prepared for easy digestion, making one package of more nutritive value than three packages of ordinary oat meal." While there is no doubt as to the good quality of Hornby's Oat-Meal, its chemical composition does not show it to be superior to other well made oat meals. On the other hand, its cost per pound is 25 per cent above the average and with but one exception higher than that of any other oat food here given.

The Liberty Pure Food Company claims for Oatnuts Food that "after many years experimenting we have succeeded in separating the meat of the oat from the shell, thus making Oatnuts; something heretofore found to be impossible." As Oatnuts Food has about the average amount of crude fiber, there is no evidence that the company has been more successful in "separating the meat from the shell" than other companies.

From the cost table on page 92 we find an interesting variation in the prices of these goods. One article purchased in bulk costs but 3.1 cents per pound, while the average cost is about 6.1 cents. An imported brand, put up in tin boxes, sells for 10.9 cents per pound, or nearly double the average price. This sample contained over one per cent less protein than the average oat preparation, but yielded an excessive amount of fat. It is possible that some reason exists why certain of these goods should sell for a higher price than others, but it is rarely possible to trace any relation between the cost and the actual nutritive value.

WHEAT PREPARATIONS.

Nineteen different samples of wheat preparations have been examined, 7 of which carry more than 13 per cent of protein, while 4 have from 9 to 10 per cent of protein. If one may judge from the analyses, the tendency has been to use stronger wheats than formerly in these preparations. A possible explanation of the high protein content may be found in the fact that during the latter part of the last grain growing season a severe drouth prevailed in the wheat districts, thus preventing the storage of starch in the berry and giving grain unusually high in protein.

"California Wheatine is made of first quality California white wheat, known the world over for its excellent flavor, sweetness, richness in nutritive qualities, particularly its large per cent of gluten." The California wheats do not carry large amounts of gluten as is illustrated by the low protein content (9.38 per cent) of this sample. Only one other of the 19 wheat foods examined carried as little protein as this. From the amounts of crude fiber and ash present, California Wheatine is probably prepared from more or less imperfectly decorticated wheat.

The manufacturers of Cream of Wheat continue to make the same claim as in 1899. The comments which follow, made in Bulletin 55 of this Station, are still true. "The claim that Cream of Wheat is almost pure gluten is false and should be criminal. As a food for people in health, Cream of Wheat is all right. Diabetic persons should avoid starch and sugar, and this preparation contains 75 per cent of these carbohydrates." In composition it closely resembles a good bread flour.

Fould's Wheat Germ Meal is said to be made from the glutenous portion of choice wheat. "Gluten of Wheat. Superior to oat meal." These statements are evidently intended to carry the impression that the starchy portions of the kernel are excluded, although the claim that it is "the best thing for thickening soup" must be based upon its high starch content and not upon a large amount of gluten. Its chemical composition indicates that it is prepared from decorticated wheat of average composition.

Fruen's Best Wheat Flakes, "made from the best Pacific Coast White Wheat," claims to be "the great nerve, brain and muscle food," "the indigestible matter being entirely removed." The claims are, of course, exaggerated, for Fruen's Wheat Flakes contain 1.8 per cent of woody fiber, which is indigestible. Its chemical composition indicates that it is made from a soft white wheat. From its high per cent of fiber and ash it seems doubtful if any considerable amount of the outer coatings have been removed in its preparation.

F S Parched Farinose, made by the American Cereal Company, "from Ohio's Best Amber Wheat," is among the highest in protein of any of the samples examined. The claims, "rich in Gluten, Germ, Nitrates, Fat and Phosphates," certainly need editing. Fortunately for the users it contains no nitrates. It is evidently prepared from a hard wheat which has been decorticated. The low cost and high protein content of Farinose make it one of the most economical of the wheat preparations.

Germea "is California White Wheat, the skin peeled off, and the rest of the kernel (including germ and gluten) ground coarse." The sample was much lower in protein (9 per cent) than that examined in 1899 (12.90 per cent). The low per cent of crude fiber (.30 per cent) and ash (.55 per cent) shows that in the process of manufacture a good deal of the outer coating of the berry is removed, the product approaching common flour in composition.

Granose Biscuit and Granose Flakes, although very different in appearance, are put up by the same company and are so much alike in chemical composition that they may be considered together, the chief difference being in the amounts of fats and crude fiber which they contain. The composition of Granose Biscuit is very nearly that of a decorticated wheat, except in the high ash content, which is probably due to the presence of common salt. The Granose Flakes resemble more closely an undecorticated wheat, though somewhat deficient in fat and with an excess of ash, probably due to the addition of salt.

The fact that these goods, in spite of their high cost, seem to meet with a ready sale demonstrates the business value of judicious advertising and proves that the public is willing to pay a generous price for an attractive article. Reference to the table on page 92 shows that 10 cents will purchase only about half a pound of Granose Biscuit, having an energy-producing value of 973 calories. Granose Flakes cost 22.4 cents per pound and 10 cents pays for less than 800 calories. The same amount of money expended for flour would buy eight times as much protein and nearly seven times as much energy-producing value. We should not, however, lose sight of the fact that Granose Biscuit and Granose Flakes are ready cooked and appetizing. Whether the average consumer can afford to pay the price asked for these goods is a question that can only be answered by the individual.

Granula. "Prepared by a peculiar process original with us, embracing the use of all the constituents of the grain, which is the best white winter wheat, grown in the famous Genesee Valley country." The manufacturers state that it is "one of the cheapest foods in use, a pound of it containing more absolute nutriment for brain and body than an equal weight of any preparation in the market." It is evidently made from a high grade hard wheat of a high protein content.

While the analyses of Granula show it to be superior to the average wheat preparation, its price flatly contradicts the claim of cheapness. A package of these goods, containing about nine-tenths of a pound, costs 25 cents, or 27.2 cents per pound. In composition it is but slightly superior to a good flour to be had at one-tenth of the price. Reference to the table on page 92 shows that no other cereal food named in this bulletin furnishes so little nutriment for the money.

The H-O Company's Breakfast Wheat carries about 10 per cent of protein, which indicates that a soft wheat low in protein was used in its preparation. Its high fiber and ash content would indicate that it is made from undecorticated wheat.

Old Grist Mill Rolled Wheat "is prepared from the finest California White Wheat." This preparation is low in ash as compared with the crude fiber which it carries. Its percentage of protein (12.1) shows that it is made from wheat of average composition. The claim that "it is not heating to the blood" is certainly fanciful, since it has practically the same heat of combustion as the other wheat and oat products. At the price paid it compares favorably with the other foods of this class, only two of which furnish as much nutriment for the money.

Old Grist Mill Toasted Wheat. Its ash and crude fiber content would indicate that it is made from a partially decorticated wheat. The claim that it is healthful and nutritious is true of this preparation as well as of the others here reported. In its protein and fat content it ranks higher than any other of the wheat preparations examined.

Pettijohn's Breakfast Food "is made from selected Pacific coast wheat." In its preparation "the hull or covering or woody matter is entirely removed, leaving only that part of the grain containing nutritious qualities, so valuable in building up the muscles of the system, and the phosphatic matter most valuable as a nerve and brain tonic, as it is entirely free from bran." The latter statement is hardly borne out by the analysis which shows

2.1 per cent of crude fiber, practically that of the average California undecorticated wheat and higher than that of any other wheat preparation here reported, except the Shredded Whole Wheat. Its protein, fiber and ash content agree with those of undecorticated wheat.

Pillsbury's Vitos. "It is the choicest product of carefully selected northwestern hard spring wheat." This sample is higher in both ash and protein than that examined three years ago. The ash and crude fiber indicate that it is made from decorticated wheat. At 13 cents a package it is one of the cheapest of these foods.

Ralston Health Breakfast Food. The writer of the advertisement printed on the package evidently mistakes starch for gluten in explaining how one part of this food can absorb six parts of water. The amount of protein is somewhat below the average. Its crude fiber and ash indicate that it is made from decorticated wheat.

Shredded Whole Wheat "consists of the whole wheat berry, (nothing added), made light and short by a mechanical shredding and thorough cooking." Its chemical composition is that of a rather soft wheat. It is interesting to note that this most extensively advertised of wheat preparations carries no advertising statements of an exaggerated nature. While the advertisement is written with the evident intention of convincing the reader that there is no other wheat product to be compared with this, a careful inspection of the package fails to disclose any statements to which exceptions can be taken. It has the same nutritive value as the wheat from which it is made. Shredded Wheat at 13 cents a package costs 15 cents per pound and is consequently somewhat expensive, though it should not be forgotten that it is cooked and ready for the table.

Sugarnuts. "This food is made from the germ and glutinous portions of Aroostook wheat. As the germ is large and fully developed in the wheat grown in this section the food contains a large portion of the germ, giving that sweet and nutty flavor peculiar to Aroostook Wheat flour." It is sold in bulk at 5 cents a pound and is by far the cheapest of the wheat preparations named here. As it is uncooked it is not quite so quickly prepared for the table as some of the cereal foods.

Wheatena is made from "peeled wheat." "As it is deficient in starch, the dyspeptic, with whom starch is indigestible, finds comfort from its use." As a matter of fact, the nitrogen-free extract, which includes the starch, is the same as that of any wheat products carrying an equal amount of protein (15.06 per cent). Its richness in the latter constituent is more than offset by its price, 10.7 cents per pound, which places it among the less economical foods of this class.

Wheatlet is apparently made from a good grade decorticated wheat. The claim that it is "exceptionally rich in the nitrogenous and phosphatic food elements" is true of Wheatlet only in the same sense that it is true of any other of the wheat preparations.

MALTED FOODS.

Starch, which makes up by far the greater part of the cereal grains, must be converted into soluble forms before it can be absorbed and made of use to the animal body. By the action of the saliva, and to a greater extent by the pancreatic juice, starch is changed to dextrin and maltose, which last is, at least in part, changed to dextrose or glucose, in which form it may be absorbed. Just so much of the starch as escapes this solvent action is lost as food. While raw starch is not easily digested by man, cooked starch in reasonable quantities offers no difficulty to the healthy individual. With many persons of weak digestion the starch of the food, even when properly cooked, is not well digested. Any process, therefore, which accomplishes the solvent action noted above either wholly or in part, to that extent relieves the digestive organs, and the food is, so far as the starch is concerned, "predigested."

In the germination of cereals the starch is rendered soluble by the action of a ferment known as diastase, which nature seems to have provided for that purpose. This ferment is able to convert into maltose not only the starch of the kernel in which it is formed, but a much larger amount as well. If barley be sprouted and the germination arrested before the sprout has reached any considerable length, a product known as *malt* is formed. When the malt is ground and mixed with a large amount of grain, the mass moistened and kept at a suitable temperature, the starch, not only of the malt, but of the unsprouted grain also, is converted into maltose.

The manufacturers of malt foods claim that a considerable portion of the starch of their products has thus been acted upon, and there seems no reason to doubt the truth of the assertion. Since a long continued fermentative process would be likely to produce undesirable flavor, it is probable that a large part of the starch is still unacted on. The action can go on only when the cereal is moist and warm and must cease when the product is cooked, as ferments are destroyed by boiling. It is needless to say that the average person should not depend upon predigested foods.

Brittle Bits, "a soluble, sterilized, predigested food scientifically prepared from entire wheat and barley, producing that delicate malt flavor." "It is ready to be absorbed the moment it is put into the stomach." "One pound of lean beef gives 447 calories of heat units, while one pound of Brittle Bits gives about 1870 calories or heat units, therefore one pound of Brittle Bits is equal to four pounds of beefsteak." While the latter statement is not far from the truth, it is too misleading to pass unchallenged. If fat beefsteak had been chosen for comparison it would have been found equal to Brittle Bits in the number of calories yielded. Fat yields more than twice as many calories as an equal weight of protein; yet the protein is by far the more valuable nutrient, costing more, and more essential. If Brittle Bits is compared with lean beef on the protein basis, we find that while the cereal food carries 14 per cent of protein, the meat carries about 23 per cent, or one and two-thirds times as much. It should be added that a food that "requires no effort on the part of the salivary or pancreatic glands to digest it, and make it fit for assimilation," is not well adapted for a person in health. Nature gave us salivary and pancreatic glands and intended that they should be used.

Force. "A simple preparation of the whole of the wheat and barley malt." "With Force the work of digestion is already half done. It slips into the tissues and makes bone and muscles almost as soon as eaten." The analysis given on the package agrees quite closely with that obtained at this laboratory.

MISCELLANEOUS PREPARATIONS.

Cook's Flaked Rice, "made from Louisiana and Texas rice." It has practically the same composition as raw rice, but is cooked and quickly prepared for use. Rice is lower in protein than wheat and oats, in its composition more nearly resembling Indian corn. The statement "Flaked Rice stands at the head of all foods as a tissue builder" is not supported by its chemical composition. The following assertions are printed upon the package:

"Flaked Rice contains	87	per cent	nutriment.
Beef "	45	"	"
Potatoes "	21	"	"

One pound Flaked Rice contains 21 per cent more life-giving nourishment than a pound of beef and a pound of potatoes combined."

So far as the total "nutriment" is concerned, the claim of the manufacturers might have been put more strongly. Whatever force the statement possesses lies in placing an equal valuation upon the various nutrients that are here classed together as "nutriment." Since the protein, as shown elsewhere, costs more than the other nutrients, the value of a food must depend more upon this than upon any other single constituent. The combined meat and potato contain two and one-half times the amount of protein found in the rice, a fact which more than off-sets the advantage claimed by the advertisers.

Grape-Nuts, "made by special treatment of entire wheat and barley." The statement formerly made, that "4 heaping teaspoons of Grape-Nuts are sufficient for the average meal," is now modified to read, "for the cereal part of a meal." The manufacturers still persist, however, in saying that "the system will absorb a greater amount of nourishment from 1 pound of Grape Nuts than from 10 pounds of meat, wheat, oats or bread." The following from Bulletin 55 of this Station, pp. 103-4, shows the absurdity of this statement:

A man at moderate work needs per day about .28 pounds of protein and sufficient fats and carbohydrates in addition to make the potential energy of the day's food 3,500 calories. Four heaping teaspoonfuls of Grape-Nuts weigh about 1 ounce. The protein and energy needed for one meal (1-3 of 1 day) and that furnished by 4 heaping teaspoonfuls of Grape-Nuts are compared in the following table:

	Protein —lbs.	Fuel value —calories.
Needed for ⅓ day by man at moderate work	.090	1,175
Furnished by four heaping teaspoonfuls (1 oz.) of Grape Nuts	.007	117

It would require .77 pounds of Grape Nuts (¾ of a package) to furnish ⅓ of the protein needed for one day for a man at moderate work; the energy needed would be afforded by .63 pounds.

The nutrients of beef are more completely digested and absorbed than those of vegetable foods. There is no reason for thinking that Grape Nuts would be more completely digested than rolled oats, wheat flour or wheat bread. About 85 per cent of the protein and of fuel value of vegetable foods are digested and rendered available to the body.

In the folowing table there are compared the pounds of protein and fuel values of one pound of Grape Nuts with "ten pounds of meat, wheat, oats or bread."

POUNDS OF PROTEIN AND FUEL VALUE OF ONE POUND OF GRAPE NUTS COMPARED WITH 10 POUNDS OF BEEF, ROLLED WHEAT, WHEAT FLOUR, ROLLED OATS AND BREAD.

	Protein —lbs.	Fuel value —calories.
1 pound of Grape Nuts	.12	1,870
10 pounds round steak, including bone	1.90	8,950
10 pounds beef rump, including bone	1.29	14,050
10 pounds rolled wheat	1.01	17,650
10 pounds bread flour	1.31	16,450
10 pounds rolled oats	1.50	19,650
10 pounds white bread	.80	12,200

CONCLUSION.

The average percentage composition of the three chief classes of these foods is shown in the following condensed table:

Class of foods.	Number of samples.	Water.	Protein.	Fat.	Crude fiber.	N-free extract.	Ash.	Heat of combustion—calories per pound.
		Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Cal.
Corn	8	10.2	8.7	.6	.3	79.9	.3	1750
Oats	14	8.4	16.0	7.2	.9	65.6	1.9	1950
Wheat	19	9.0	12.4	1.9	1.3	73.9	1.5	1800

If these figures be compared with those on page 84, a considerable variation will be noticed, due in part to a difference in the original grains and in part to the methods of manufacture. The fat of the corn kernel is mostly included in the germ which is removed in the manufacture of hominy, thus greatly reducing the fat content. In both cases, however, the three grains, corn, oats and wheat, will be found to stand in the same relation to one another, the oats carrying the most protein, fat, and ash, and yielding the greatest amount of energy per pound. Corn ranks far below oats in these respects, while wheat occupies an intermediate position. The amount of nitrogen-free extract is in inverse ratio to these other constituents.

If we study the above table in connection with the average cost per pound of these three classes of cereal foods, remembering at the same time that the protein is the most valuable of the nutrients, we are left in no doubt as to their relative economy. The average price per pound was:

Corn preparations	5.7 cents
Oat preparations	6.0 cents
Wheat preparations (omitting 4 extreme cases)	10.6 cents

In conclusion, it should be repeated that all the cereal foods examined were good articles and the average prices as a rule are not exorbitant. On the contrary, when compared with the meats and vegetables, the most of them must be classed as very economical foods. The prices are exceedingly variable and, so far as ordinary chemical analysis shows, furnish no measure of the value of the goods. On the other hand, while their comparative digestibility has not yet been well worked out, there can be no doubt that the attempts to increase the digestibility of some of these goods by special treatment has been successful and persons of weak digestion would find it to their advantage to base their selection upon other data than that here given. Fortunately the invalids are still in the minority; and the average consumer, who will experience no difficulty with any of these foods, is not justified in paying 20 cents per pound for a cereal preparation when another, that will serve his purpose exactly as well, can be had at 5 or 6 cents.

VARIATION IN TRILLIUM GRANDIFLORUM.

H. W. Britcher.

To all those who have cultivated vegetable or flower gardens it has probably been a matter of frequent observation that, in any bed composed of plants all of the same sort, there have been individual differences or variations. Some of the plants have been more vigorous growers than others and have come to earlier maturity. In some of the plants the flowers have been uniformly of larger size or perhaps have shown a tendency to be double or in some other way differ from the flowers of the rest of the plants. The horticulturist, growing plants in large quantities, has a much wider field of observation. When he finds a plant exhibiting a slight variation which he considers of value he carefully saves the seed and from it raises another generation of plants, some of which will show the variation in intensified form. From such plants another generation is raised and the process is repeated until the variation becomes fixed, that is, until the desired character is present in all the plants raised from the selected seed. This is known as artificial selection and is one of the ways in which new and improved varieties are produced. Propagation from sports, or plants in which variations become fixed in a single generation, is another method and hybridization is still another. By these methods most of our cultivated crops of the present day have been developed or artificially evolved from, in most cases, practically worthless ancestors. In his book entitled "The Evolution of Our Native Fruits," Professor Bailey says: "The American grapes have given rise to eight hundred domestic varieties, the American plums to more than two hundred, the raspberries to three hundred and various other native fruits have a long cultivated progeny."

In "Animals and Plants Under Domestication" Darwin presented a vast amount of material on artificial selection, and in his "Origin of Species" he showed how by natural selection, the slight variations normally occurring in nature would be magnified until, in the course of ages, several distinct species would result from a single ancestor and differ from that ancestor even more than they differ among themselves. Several instances showing how extensive may be the variations in a single wild species have been given by Wallace in his book entitled "Darwinism." Such differences among individuals of a species in a state of nature are much commoner than the indifferent observer would believe, but are well known to those who, in studying carefully small groups of either plants or animals, have been brought in contact with large numbers of individuals of the same species. Within recent years the results of several such studies of variations have appeared in the scientific periodicals and the main purpose of this article is to present in tabular form the size and color variations found in a number of individuals of the common white trillium or large-flowered wake-robin.

The tendency of *Trillium grandiflorum* to exhibit variations of the sort known as phyllody, or the reversion of flower parts to leaves, is well known to botanists. Professor Charles A. Davis read a paper on the subject at the meeting of the American Association for the Advancement of Science in 1897 and exhibited a large number of specimens collected in Michigan. Mrs. L. L. Goodrich, a well-known botanist of Syracuse, has studied the same phenomenon at considerable length and has found that the variations persist even after removal of the plants to a suitable place in the garden. The results of part of her work were very briefly and unostentatiously noted a few years ago in "Meehan's Monthly." The occurrence of the same phenomenon in other localities has occasionally been brought to the notice of some scientific society so that the present account can lay no claim to novelty. However, it is thought worth while to record in permanent form the actual measurements of various parts of a series of plants exhibiting different degrees of this sort of variation, which, as soon as it materially affects the essential organs of the plant, namely the stamens and pistils, prevents the formation of seed by the plant. This of course stops the direct propagation of the more abnormal forms by the method of seed selection. It is conceivable, however, that such forms may be increased by natural division of the rootstocks of the two-stemmed individuals, and perhaps also by cross pollination, as in many of the very abnormal forms one or more of the stamens produce pollen, which is probably potent. In fact among the plants examined, in only five flowers was it noted that none of the stamens were pollen bearing.

The plants here described were collected near Syracuse, N. Y., in a wood of second-growth timber. The soil, which overlies a limestone formation and which is more or less intermixed with limestone rocks, is a rich leaf-mould on top and a compact clay loam beneath. The rootstocks usually rest on the clay and most of the roots penetrate into it. The richness of the locality in trillium individuals is only poorly shown by the first illustration. In a strip of territory hardly a quarter of a mile wide and less than a mile long normal plants occur by the hundreds of thousands and abnormal ones by thousands. At some spots barely half a dozen abnormal forms can be found among a thousand plants, while at a nearby spot from ten to fifteen out of every hundred will show coloration of the petals with the accompanying variations of the other parts. On the whole, probably at least one per cent of the plants shows abnormal variation.

While the measurements given indicate approximately the size of each part, they do not of course indicate the shape of the outline. This varies to some extent in the cases of the leaf blades and sepals, but very conspicuously so in the case of the petals. Thus, as the photographs and table of measurements show, plants 13 and 143 have petals more than three times as long as they are wide, while numbers 22 and 31 are nearly as broad as they are long. Numbers 84, 105 and 163*a* are just as broad as long, while 163*b* is broader than long. But, however much the outline may vary, the petal never loses its pointed tip. In some of the specimens examined it was in a deeper notch than shown in plants 111 and 22. It comes more nearly being obliterated in extremely broad-petaled plants of the normal sort, such as number 12, than it does in any of the greatly abnormal varieties.

In the following table all the measurements are in millimeters, the greatest width of the organ being given first and then the length. When two figures are given in the column "Length of ovary," the first refers to the length of the stalk or stem upon which in such specimens the ovary is placed, and the second refers to the length of the ovary proper, as indicated usually by a slight swelling.

In the column "Color of petal" the size of the green centre stripe is frequently given and also its position (proximally or distally) when it is not approximately in the centre of the petal. When the green stripe is rather narrow it usually does not extend to either the base or the tip of the petal.

ABBREVIATIONS.

b. border, referring to a space from two to four millimeters wide along the margin of the petal. *c.* centre. *dis.* distally, referring to the distal part of the petal. *ed.* edge, referring to a space not more than one millimeter wide along the margin of the petal. *gr.* green. *lt.* light. *m.* margin, referring to a space from four to six millimeters wide along the margin of the petal. *pr.* proximally, referring to the proximal or basal part of the petal. *wh.* white.

NOTES.

1-14. Typical plants, showing ordinary slight variations of the different parts.

15-17. Plants with petioled leaves, all the other parts being typical.

18-129. Abnormal plants, showing variation in petal coloration and in structure of parts.

22. Length of petioles 76, 81 and 86 mm.

24. The green centre stripes on the petals are 10, 14 and 18 mm. wide.

25. The green centre stripes on the petals are 12, 14 and 22 mm. wide.

26. The third petal is smaller than the others, the stem being 14 mm. long and the blade 18x30 mm. in size; two stamens are aborted, the others having filaments 14, 10, 8 and 4 mm. long and anthers 9, 9, 5 and 0 mm. long.

27. Two stamens are aborted.

28. Two leaves are reduced to spurs 2 mm. long.

29. All the leaves are aborted.

30. One petal is entirely white, one has a trace of green along its centre distally and the other has a green stripe 3 mm. wide along the centre.

31. All the leaves are reduced to spurs 1 mm. long at the tip of the rootstock.

32. All the leaves are reduced to spurs 3 mm. long and one petal has a white border distally.

36. Two petals are entirely white.

37. One petal is entirely white.

49. One petal has a green centre 22x26 mm. in size.

55. One petal has a green centre 2x16 mm. in size.

65. Four stamens have filaments only 2 mm. long and anthers aborted.

67. Five stamens have filaments only 3 mm. long and anthers aborted.

71. All the leaves are reduced to spurs 4 mm. long.

73. One petal is entirely white, one has a green centre 1 x 15 mm. in size and the other has a green centre 2 x 30 mm. in size.

74. One petal is entirely white, one has a green centre 1 x 12 mm. in size and the third has a green centre 2 x 14 mm. in size.

92. One leaf is reduced to a spur 1 mm. long. There are only two sepals, which are opposite and two petals, also opposite. One stamen is 11 mm. long and 4 mm. wide and is white edged.

104. Three stamens have filaments only 2 mm. long and anthers aborted.

106. One petal is reduced to a spur 3 mm. long.

108. Four stamens are aborted.

109. Two stamens have filaments 6 mm. long and anthers aborted. The ovary is stalked.

111. Two leaves are reduced to spurs.

120. Five stamens have filaments 10 mm. long and anthers aborted.

121. One stamen is aborted.

122. One leaf has the petiole 135 mm. long and the blade 40 x 60 mm. in size. The stamens of the outer whorl have filaments 14, 28 and 4 mm. long and anthers 6, 8 and 0 mm. long, while those of the inner whorl have filaments 30, 28 and 24 mm. long and anthers 8, 8 and 7 mm. long.

123. One leaf is reduced to a spur 4 mm. long.

124. The stamens of the outer whorl have filaments 6, 12 and 18 mm. long and anthers 6, 8 and 8 mm. long, while those of the inner whorl have filaments 9, 13 and 21 mm. long and anthers 8, 8 and 10 mm. long.

127. Two leaves entirely aborted. There are only two sepals which are opposite and two petals, also opposite: two stamens aborted.

128. The place of the ovary is taken by three leaf-like parts with stems 10 mm. long and blades 5 x 14 mm. in size. Within this circle are two pollen bearing stamens with filaments 4 and 7 mm. long and anthers 5 and 10 mm. long.

129. In this plant the sepals are marked with white, one being two-thirds white, one being one-half white and one having a white edge along one side proximally.

130-133. Typical plants in which a single rootstock gives rise to two stems.

134-180. Abnormal plants in which a single rootstock gives rise to two stems.

141 *a*. One petal has a stem 6 mm. long and a blade 16 x 30 mm. in size.

143 *b*. One petal is entirely white.

144 *b*. Two petals are green at their bases and white distally.

146 *a*. All the leaves are reduced to spurs 3 mm. long.

b. All parts above the leaves are aborted.

147 *a*. Two leaves are reduced to spurs.

b. One leaf is reduced to a spur and all parts above leaves are aborted.

148 *a*. One stamen is aborted and two of the others have filaments 13 and 6 mm. long and anthers 8 and 8 mm. long. Pistil aborted.

b. One stamen has the filament 12 mm. long and the anther 9 mm. long. Pistil aborted. Leaves in both *a* and *b* are reduced to spurs 1 mm. long.

149 *a*. All the leaves are reduced to spurs.

b. Only one leaf present, the other two being mere spurs.

151 *a*. This flower has twelve stamens each with a filament 7 mm. long and an anther 8 mm. long.

152 *a*. The sepals are red and green and the place of the petals is taken by three stamens having red filaments 6 mm. long and green anthers 6 mm. long.

b. The sepals are red-veined and interpolated between the sepals and petals are six extra stamens, green in color and having filaments 5 mm. long and anthers 8 mm. long.

164 *a*. Five stamens have light green filaments only 2 mm. long and anthers aborted.

165 *b*. Four stamens aborted.

166 *a*. Two stamens aborted.

175 *a*. Only two leaves are present, the blades of which are 43 x 52 mm. and 35 x 56 mm. in size. There are only two sepals which are opposite and two petals, also opposite.

176 *b*. Three stamens with filaments 6 mm. long and anthers aborted.

177 *b*. Two leaves reduced to spurs and three stamens with filaments 2 mm. long and anthers aborted.

178 *a*. Only three stamens, which are green in color and have filaments 29, 20 and 9 mm. long and anthers 10, 10 and 0 mm. long.

181. A typical plant in which the rootstock sends up three stems.

182-185. Abnormal plants in which the rootstock sends up three stems.

184 *a*. Five stamens have filaments 3 mm. long and anthers aborted.

b. The third leaf has the petiole 38 mm. long and the blade 34 x 44 mm. in size.

c. The place of the third leaf is taken by two leaves having a common petiole 4 mm. long and separate petioles 50 and 46 mm. long and blades 23 x 38 mm. and 26 x 44 mm. in size.

185 *a*. One petal has a green stripe 5 mm. wide along one margin.

b. One petal has four yellowish green veins, one is notched at one side and the notch has a yellow pollen bearing edge backed by a green line, and the third petal is lacking, its space being left open.

c. Only two sepals, the space of the third being open. Only two petals which are opposite. One of them is 37 x 44 mm. in size and entirely white. The other is 48 x 54 mm. in size and has directly over the open sepal space a green stripe 26 x 54 mm. in size. Within this green stripe is a white stripe 3 x 54 mm. in size. Two of the stamens have their filaments fused and their anthers fused for 4 mm., the remaining 10 mm. of the anthers being separate.

Number.	Length of stem.	Length of petiole.	Size of leaf blade.	Length of peduncle.	Length of sepal stem.	Size of sepal blade.	Length of petal stem.	Size of petal blade.
1	180	....	80×90	63	....	18×46	....	33×50
2	210	....	67×95	44	....	13×33	....	26×47
3	225	....	80×95	70	....	18×54	....	46×80
4	235	....	65×100	50	....	10×38	....	20×54
5	275	....	95×115	73	....	18×48	....	34×58
6	290	....	78×115	62	....	16×48	....	28×72
7	305	....	94×118	64	....	16×47	....	30×64
8	325	....	85×120	64	....	13×58	....	30×62
9	340	....	113×157	93	....	20×56	....	37×74
10	220	....	84×84	60	....	20×38	....	36×50
11	240	....	100×124	84	....	26×58	....	40×74
12	230	....	86×100	53	....	14×36	....	30×49
13	250	....	67×98	47	....	10×36	....	18×50
14	265	....	105×113	60	....	21×50	....	40×68
15	130	22	54×90	80	....	17×49	....	25×60
16	145	6	46×76	50	....	14×40	....	19×54
17	295	2	68×105	50	....	12×44	....	17×56
18	130	50	90×96	75	....	33×70	14	48×60
19	162	2	42×56	30	....	11×26	....	22×34
20	115	20	50×60	28	4	20×44	12	22×42
21	115	4	36×50	12	....	13×34	4	24×34
22	65	81	35×54	118	....	20×40	8	30×34
23	175	18	42×62	54	....	17×40	7	26×44
24	335	....	110×140	72	....	25×58	....	46×68
25	210	22	90×98	90	....	24×48	....	46×60
26	35	90	46×60	85	14	26×45	22	25×40
27	87	12	46×52	18	....	18×34	6	19×32
28	18	60	32×45	95	....	20×37	3	22×37
29	2	....	spurs	155	....	30×63	22	38×54
30	165	5	74×79	62	....	24×42	....	32×52
31	....	....	spurs	168	....	28×60	12	45×50
32	60	....	spurs	106	....	30×57	8	32×50
33	230	10	96×98	70	....	30×60	....	46×62
34	195	10	68×86	56	....	18×48	....	30×55
35	235	40	86×115	112	....	20×56	....	26×70
36	250	3	44×82	38	....	12×40	....	16×58
37	190	6	45×86	54	....	13×38	....	17×47
38	235	5	56×82	38	....	16×42	....	20×60
39	200	12	56×72	62	....	20×42	....	33×58
40	155	35	60×84	65	4	24×54	15	24×52
41	160	12	56×80	50	....	17×50	....	30×55
42	120	46	43×58	80	....	20×50	....	26×50
43	140	38	45×70	82	....	22×42	....	31×48
44	195	6	48×82	50	....	16×48	....	20×60
45	180	38	76×86	70	....	20×48	6	30×46
46	180	10	56×90	43	....	18×48	....	26×56
47	130	40	49×68	52	4	23×46	22	35×42
48	210	8	70×78	18	....	18×44	6	38×44
49	255	4	62×74	34	....	15×40	....	37×46
50	10	70	68×85	122	....	24×55	....	30×55
51	55	135	52×78	210	....	24×54	....	33×57
52	210	4	60×58	26	....	15×42	....	27×38
53	110	56	34×60	102	....	16×42	....	38×44
54	185	12	58×86	45	....	20×52	10	28×42
55	235	2	62×72	48	....	15×34	....	25×45
56	260	....	93×117	56	....	17×43	....	38×55
57	270	....	87×105	43	....	20×49	....	37×66
58	190	4	55×76	26	....	16×42	4	24×40
59	165	6	68×68	32	....	24×44	6	38×40
60	54	36	36×50	64	....	20×42	8	22×38
61	58	6	33×48	10	....	12×28	6	15×18
62	80	4	47×58	3	....	15×34	4	18×28
63	30	12	52×54	2	....	14×37	12	15×20
64	16	42	22×30	44	4	15×26	8	15×24
65	75	34	42×50	66	....	18×34	4	16×30

Color of Petal.	Length of filament.	Color of filament.	Length of anther.	Color of anther.	Length of ovary.	Color of ovary.	Length of style.	Color of style.	
white	8	white	12	white	8	white	10	white	note.
white	6	white	10	white	5	white	5	white	
white	10	white	12	white	10	white	10	white	
white	8	white	7	white	5	white	5	white	
white	8	white	10	white	8	white	8	white	
white	9	white	9	white	8	white	10	white	
white	8	white	10	white	8	white	8	white	
white	9	white	10	white	6	white	6	white	
white	10	white	10	white	9	white	6	white	
white	6	lt. gr.	12	white	8	white	8	white	
white	8	lt. gr.	14	white	10	white	10	white	
white	7	lt. gr.	8	lt. gr.	7	white	4	white	
white	7	lt. gr.	8	lt. gr.	4	white	6	white	
white	8	lt. gr.	14	lt. gr.	10	white	10	white	
white	8	lt. gr.	12	lt. gr.	6	lt. gr.	9	lt. gr.	note.
white	8	white	8	white	5	white	5	white	note.
white	8	white	8	lt. gr.	6	white	6	white	note.
gr. c., m. wh	14	lt. gr.	14	lt. gr.	18	green	22	green	
gr. c., m. wh	5	lt. gr.	8	lt. gr.	4	green	5	green	
gr., ed. wh. dis	9	lt. gr.	10	lt. gr.	8	green	10	green	
green	7	lt. gr.	10	green	12	green	12	green	
gr., m. wh. dis	10	lt. gr.	12	lt. gr.	7	lt. gr.	10	lt. gr.	note.
gr. pr., wh. dis	11	lt. gr.	9	lt. gr.	8	green	8	lt. gr.	
gr. c. 10, 14, 18 wide	10	lt. gr.	15	lt. gr.	10	lt. gr.	20	white	
gr. c. 12, 14, 22	11	lt. gr.	11	lt. gr.	7	lt. gr.	14	white	note.
note	note	green	note	green	......	....	.....	....	note.
gr., ed. wh. dis.	5	lt. gr.	12	lt. gr.	6	green	9	green	note.
gr., m. wh. dis.	8	lt. gr.	8	lt. gr.	5	green	7	green	note.
gr., m. wh. dis..	14	lt. gr.	10	lt. gr.	8	green	20	green	note.
gr. c. 5×36	8	white	9	white	5	white	9	white	note.
gr. m. wh	12	lt. gr.	10	lt. gr.	12	green	24	green	note.
gr., m. wh. dis	10	lt. gr.	10	lt. gr.	10	green	12	green	note.
gr. c. 8×45	10	lt. gr.	10	lt. gr.	9	lt. gr.	18	lt. gr.	
gr. c. 16×54	10	white	11	white	8	lt. gr.	14	lt. gr.	
gr. c. 2×18 dis	11	white	12	lt. gr.	6	lt. gr.	14	white	
gr. c. 1×20	10	white	8	lt. gr.	4	white	6	white	note.
gr. c. 2×30	7	white	5	lt. gr.	4	lt. gr.	5	white	note.
gr. c. 16×42.	10	lt. gr.	10	lt. gr.	6	green	14	lt. gr.	
gr. c. 4×32	8	white	10	lt. gr.	5	lt. gr.	13	white	
gr., b. wh. dis	11	lt. gr.	10	lt. gr.	10	green	12	lt. gr.	
gr. c. 12×35	10	white	10	lt. gr.	8	lt. gr.	12	white	
gr. c. 5×32	7	lt. gr.	9	green	5	lt. gr.	10	lt. gr.	
gr. c. 5×32	8	lt. gr.	10	lt. gr.	4	lt. gr.	10	white	
gr. c. 4×35	10	lt. gr.	9	lt. gr.	6	lt. gr.	9	white	
gr., b. wh. dis	12	green	12	lt. gr.	5	green	11	lt. gr.	
gr. c. 4×35	10	white	9	lt. gr.	6	white	7	white	
gr., m. wh	14	green	9	green	16	green	14	green	
gr. c. 28×34.	7	green	9	green	8	green	12	green	
gr. c. pr. 14×13	11	lt. gr.	7	lt. gr.	4	green	6	lt. gr.	note.
gr. c. 3×24	10	lt. gr.	10	green	8	green	12	lt. gr.	
gr. c. 10×50	10	lt. gr.	10	green	7	green	11	lt. gr.	
gr., b. wh.	2	green	.....	....	5	green	9	green	
gr. c. 14×42	8	lt. gr.	8	green	4	green	11	lt. gr.	
gr., ed. wh	9	lt. gr.	7	green	7	green	7	lt. gr.	
gr. c. 16×24	10	lt. gr.	10	green	5	green	9	lt. gr.	note.
gr. c. 28×38	8	lt. gr.	10	lt. gr.	5	lt. gr.	11	lt. gr.	
gr. c. dis. 2×13..	10	lt. gr.	12	lt. gr.	6	lt. gr.	12	white	
green	9	lt. gr.	7	green	7	green	12	green	
green.	11	lt. gr.	14	green	10	green	14	green	
gr., b. wh. dis	10	lt. gr.	6	green	8	green	10	green	
gr., ed. wh. dis.	2	green	......	....	4	green	4	green	
gr., b. wh. dis	2	green	......	.. ....	3	green	4	green	
gr., ed. wh. dis.	1	lt. gr.	......	....	5	green	8	green	
gr., ed. wh. dis.	2	lt. gr.	......	....	4	green	6	green	
gr., ed. wh. dis.	5	lt. gr.	7	green	6	green	4	green	note.

Number.	Length of stem.	Length of petiole.	Size of leaf blade.	Length of peduncle.	Length of sepal stem.	Size of sepal blade.	Length of petal stem.	Size of petal blade.
66	170	6	98×98	46	....	22×54	8	44×50
67	170	8	68×74	40	......	19×46	4	32×42
68	130	10	62×64	40	......	22×46	8	29×38
69	140	6	66×70	24	......	19×47	8	34×44
70	140	6	54×68	6	......	17×38	4	32×38
71	60	......	spurs	112	......	24×54	6	32×46
72	165	2	54×85	40	......	14×42	4	22×40
73	210	22	54×70	78	......	20×50	....	26×60
74	185	8	57×75	65	......	20×46	....	28×50
75	280	.....	100×108	53	.....	22×46	....	42×56
76	250	2	95×115	56	......	24×54	......	45×60
77	210	2	102×128	34	......	20×58	2	44×55
78	180	4	95×92	45	....	22×48	......	50×52
79	235	8	56×90	60	......	16×42	......	29×50
80	185	8	54×75	40	......	15×44	10	22×40
81	200	8	76×80	48	......	20×52	4	40×44
82	225	2	56×62	13	......	17×36	4	25×30
83	290	10	85×108	54	......	29×72	....	46×80
84	100	2	54×40	17	....	16×27	....	25×25
85	180	2	65×95	44	....	13×50	....	28×49
86	180	5	60×90	44	......	16×50	4	26×46
87	140	36	52×76	42	2	18×46	14	18×39
88	60	42	37×58	58	......	15×38	12	15×36
89	175	2	54×78	36	....	16×44	....	29×38
90	120	32	52×68	78	....	17×38	......	20×42
91	90	125	85×110	192	......	44×78	8	42×70
92	1	140	64×70	182	....	28×44	4	20×36
93	165	10	64×66	10	2	22×46	16	31×40
94	70	100	66×74	152	......	28×50	4	31×50
95	2	....	spurs	115	12	28×44	22	21×35
96	5	.....	spurs	170	......	28×56	10	32×50
97	90	34	35×56	52	8	18×44	20	28×42
98	65	36	50×66	54	6	19×44	20	22×37
99	75	60	52×70	67	22	22×48	34	31×45
100	110	30	48×62	46	6	20×49	17	27×40
101	190	6	74×78	25	....	11×50	6	31×41
102	195	6	75×100	29	......	20×56	4	34×50
103	5	......	spurs	140	24	32×67	48	40×56
104	120	36	42×58	38	4	22×42	16	25×37
105	100	8	44×50	6	4	18×40	14	30×30
106	125	48	54×68	27	23	30×55	45	26×44
107	80	8	30×48	6	2	12×32	10	16×28
108	175	5	65×66	42	.....	26×46	3	36×46
109	25	110	40×58	88	21	27×50	35	23×40
110	70	60	56×70	82	10	26×52	34	33×60
111	......	130	83×90	150	8	35×64	38	41×54
112	8	60	36×52	90	6	25×44	14	20×40
113	95	64	55×76	74	8	25×56	26	22×46
114	155	50	74×94	36	14	28×64	37	40×52
115	125	80	66×80	112	4	27×52	12	36×52
116	130	44	66×66	64	6	26×50	26	36×46
117	105	46	67×80	72	5	26×55	24	38×55
118	100	30	48×60	45	4	19×40	20	28×40
119	45	73	52×68	94	......	25×48	12	34×45
120	225	44	58×78	44	10	27×50	28	22×44
121	65	83	59×69	33	44	33×59	64	36×52
122	14	117	47×60	94	36	27×52	46	28×45
123	8	110	28×50	140	2	18×40	8	12×32
124	8	100	60×76	100	18	20×55	42	33×50
125	60	75	52×58	66	8	26×36	25	23×40
126	70	58	40×58	87	2	18×40	8	14×30
127	235	....	110×135	75	......	22×52	......	45×68

Color of petal.	Length of filament.	Color of filament.	Length of anther.	Color of anther.	Length of ovary.	Color of ovary.	Length of style.	Color of style.	
gr., b. wh	12	lt. gr.	12	green	8	lt. gr.	16	green	
gr., ed. wh	8	lt. gr.	10	green	7	lt. gr.	17	green	note.
gr., ed. wh	7	green	9	green	9	green	12	green	
gr., b. wh	14	green	10	green	7	green	15	green	
gr. c. pr. 26×28	4	green	6	green	7	green	6	lt. gr.	
gr. c. 20×40	10	lt. gr.	8	lt. gr.	8	green	14	green	note.
gr. ed. wh	8	green	11	green	7	green	12	green	
note	12	white	9	lt. gr.	6	green	12	white	note.
note	9	white	8	lt. gr.	4	white	6	white	note.
gr. c. 30×40	10	white	12	lt. gr.	6	lt. gr.	16	white	
gr. c. 36×52	12	lt. gr.	14	lt. gr.	12	lt. gr.	18	lt. gr.	
gr., ed. wh	8	lt. gr.	12	green	6	lt. gr.	16	green	
gr. c. 30×50	10	lt. gr.	14	lt. gr.	10	green	20	green	
gr. c. 4×30	10	white	10	lt. gr.	6	lt. gr.	10	white	
gr., ed. wh. dis.	8	lt. gr.	10	green	6	green	14	green	
gr. c. pr. 30×28	5	lt. gr.	.....	....	6	lt. gr.	10	green	
gr., ed. wh. dis	1	lt. gr.	.....	....	4	lt. gr.	4	lt. gr.	
gr. c. pr. 22×45	14	lt. gr.	16	lt. gr.	14	green	20	green	
gr., ed. wh. dis	2	lt. gr.	...	....	3	lt. gr.	5	lt. gr.	
gr., ed. wh	8	lt. gr.	11	green	5	lt. gr.	16	green	
gr., ed. wh	10	lt. gr.	10	green	8	lt. gr.	14	green	
gr., ed. wh. dis	1	lt. gr.	.....	......	10	lt. gr.	8	green	
gr., ed. wh	11	green	8	green	8	green	8	green	
gr., ed. wh	7	green	15	green	6	lt. gr.	12	green	
gr. c. 2×10	7	white	7	lt. gr.	4	green	5	lt. gr.	
gr., m. wh	10	white	10	lt. gr.	12	lt. gr.	18	lt. gr.	
gr. c. 8×34	8	white	7	lt. gr.	3	lt. gr.	3	lt. gr.	note.
gr. b. wh. dis	1	green	.....	....	7	green	15	green	
gr. c. 15×36	10	lt. gr.	8	green	10	green	12	lt. gr.	
gr., b. wh. dis	6	green	......	....	5	green	5	green	
gr., ed. wh	12	lt. gr.	10	green	9	green	17	green	
gr., b. wh. dis	10	green	10	green	8	green	12	green	
gr., b. wh. dis	14	lt. gr.	8	green	13	green	10	green	
gr., b. wh	18	lt. gr.	10	green	14	green	14	green	
gr., ed. wh. dis	10	lt. gr.	11	green	12	green	12	green	
green	4	green	......	... ...	5	green	10	green	
green	14	green	10	green	9	green	13	green	
gr., ed. wh. dis	16	lt. gr.	12	green	30	green	16	green	
green	9	green	7	green	8	green	8	green	note.
green	2	green	......	....	8	green	14	green	
green	......	... ...	......	... ..	......	......	......	....	note.
gr., b. wh. dis	2	green	......	....	3	green	6	green	
gr. b. wh	8	green	10	green	8	green	14	green	note.
green	12	lt. gr.	8	green	15-5	green	18	green	note.
gr., m. wh. dis	18	lt. gr.	8	lt. gr.	12-6	green	16	green	
gr., b. wh. dis	18	green	14	green	14-6	green	24	green	note.
gr., b. wh. dis	10	lt. gr.	8	green	5-6	lt. gr.	12	green	
gr., ed. wh. dis	14	green	10	green	14-6	green	22	green	
gr., ed. wh. dis	14	lt. gr.	13	green	16-10	green	22	green	
gr., b. wh. dis	12	lt. gr.	14	green	7-13	green	13	lt. gr.	
gr., b. wh. dis	18	green	11	green	10-8	green	22	green	
gr., b. wh. dis	15	lt. gr.	12	green	7-6	green	16	lt. gr.	
gr., m. wh. dis	16	green	8	green	9-5	green	12	green	
gr. b. wh. dis	11	lt. gr.	9	green	10-5	green	15	green	
green	14	lt. gr.	8	lt. gr.	10-6	green	16	green	note.
gr., b. wh. dis	34	green	10	green	23-10	green	27	green	note.
gr. pr., wh. dis	......	note	......	....	15-5	green	13	green	note.
gr., ed. wh. dis	10	green	6	green	4-4	green	7	green	note.
gr., ed. wh. dis	.....	note	......	... ...	16-8	green	20	green	note.
green	3	green	......	....	8-8	green	16	green	
green	3	green	5	lt. gr.	5-5	green	6	green	
gr. c. 2×68	6	lt. gr.	10	lt. gr.	10	white	8	white	note.

Number.	Length of stem.	Length of petiole.	Size of leaf blade.	Length of peduncle.	Length of sepal stem.	Size of sepal blade.	Length of petal stem.	Size of petal blade.
128	....	....	....	135	....	25×44	5	22×34
129	230	2	80×90	60	....	16×41	....	32×50
130	330	....	124×155	85	....	18×56	....	34×76
	300	....	120×145	85	....	19×49	......	40×74
131	305	......	93×130	70	....	19×50	....	37×62
	305	....	78×125	60	......	18×48	....	32×64
132	275	....	76×100	46	....	15×39	......	36×56
	285	....	70×120	56	....	14×46	....	28×62
133	255	....	80×115	56	....	12×46	......	22×64
	245	....	80×110	60	....	14×45	....	38×64
134	115	44	60×68	84	....	20×44	4	26×42
	1	105	56×70	90	28	34×56	46	40×46
135	125	8	52×66	24	....	19×46	8	27×37
	115	20	46×60	26	....	19×44	8	22×36
136	125	20	31×42	38	......	15×36	4	14×34
	120	14	62×66	17	4	24×52	16	36×44
137	95	26	54×70	10	....	21×53	12	32×52
	35	16	64×76	3	....	16×38	....	34×42
138	155	34	44×75	80	....	20×45	....	24×46
	110	50	36×60	93	....	22×46	4	26×42
139	110	14	32×50	52	....	14×35	....	19×40
	145	8	42×60	48	....	12×38	....	17×44
140	95	60	60×70	102	4	30×52	12	33×45
	60	75	45×60	115	4	28×48	16	28×42
141	75	110	35×66	147	....	23×46	26	21×44
	....	....	spurs	170	10	23×54	38	29×40
142	80	40	33×54	83	....	20×44	5	20×44
	115	35	40×70	75	....	20×48	5	28×45
143	150	12	46×84	55	....	16×44	....	14×50
	50	70	37×74	110	....	17×46	....	13×44
144	155	12	40×66	56	....	9×34	....	12×40
	28	95	30×53	140	....	14×34	4	15×34
145	85	40	37×60	85	....	16×38	4	26×40
	4	....	spurs	144	....	17×34	6	23×34
146	20	....	spurs	115	....	22×46	6	26×40
	120	12	50×68	....	....	....	....	....
147	12	120	33×48	164	....	22×43	6	24×40
	4	142	42×54	....	....	....	......	....
148	....	....	spurs	85	12	31×52	28	21×40
	....	....	spurs	70	25	31×49	36	20×38
149	2	....	spurs	135	4	20×40	10	20×38
	70	36	38×52	....	......	....	....	....
150	210	....	92×115	44	....	18×46	....	42×61
	210	8	60×82	36	....	15×44	....	30×48
151	3	....	spurs	155	....	20×40	....	30×40
	....	....	....	170	......	23×36	....	27×38
152	140	....	31×56	....	....	26×50	....	....
	130	....	33×50	....	....	30×48	....	13×32
153	250	....	80×93	54	....	20×46	....	43×58
	245	....	75×88	43	....	18×46	....	40×56
154	135	42	62×76	95	....	25×48	....	33×50
	7	....	spurs	165	....	42×64	8	42×50
155	130	57	62×76	120	....	22×52	....	30×48
	122	14	47×50	42	....	20×44	....	18×33
156	155	5	50×62	26	......	17×36	....	32×44
	120	25	43×60	32	2	18×38	12	30×35
157	170	44	54×84	90	....	22×50	......	32×54
	110	70	39×70	107	....	28×58	12	39×52
158	205	16	70×95	71	.....	20×54	....	37×66
	115	....	22×40	....	....	....	....	....
159	180	4	60×66	32	......	15×34	....	32×46
	170	4	50×56	36	......	12×30	......	22×38

Color of petal.	Length of filament.	Color of filament.	Length of anther.	Color of anther.	Length of ovary.	Color of ovary.	Length of style.	Color of style.	
gr., b. wh. dis	12	lt. gr.	8	lt. gr.	......	note	......	......	note.
white	6	lt. gr.	9	white	5	white	7	white	note.
white	9	white	12	white	12	white	12	white	note.
white	8	white	12	white	10	white	10	white	
white	9	white	12	white	8	white	10	white	
white	8	white	12	white	8	white	8	white	
white	8	white	12	white	8	white	10	white	
white	8	white	10	white	7	white	9	white	
white	8	white	10	lt. gr.	6	white	10	white	
white	8	white	10	lt. gr.	6	white	10	white	
gr., ed. wh	10	white	8	lt. gr.	6	lt. gr.	6	lt. gr.	
gr., ed. wh. dis	20	lt. gr.	12	lt. gr.	20	lt. gr.	14	lt. gr.	
green	2	green	......	......	8	green	14	green	
green	2	green	......	......	8	green	12	green	
gr., ed. wh. dis	2	lt. gr.	......	......	......	......	......	......	
gr., ed. wh. dis	2	lt. gr.	......	......	10	green	14	green	
gr., b. wh. dis	2	lt. gr.	......	......	2	lt. gr.	8	lt. gr.	
gr., m. wh. dis	......	......	......	......	4	lt. gr.	6	lt. gr.	
gr. c. 12×32	8	white	7	lt. gr.	5	lt. gr.	9	lt. gr.	
gr., b. wh. dis	8	white	6	lt. gr.	5	lt. gr.	10	lt. gr.	
gr. c. 3×18	7	white	8	white	4	lt. gr.	6	white	
white	7	white	8	lt. gr.	4	lt. gr.	6	white	
gr., b. wh. dis	9	lt. gr.	10	lt. gr.	12	green	12	lt. gr.	
gr., m. wh. dis	12	lt. gr.	9	lt. gr.	12	green	16	lt. gr.	
gr., b. wh. dis	11	lt. gr.	9	green	7	green	7	green	note.
gr., ed. wh. dis	23	lt. gr.	10	green	18	green	12	green	
gr. c. 12×44	9	lt. gr.	9	lt. gr.	6	green	14	lt. gr.	
gr. c. 16×44	8	lt. gr.	8	lt. gr.	6	green	16	lt. gr.	
gr. c. 2×50	7	lt. gr.	7	white	3	green	3	lt. gr.	
gr. 2×42	6	lt. gr.	6	white	4	green	2	lt. gr.	note.
white	6	white	6	lt. gr.	3	white	3	white	note.
gr. c. 2×12	7	lt. gr.	8	lt. gr.	4	lt. gr.	6	white	
gr. c. 12×36	8	lt. gr.	8	white	6	lt. gr.	8	lt. gr.	
gr., b. wh	8	lt. gr.	8	white	6	green	8	lt. gr.	
gr., m. wh	10	lt. gr.	10	lt. gr.	8	green	10	green	note.
......	......	......	......	......	......	......	......	......	
gr., ed. wh. dis	8	white	8	lt. gr.	4-4	green	8	lt. gr.	note.
......	......	......	......	......	......	......	......	......	
green	4	lt. gr.	6	lt. gr.	......	......	...	......	note.
green	5	green	5	green	......	......	......	...	
green	6	green	7	green	6	green	6	green	note.
......	......	......	......	......	......	......	......	......	
gr., b. wh	10	lt. gr.	12	green	8	lt. gr.	20	lt. gr.	
gr., b. wh	9	lt. gr.	9	green	8	lt. gr.	12	lt. gr.	
gr. c. 12×34	8	lt. gr.	7	green	8	green	8	green	note.
gr. c. 12×32	7	lt. gr.	8	green	8	green	2	white	
note	6	lt. red	6	green	......	......	......	......	note.
red and green	4	red	6	red	......	......	......	......	
gr. c. 28×40	12	lt. gr.	13	lt. gr.	6	lt. gr.	18	lt. gr.	
gr. c. 25×45	10	lt. gr.	13	lt. gr.	8	lt. gr.	16	lt. gr.	
gr. c. 20×45	10	lt. gr.	10	green	8	green	14	green	
gr. c. 30×42	11	green	11	green	4	green	12	green	
gr. c. 16×35	9	green	12	green	8	green	17	green	
gr., ed. wh	4	green	10	lt. gr.	6	green	14	green	
gr., ed. wh	8	green	11	green	6	green	14	green	
gr., ed. wh	14	green	10	green	10	green	12	green	
gr. c. 12×42	10	white	10	green	8	green	14	lt. gr.	
gr. c. 20×49	11	lt. gr.	11	green	8	green	17	lt. gr.	
gr. c. dis. 5×28	10	lt. gr.	10	green	6	green	20	white	
......	......	......	......	......	......	......	......	......	
gr. c. 2×12	8	lt. gr.	8	green	6	green	8	lt. gr.	
gr. c. 12×26	7	lt. gr.	6	green	3	lt. gr.	5	lt. gr.	

Number.	Length of stem.	Length of petiole.	Size of leaf blade.	Length of peduncle.	Length of sepal stem.	Size of sepal blade.	Length of petal stem.	Size of petal blade.
160	115	46	36×56	78	....	19×43	4	21×41
	85	60	34×50	80	....	18×40	8	14×34
161	160	12	41×65	50	....	14×35	....	20×38
	115	30	32×53	60	....	16×36	4	21×33
162	190	....	70×80	32	....	22×48	2	38×44
	50	....	74×76	4	....	12×28	....	....
163	90	80	60×75	96	2	23×48	8	40×40
	8	160	55×65	180	10	30×46	30	43×40
164	55	38	38×44	36	8	21×36	20	20×32
	42	58	42×48	....	......	....	......	....
165	90	40	32×50	66	....	16×34	4	15×34
	54	50	32×48	61	4	15×32	10	16×30
166	1	100	33×47	138	....	15×34	8	20×32
	....	100	40×50	......	....	....	......	....
167	125	42	38×60	66	....	14×32	2	8×26
	115	38	46×54	......	....	....	....	....
168	80	28	31×54	67	......	16×40	......	22×46
	1	....	spurs	145	......	22×44	4	23×40
169	110	25	30×50	52	....	12×34	4	16×34
	80	40	30×48	39	5	16×34	14	16×30
170	44	96	42×55	113	6	19×38	20	23×34
	40	80	38×58	108	8	19×36	20	20×30
171	120	58	58×70	103	....	22×48	5	32×48
	45	110	50×68	143	4	24×42	14	32×40
172	40	105	50×74	133	2	25×50	10	30×38
	2	....	spurs	220	....	25×50	4	35×48
173	155	10	70×65	20	....	25×52	10	42×46
	105	15	74×64	2	....	22×38	14	34×40
174	160	20	54×60	40	....	20×46	16	27×38
	145	20	60×66	42	2	20×50	12	32×42
175	70	40	note	64	....	16×39	4	20×30
	10	90	38×52	......	....	....	....	....
176	2	....	spurs	200	2	26×56	10	36×44
	2	....	spurs	156	8	31×50	20	30×43
177	1	100	34×50	145	......	20×40	4	19×40
	....	93	33×40	118	4	19×37	15	18×34
178	10	115	65×65	74	25	30×60	42	40×46
	....	90	40×55	72	12	28×46	26	35×40
179	160	42	48×72	64	....	19×50	6	29×44
	160	38	42×70	54	....	19×45	8	22×38
180	....	105	40×65	130	8	25×48	22	26×42
	....	....	spurs	188	......	25×50	4	31×48
181	225	....	85×112	74	....	23×58	......	38×76
	233	....	70×100	48	....	15×52	....	30×62
	235	....	86×120	70	....	22×58	....	44×80
182	330	....	103×107	46	....	26×54	....	44×60
	335	6	88×94	36	....	26×52	....	38×52
	332	....	103×105	55	....	27×56	....	40×64
183	....	85	36×46	....	....	....	....	....
	40	70	54×74	115	....	13×40	....	20×46
	1	....	spurs	142	....	17×40	....	30×50
184	66	44	36×42	70	....	15×35	8	17×30
	70	44	34×46	....	....	....	....	....
	60	44	32×44	....	....	....	....	....
185	325	....	98×127	95	....	23×52	....	36×56
	320	....	100×130	100	....	37×56	....	35×60
	325	....	93×125	85	....	21×58	....	....

Color of petal.	Length of filament.	Color of filament.	Length of anther.	Color of anther.	Length of ovary.	Color of ovary.	Length of style.	Color of style.	
gr., ed. wh.	11	lt. gr.	10	green	8	green	10	green	
gr. pr., m. wh. dis	10	green	10	green	10	green	8	green	
gr. c. 6×34	8	lt. gr.	7	lt. gr.	......	......	......	......	
gr. c. 18×30	10	lt. gr.	8	green	7	green	5	green	
gr., ed. wh.	14	lt. gr.	11	green	9	green	15	green	
......	......	......	......	......	......	......	......	......	
gr., m. wh. dis	......	......	......	......	......	......	......	......	
gr., b. wh. dis	13	lt. gr.	12	green	12	green	14	green	
green	10	green	20	green	15	green	15	green	note.
......	......	......	......	......	......	......	......	......	
gr., b. wh. dis	6	green	7	green	......	......	......	......	note.
gr., ed. wh. dis	10	green	8	green	8	green	6	green	
gr. pr., wh. dis	8	lt. gr.	6	lt. gr.	2	white	4	white	note.
......	......	......	......	......	......	......	......	......	
gr. pr., wh. dis	......	......	......	......	......	......	......	......	
......	......	......	......	......	......	......	......	......	
gr. c. 10×40	8	white	10	lt. gr.	5	green	10	lt. gr.	
gr. c. 12×34	8	white	10	lt. gr.	4	green	12	lt. gr-	
gr., ed. wh.	7	lt. gr.	5	green	6	green	4	lt. gr.	
gr., m. wh. dis	10	green	6	green	......	......	......	......	
gr., b. wh. dis	12	lt. gr.	11	lt. gr.	10	green	8	lt. gr.	
gr., b. wh. dis	14	green	10	green	10	green	10	lt. gr.	
gr. c. 22×42	10	lt. gr.	9	green	6	green	12	green	
gr. c. 30×40	10	lt. gr.	10	green	7	green	13	green	
gr., ed. wh. dis	2	lt. gr.	...	......	14	green	11	green	
gr., b. wh. dis	12	lt. gr.	10	green	8	green	18	green	
gr., ed. wh. dis	2	lt. gr.	......	......	10	green	14	green	
gr., ed. wh. dis	......	......	......	......	5	lt. gr.	5	lt. gr.	
gr., b. wh. dis	8	lt. gr.	14	lt. gr.	5–5	green	12	green	
gr., b. wh. dis	12	lt. gr.	12	green	10	green	12	green	
gr., ed. wh. dis	5	green	6	green	3–6	green	9	green	note.
......	......	......	......	......	......	......	......	......	
gr., ed. wh. dis	8	lt. gr.	10	green	14	green	12	green	
gr., b. wh. dis	10	lt. gr.	10	green	4–10	green	18	green	note.
gr., b. wh. dis	8	lt. gr.	6	green	8	green	5	green	
gr., ed. wh. dis	8	lt. gr.	7	green	5-5	green	10	green	note.
gr., b. wh. dis	......	note	....	......	18–12	green	18	green	
gr., ed. wh. dis	2	green	....	......	14	green	12	green	note.
gr., b. wh. dis	10	lt. gr.	8	green	5–4	green	12	green	
gr., b. wh. dis	10	lt. gr.	7	green	4–4	green	13	green	
gr., ed. wh. dis	10	green	9	green	8-6	green	14	green	
gr., b. wh. dis	11	lt. gr.	11	green	5–7	green	16	green	
white	8	lt. gr.	14	white	10	white	9	white	
white	8	lt. gr.	12	white	8	white	8	white	
white	10	lt. gr.	14	white	10	white	10	white	
gr. c. 34×50	11	white	13	lt. gr.	10	lt. gr.	18	lt. gr.	
gr. c. 30×48	10	white	10	lt. gr.	10	lt. gr.	18	white	
gr. c. 36×50	10	white	14	lt. gr.	10	lt. gr.	18	white	
......	......	......	......	......	......	......	......	......	
gr. c. 2×16	7	white	8	lt. gr.	4	lt. gr.	6	lt. gr.	
gr. c. 4×35	8	white	8	lt. gr.	5	green	10	lt. gr.	
gr., ed. wh. dis	8	lt. gr.	6	green	1	green	5	green	
......	......	......	....	......	......	......	....	......	note.
......	......	......	......	......	......	......	......	......	
white	8	lt. gr.	14	lt. gr.	10	white	8	white	note.
note.	8	lt. gr.	14	lt. gr.	12	white	8	white	note.
note	8	lt. gr.	14	lt. gr.	12	white	8	white	note.

PLATE VIII.

Fig. 17. A photograph showing trilliums growing in the woods.

PLATE VIII.

FIG. 17.

Plate IX.

Fig. 18. 13. A typical plant of *Trillium grandiflorum* with narrow-petaled flower.

12. A typical plant with broad-petaled flower and broad leaves, which usually accompany such flowers.

30. A plant varying from the typical ones by having short-petioled leaves, broadened sepals, petals marked with green and the "cup" formed by the bases of the petals more open than normally. One petal is entirely white, one has a slight trace of green along the centre distally and the third has a green centre stripe 3 mm. wide.

Fig. 19. 15. A plant with petioled leaves and normal flower parts, the "cup" formed by the bases of the petals showing in side view.

23. A plant with short-petioled leaves and with the proximal or basal portions of the petals narrowed into stems. The petals are green proximally, one of them to a lesser extent than the other two.

22. A plant with long-petioled leaves and stemmed petals.

PLATE IX.


13 12 30

FIG. 18.


15 23 22

FIG. 19.

Plate X.

Fig. 20. 110. A plant with petioled leaves, short-stemmed sepals, long-stemmed petals, ovary raised on a stalk and stamens with elongated filaments, Petals white-margined distally.

27. A dwarf plant with short-petioled leaves and short peduncle which brings the flowers close to the leaves. Petals short-stemmed and narrowly white-edged distally.

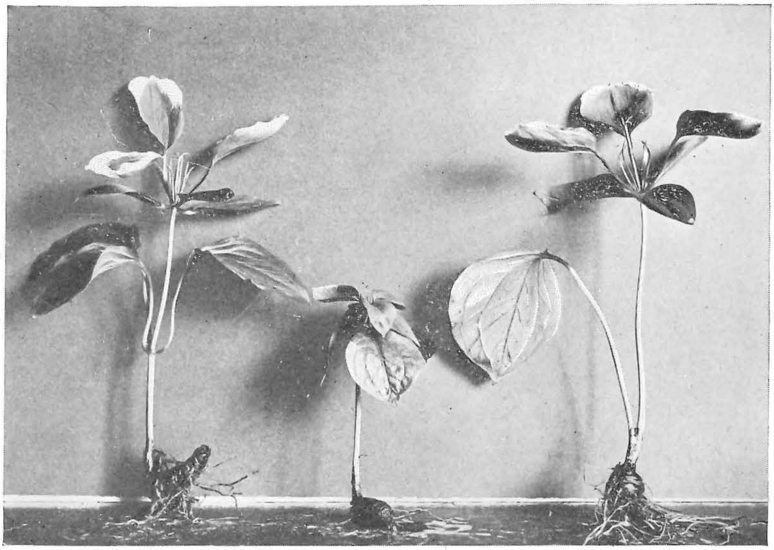
111. A stemless plant with one long-petioled broad-bladed leaf arising from the rootstock, the other two leaves being reduced to short spurs or points. The sepals are short-stemmed and broad-bladed; the petals long-stemmed, broad-bladed and white-bordered distally, the ovary is stalked and the styles are much elongated.

Fig. 21. A plant in which the petioles, peduncle and petal stems are all short and all the parts are green.

109. A short-stemmed plant with long-petioled leaves, long-stemmed sepals and petals and stalked ovary with elongated styles. All parts of the plant are green.

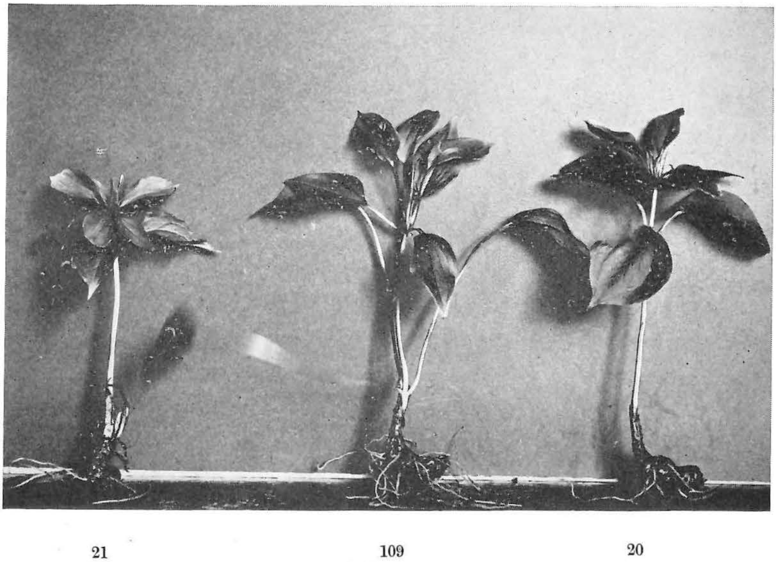
20. A long-stemmed plant with petioled leaves, short-stemmed sepals and long-stemmed petals, which are white-edged distally.

PLATE X.



110 27 111

FIG. 20.



21 109 20

FIG. 21.

Plate XI.

Fig. 22. 32. A plant in which the leaves are reduced to spurs 3 mm. long, the plant stem being 60 mm. long. The broad sepals are sessile and the petals are stemmed. Two petals are distally broadly margined with white, while the third is merely white-bordered distally.

28. A plant with stem 18 mm. long and one long-petioled leaf, the other two being reduced to spurs 2 mm. long. The sepals are sessile and the petals have stems 3 mm. long and are broadly margined with white distally.

29. A plant with stems only 2 mm. long, the leaves being reduced to small spurs close to the rootstock. The sepals are sessile and the petals moderately long-stemmed.

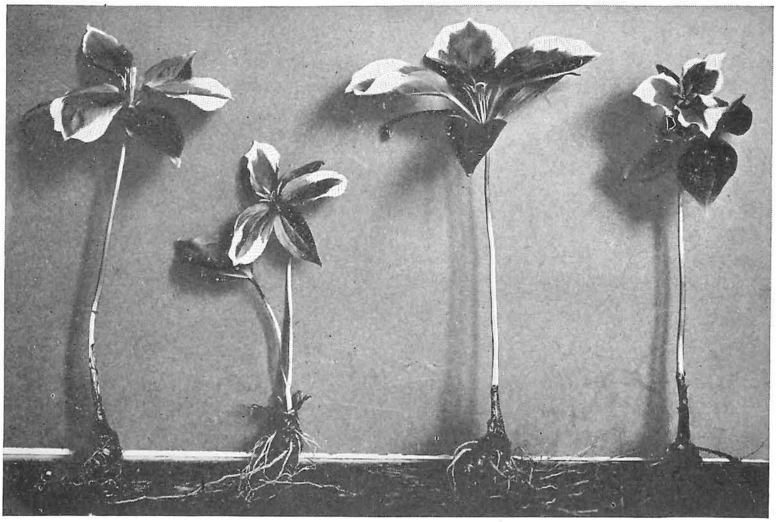
19. A plant with leaves nearly sessile and with sessile sepals and petals.

Fig. 23. 148. A plant with two flower scapes, in each of which the leaves are reduced to spurs at the tip of the rootstock. In each scape the sepals and petals are stemmed and the pistil aborted. The petals are all green.

31. A stemless plant, the leaves being reduced to spurs at the tip of the rootstock. The sepals are sessile, the petals are stemmed and white-margined and the styles are elongated.

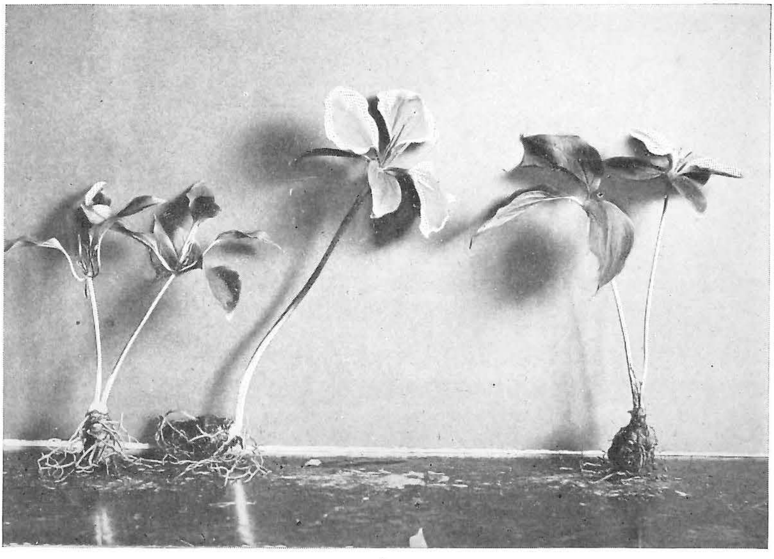
146. A two-stemmed plant in which one stem is long and surmounted by petioled leaves but has no other parts. The other stem is short and has its leaves reduced to spurs 3 mm. long. The sepals are sessile and the petals short-stemmed and white-margined.

PLATE XI.



32 28 29 19

FIG. 22.



148 31 146

FIG. 23.

Plate XII.

Fig. 24. 26. A plant with long-petioled leaves and with stemmed sepals and petals, one of the latter of which is shorter-stemmed and smaller-bladed than the other two. Two stamens are aborted and the rest vary in the length of their filaments and anthers.

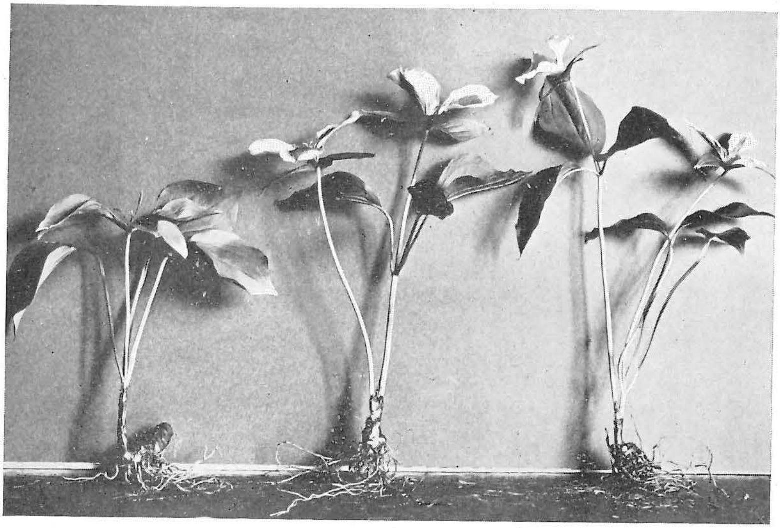
145. A plant with two flowers scapes, one of which has the leaves reduced to spurs at the tip of the rootstock while the other has well developed petioled leaves placed 40 mm. above the rootstock. In both flowers the sepals are sessile and the petals short-stemmed.

144. A two-stemmed plant in which one stem is long and bears short-petioled leaves and a flower having both sepals and petals sessile and the petals entirely white. The other stem is short and bears long-petioled leaves and a flower with sessile sepals and short-stemmed petals, one of which has a green centre stripe while the other two are green proximally and white distally.

Fig. 25. 142. A two-stemmed plant, each stem bearing petioled leaves and green-marked flowers, each with sessile sepals and short-stemmed petals.

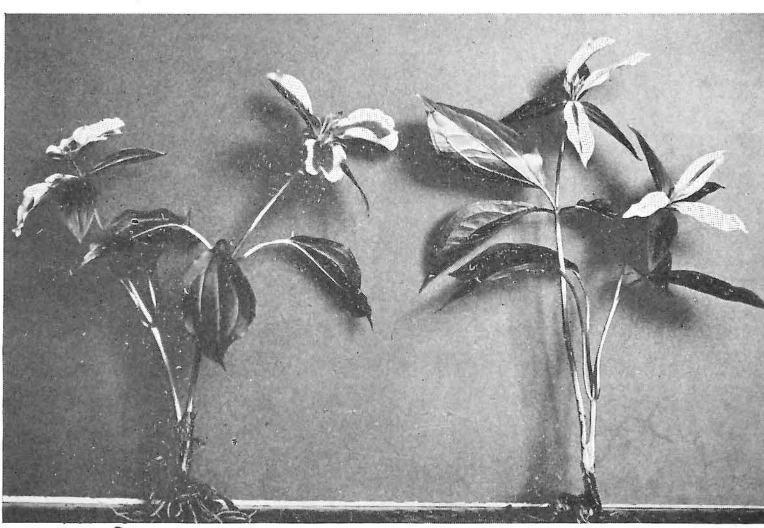
143. A two-stemmed plant, one stem of which is short and bears long-petioled leaves and a flower with sessile sepals and petals, one of which is entirely white, while the other two have green centre stripes. The other stem is long and bears shorter-petioled leaves and a flower with sessile sepals and petals, each petal being marked with a green centre stripe.

PLATE XII.



26 145 144

FIG. 24.



142 143

FIG. 25.

PLATE XIII.

Fig. 26. 24. A large-flowered plant with broad sessile leaves and sessile sepals and petals.

25. A large-flowered plant with short-petioled leaves and sessile sepals and petals.

18. A large-flowered plant with longer-petioled leaves, stemmed petals and somewhat elongated stamens and pistil.

PLATE XIII.

25 24 18

FIG. 26.

SUMMARY OF VARIATIONS.

When in full bloom the petals vary in color from typical white or pink, through white with green centre stripe to solid green. Those petals which are entirely green usually persist on the plant regardless of the presence or absence of leaves, and in those which are merely white-margined the green portions usually persist after the white parts have withered. Such persistent petals, the sepals and the leaves, gradually become purplish-brown in color, remaining thus colored until the plant withers to the ground. Usually by the time the carpels of the normal plants have attained their full size all traces of the abnormal plants have disappeared.

The following figures will show the limits of variation in size of the different parts of the plants which have been tabulated:

Length of plant stem varies from	0 mm. to	340 mm.
Length of petiole..............	0	160
Width of leaf blade.............	22	124
Length of leaf blade...........	30	157
Length of peduncle............	2	220
Length of sepal stem...........	0	44
Width of sepal blade...........	9	37
Length of sepal blade...........	26	78
Length of petal stem...........	0	64
Width of petal blade............	8	50
Length of petal blade...........	18	80
Length of filament.............	1	34
Length of anther..............	0	20
Length of ovary...............	1	30
Length of ovary stalk..........	0	23
Length of style................	2	27

NOTES ON AND EXPERIMENTS WITH INSECTICIDES AND FUNGICIDES IN 1902.

CHAS. D. WOODS.

The year 1902 was not characterized by special abundance of the Colorado potato beetle. Early in the season there were only a few old beetles to be seen on most fields and compared with some years little damage was done by the potato bug even upon potatoes that were inadequately protected. The damage from the flea beetles was not any above and perhaps below that of average years. The insecticides used in the State were practically the same as in past years, Paris green taking the lead. Considerable quantities of arsenate of lead and Bug Death were used.

PARIS GREEN.

Pure Paris green is aceto-arsenite of copper and should carry 58.65 per cent of arsenic. The arsenite of copper with 52.94 per cent of arsenic is sometimes sold under the name of Paris green. As made commercially, there is practically no Paris green which is a strictly aceto-arsenite of copper. Since arsenious oxide (white arsenic) is the cheapest single constituent that enters into the manufacture of Paris green, it follows that the manufacturer will usually endeavor to use as much white arsenic as is consistent with making a good green. Forty-five samples of Paris green have been recently examined by the Bureau of Chemistry of the U. S. Department of Agriculture. The total arsenic (arsenious oxide) ranged from 56.2 to 61.2 per cent and the copper (copper oxide) varied from 28.5 to 31.2 per cent. These analyses confirmed our own observation that there are practically no Paris greens on the market deficient in arsenic.

Since Paris green has begun to be used as an insecticide it has been a familiar experience that sometimes it burns the foliage. The reasons for this have been quite carefully investigated and it has apparently been found that this scorching of the foliage is due to the water soluble arsenic in the goods. In the Paris green examined by the U. S. Department of Agriculture, the water soluble arsenic (arsenious oxide) varied from 2.7 to 10.5 per cent. With four exceptions there was less than six per cent of water soluble arsenic in the samples examined.

The green made by the C. T. Reynolds Company, which is very largely used in Maine, was found by the Department to carry the highest per cent of water soluble arsenic. A sample of Reynolds green examined at this Station was found to carry 7.49 per cent of arsenic soluble in water. The amount of water soluble arsenic in the Paris green is of considerable importance. In many states there are laws limiting the amount of arsenious oxide which is allowable in Paris green. In California and in Massachusetts and other eastern states, 4 per cent is the limit. In Idaho 6 per cent has been adopted as the maximum amount.

As has been pointed out in other publications of the Station, much of the harm of the soluble arsenious oxide in Paris green can be overcome by mixing it with lime water. To be most effectual, it should be mixed with the lime water several days before it is to be used and the mixture occasionally stirred, as the water soluble arsenious oxide goes into solution very slowly.

If samples of green, particularly in the original package, are sent to the Station they will receive as prompt analysis, free of charge, as is consistent with our other work. The time involved in an analysis is considerable and it is not always possible to take up the work immediately on receipt of sample.

ARSENATE OF LEAD.

Arsenate of lead is made by the Merrimac Chemical Company and the Bowker Chemical Company, both of Boston. The Bowker Company sell their output under the name of Disparene. As sold they both carry considerable water, which seems to be necessary in order to make them go readily into suspension in water. They carry from 50 to 60 per cent of actual arsenate of lead, which gives them from 13 to 15 per cent of arsenious oxide. Hence it would take nearly four pounds of arsenate of lead as found in the market to furnish as much arsenious oxide as a pound of Paris green. The arsenate of lead is but very slightly soluble in water and on this account is safer for foliage than is Paris green. In our experiments arsenate of lead was not used with as good results in 1902 as in the two preceding seasons.

OTHER ARSENICAL COMPOUNDS.

The arsenoids, London purple, Paragrene, etc., have been used in the State only to a very limited extent. Any one interested will find these discussed in Bulletin 68 of this Station.

INSECTICIDES CARRYING A SMALL PERCENTAGE OF ARSENIC.

There are a number of insecticides in the market, some of which purport to be better than Paris green, all of which are dependent upon arsenic in some form for whatever value they possess as insecticides. These materials practically consist of Paris green mixed with gypsum, coal dust, or something of that kind, and are for all practical purposes simply badly adulterated Paris green. Their cost is considerably less than that of a pure green, but the poison they contain costs the consumer from five to ten times as much as it would if he were to buy a good green and mix it with the diluents.

BLACK DEATH, QUICK DEATH, ENGLISH BUG COMPOUND.

Black Death has been quite extensively advertised in this State and probably has been more or less used. Its analysis shows it to be Paris green diluted with gypsum to make weight, and colored with charcoal or coal dust. According to the analysis of the U. S. Department of Agriculture it carries about 1.75 per cent of Paris green; the other constituents being chiefly gypsum and carbon. It follows, therefore, that it would take more than fifty pounds of Black Death to equal one pound of Paris green as an insecticide.

Quick Death, made by the American Insecticide Company, Binghamton, N. Y., in appearance and composition resembles Black Death and is stated by those who should know to be Black Death under another name.

English Bug Compound has not been heard of very much lately. A sample examined a few years ago consisted of white arsenic diluted with gypsum.

KNO-BUG.

Kno-bug is a reddish brown powder made by the Carpenter-Morton Company of Boston, which, according to the claim of the makers in 1902, destroys potato bugs, acts as a vegetable tonic, stimulates the growth of the plant, and prevents blight, scab and rust.

The material is found to contain several things, of which Paris green is the poison, nitrate of potash the plant food, and carbonate of copper the germicide.

Analysis of the material shows it to have substantially the following composition:

Calcium sulphate (land plaster),	88.0 per cent.
Iron ochre,	2.0 per cent.
Nitrate of potash,	4.5 per cent.
Paris green,	2.5 per cent.
Carbonate of copper,	2.0 per cent.
Water and undetermined,	1.0 per cent.

The Paris green in these goods is the only thing of much value to the potato grower. The plaster and nitrate of potash contain plant food, but the benefit to be obtained from small applications above ground is inconsiderable.

The goods sell according to the advertisements at prices ranging from five to ten cents per pound, according to the size of the package. Its high cost comes chiefly from the fact that it is put up in small packages. A mixture of Paris green and plaster which will equal Kno-bug as an insecticide can be made by the farmer for very much less cost.

In a newspaper bulletin issued last June by the Station, Kno-bug was called a fraud. It was so called because it claimed to be better than Paris green and safer to use as an insecticide, when it depended upon Paris green for its value as an insecticide; because it claimed to prevent blight, for which carbonate of copper is not a specific; and because it was claimed to prevent scab, which cannot be done by any treatment of vines. The manufacturers, Carpenter-Morton Company, Boston, state that they acted in good faith and had no intention of fraud in putting the goods on the market, and that chemists in whom they had confidence advised them that its ingredients would produce the results claimed. The coming season they intend to make no claim for Kno-bug as a fungicide, and will base their reasons for its sale upon its merits as an insecticide.

A field test of Kno-bug was made by the Station in 1902 chiefly to ascertain if it had value as a fungicide. The first application was made when the potatoes were about a foot high. This piece had been previously sprayed with Bordeaux mixture and arsenate of lead. No further application of Bordeaux mixture was made to this plot. The adjoining plots were sprayed four more times with Bordeaux mixture and a poison. The yield was much less on the plot to which Kno-bug was applied and the percentage of rot was very much increased. The vines died three weeks earlier than on the plots treated with Bordeaux mixture.

In this test Kno-bug was practically valueless as a fungicide. The diminished yield was due to blight and not to injury from insects. Applied in sufficient quantity, the Paris green contained in Kno-bug will kill the bugs.

HAMMOND'S SLUG SHOT.

Hammond slug shot carries sulphur, carbolic acid, Paris green, and tobacco, mixed with gypsum. The manufacturers claim it to carry only one per cent of arsenic. A sample examined by the U. S. Department of Agriculture carried 1.58 per cent of arsenic in the form of Paris green.

INSECTICIDES NOT CONTAINING ARSENIC.

BUG DEATH.

Bug Death, made by the Danforth Chemical Company, Leominster, Mass., is unique in being, so far as has come to the writer's attention, the only insecticide which does not depend upon arsenic for its effectiveness. It is practically impure zinc oxide. It carries more or less of iron and lead oxide and small amounts of silica, chlorine, potash and phosphoric acid. These latter constituents are apparently accidental and vary somewhat within narrow limits. When the goods were first placed upon the market, their mechanical condition was very different from what it is at present. In 1900 the Experiment Station used it in the field at Houlton and also in a greenhouse test. The Bug Death killed some of the beetles and slugs and drove the majority of the others from the plants. Many of them went into a stupor lasting from 12 to 36 hours and then revived and were apparently as well as ever. The goods used that year were coarsely ground, feeling gritty to the touch and could not have been sprayed successfully, as they would have clogged a Vermorel nozzle. The Bug Death used by the Station in the season of 1902 was ground to an impalpable powder and even at the rate of 40 pounds to the barrel was sprayed through a Vermorel nozzle without any difficulty. One enthusiastic user of Bug Death in Maine believes it to be exceedingly valuable as a means of ridding cucumber and squash vines of the striped bug. It will be thoroughly tested by the Station the coming season on the melon family, and if it should prove efficient it will be very valuable, because thus far we have no adequate remedy for the striped beetle.

In 1900 Bug Death was used by us in the dry form; in 1902 it was used by us in connection with Bordeaux mixture and applied by spraying. The full account of this experiment is given on pages 142-145 and, as will be there noted, at the rate of 62½ to 125 pounds per acre, in five applications, it was efficient as an insecticide. The following is the summary of the results of experiments in 1900 as given in Bulletin 68 of this Station.

1. As an insecticide, at the rate of 100 pounds per acre, it freed from bugs; at the rate of 40 pounds per acre it had no appreciable effect.

2. As a fungicide; blight did not appear so soon or so badly when Bug Death was applied, in three applications, at the rate of 180 pounds per acre, as on untreated vines.

3. Effect on foliage; at the rate of 40 pounds per acre, no appreciable effect; at the rate of 100 pounds per acre, some of the leaves curled on the edges and finally died.

4. Fertilizer; as its only fertilizer constituent is a little potash with a trace of phosphoric acid, it was not tested as a source of plant food.

5. Its economy; because of its high cost and slow application, no one growing any considerable amount of potatoes can afford to use Bug Death.

Tde results of the experiments described on pages 142-145 seem to warrant a modification of conclusions 1 and 5 so that they will read as follows:

1. As an insecticide. Applied in a fine spray at the rate of 15 pounds per acre at each application, it will free the potato vines from bugs well enough for practical purposes; and at the rate of 25 pounds, it is thoroughly efficient as a remedy against the potato bug.

5. Applied with Bordeaux mixture, it can be as cheaply and as easily applied as Paris green or arsenate of lead. The experiments by Mr. Rogers and the Danforth Chemical Company

seem to indicate a sufficiently increased yield to pay its cost ($5 to $7). These results are *not* confirmed by the Station experiments.

NOTES ON FUNGICIDES.

The year 1902 is the first year in which potato blight has been particularly bad since the Station began experiments in the great potato growing section of this State. In 1901 there was a large acreage with some blight and rot on unsprayed fields. In that season sprayed potatoes, even though treated only once or twice were free from blight and rot. Unfortunately this apparent help from imperfect protection led many to believe that the four to six sprayings urged by the Station were unnecessary and that two sprayings were equally good. In 1902, even in the case in which the spraying has been quite thorough, the results have been disappointing, as the protection has been only partial. For example: In the Experiment Station experiments with insecticides there was found on fairly drained ground a loss of 10 per cent due to rot, and on poorly drained ground the loss was much greater. One large grower recently at the Station was much discouraged at the outlook; he said he sprayed three times and fully half of his potatoes rotted. However, it came out in the course of the conversation that a piece which he sprayed twice rotted so badly that he did not dig them. Thus the extra spraying gave him one-half of a crop and it is probable that if he had sprayed twice more his loss from rot would have been no greater than in the Station experiments. The blight progressed peculiarly the present season. For the most part potatoes were late planted and through July and August made very rapid growth, much of the time an inch a day. This soft, succulent foliage was apparently peculiarly susceptible to the blight. Blight, however, did not appear until late, so that in most instances the tops were covering the ground and forming a dense mat at the time in which it appeared and most pieces had not been sprayed for some little time previous for fear of injuring the tops by driving through the field. The blight progressed somewhat slowly but still made decided progress at lower temperatures than has usually been supposed to be favorable to its growth. While pieces quite thoroughly treated have not been perfectly free from rot, the season has added to the importance of thorough spraying as a protection against blight and the subsequent rot. The fact that pieces planted on land not well drained and on farm manure suffered worse from rot than where the conditions were different, points out the necessity for careful selection of potato land. The ill effects of farm manure seem to indicate that the fungus which produces the rot may be distributed through the soil as well as through the tops. This is in accord with observations made before Bordeaux mixture was used and confirms the soundness of the usual practice of planting on turf land with commercial fertilizers.

Ready made Bordeaux mixtures were not used in experiments in the Station this year. In former years they gave fairly satisfactory results. Some users in 1902 are not as well satisfied as though they had used the regular home made mixture. This can probably be explained by the fact that if they had used the ready made goods in accordance with directions which come with them, they were only about one-half the strength of the home made goods.

EXPERIMENTS WITH PARIS GREEN, BUG DEATH AND ARSENATE OF LEAD.

In the season of 1901 some users of Bug Death were satisfied that they got a larger yield of potatoes where Bug Death was used as an insecticide in conjunction with Bordeaux mixture than where Paris green was used, also with Bordeaux mixture. Many articles were written for the agricultural press condemning the use of Paris green on the ground that it injured the foliage, thus stopping growth, and one writer made the claim that the tubers themselves contained arsenic when Paris green was used for killing bugs. Therefore, an experiment was undertaken to compare arsenical poisons with Bug Death, with the view of ascertaining whether arsenic in the form of Paris green or arsenate of lead injures the growth of the potato vines so as to affect the quantity or the quality of the tubers.

Field experiments at best are apt to be unsatisfactory because of lack of uniformity of soil and stand of the crop. In order to avoid the former the experiment was arranged alternately in ribbon strips, so the number of plots might reduce the inequalities of soil as far as possible. The chief difficulty of the experiments in 1902 was missing hills. The field which at planting was intended for this experiment was not used because of the number of missing hills. A field was finally selected on which the stand was fairly uniform. The land had been uniformly manured the preceding year and had grown potatoes and the yield of 1901 was fairly uniform over the whole field, being somewhat smaller on the north side, the yield gradually increasing to the south. Eight rows running across the field, so as to include nearly one-half acre, were selected for each plot. At harvest the two outer rows of each plot were rejected and 14 rods of the west end of 6 rows were used for the comparative yields. The potatoes from these pieces were assorted and weighed in the field. All of the details of the experiment were under the personal supervision of the director or Mr. Bartlett, chemist to the Station. Twice at the time of taking notes representatives of the Danforth Chemical Company and of the Merrimac Chemical Company were present and their judgment agreed with the notes taken.

The amounts of Bug Death used per acre were those suggested by Mr. Merrill, the superintendent of the Danforth Chemical Company. The field was sprayed five times, July 12, July 19, July 26, August 2, and August 27. Bordeaux mixture was used at each application at the rate of a barrel to the acre. The Paris green and arsenate of lead were used only in the four first applications. Bug Death, at the request of Mr. Merrill, was used in all five applications. The arrangement of plots and yields are given in the table on page 145. The rows ran east and west, plot one being on the north side.

FIELD NOTES.

Plots were all sprayed July 12.

July 15 there were very few eggs on the pieces and no slugs had hatched. The plants had formed two or three leaves since they were sprayed the 12th.

July 19 plots all sprayed.

July 22 slugs just beginning to hatch and practically no slugs of any size on the entire field. The notes for the individual plots were practically all alike. Occasional plants over the piece had a few newly hatched slugs on the terminal leaves.

July 26, all plots sprayed.

July 27. Plot 1. Few small slugs on occasional plants. Plot 2. Quite free from bugs, but rather more than on plot 1. Practically no large slugs. Plot 3. Rather more slugs than on plot 2, particularly on the south side of the plot. Plot 4. Some slugs, rather less than on plot 1 and small. Plot 5. About the same as plot 4. Very few slugs. Plot 6. Had no slugs; all smaller than on plot 5; vines somewhat eaten. Plot 7. Very few slugs, less than on 1 or 4. Plots 8-9. Few small slugs, about same as plot 2. Plot 10. Practically no slugs, cleaner than any of the preceding plots. Plots 11-12. About the same as plot 5, rather less slugs, if anything.

August 2 all sprayed.

August 5. Plot 1. Very few slugs, a few old bugs, tops not eaten. Plot 2. No small slugs, a few large ones, tops eaten more than on 1. Plot 3. About the same as plot 2, perhaps not eaten so much nor quite so many slugs. Plot 4. Practically no bugs or slugs, tops very little eaten. Plot 5. Practically as plot 4 as regards bugs, the tops appeared larger than the preceding plots. Plot 6. About the same as 3, not as free from bugs and slugs as 4 and 5, eaten rather more than 4 or 5, tops fully as large as on plot 5. Plot 7. About as plot 4 but not so much eaten. Plot 8. Slugs and bugs as on plot 2, perhaps tops not quite so much eaten. Plot 9. Rather better than 6, less bugs and less eaten than on plot 6. Plot 10. Cleanest from bugs and less signs of their work than on any of the plots 1 to 9. Plot 11. Very clean, but not quite so free from bugs as 10 and more traces of their work than on plot 10. Plot 12. Not quite so free from bugs as plot 11 and more eaten. Plots 1 to 12, for all practical purposes, are very free from bugs, a few leaves on occasional plants had been eaten to a small extent. No plants on the whole piece damaged enough to have any probable effect on yield.

August 27 some blight on all of the plots, leaves yellowed on some plots. Occasional spots on some green leaves. No perceptible difference between the plots of each different kind of insecticide that was used. The general appearance of the crop is too light color to the tops. It is more marked on some rows and especially on the plots near the north side of the field. Some rows are much more affected than others. There is no bloom to be seen on the entire field at a distance. An occasional plant is in the last stage of flowering. The Bug Death was used on plots 2, 5, 8, 11, but no insecticides on the other plots.

September 2, blight on unsprayed fields has made much progress in the past week. Vines with stalks and leaves green a week ago have only the stems left. On Mr. Watson's fields, which had not been sprayed for four weeks, the disease had progressed considerably. The experimental plots are about the same as a week ago, still green with some blight. No noticeable difference between different plots.

September 11. Blight has made a good deal of progress. A few plants died on all the plots; many plants still as green as ever and most of the plants are quite green. No perceptible difference between the different plots. The plots were harvested October 8, 9 and 10. The tops were all dead, having been killed by frost about the middle of September.

PARIS GREEN, BUG DEATH AND ARSENATE OF LEAD COMPARED.

Kind and amount of insecticide, the weighed yield of potatoes, and the starch content of the merchantable potatoes. Bordeaux mixture was used five times on each plot.

Plot number.	Insecticides Used, Kind.	Amount per acre.	Yield of Potatoes per Acre. Merchantable.	Small.	Rotten.*	Total.	Starch.
		lbs.	bush	bush	bush	bush	per ct.
1	Paris green	21	295	36	32	363	21.28
2	Bug Death	60	315	34	23	372	21.28
3	Arsenate of lead	4	285	27	25	337	21.41
4	Paris green	12	305	28	40	373	21.41
5	Bug Death	125	290	34	35	359	22.06
6	Arsenate of lead	24	295	29	80†	404	18.84
7	Paris green	4	285	25	58†	368	19.50
8	Bug Death	75	320	23	55†	398	18.46
9	Arsenate of lead	8	320	27	50†	397	19.19
10	Paris green	8	370	34	28	432	19.46
11	Bug Death	100	350	25	35	410	18.25
12	Arsenate of lead	16	365	26	41	432	18.87
	Average Paris green	......	314	31	42	384	20.41
	Average Bug Death	......	319	29	37	385	20.01
	Average Arsenate of lead	......	318	27	49	393	19.58

* There was no soft rot. This includes all discolored potatoes.

† Depressions on part of the field with more rot where the soil was wetter.

SUMMARY OF RESULTS OF THIS EXPERIMENT.

At no time during growth were there perceptible differences in color, size or vigor of the vines treated with different insecticides. All these insecticides kept their respective plots sufficiently free from insects to prevent damage; the smaller amounts of the insecticides were nearly as effective as the larger. The poisons were applied early so that the vines were protected before the bugs appeared. Paris green kept the vines a little freer than Bug Death, and Bug Death acted quicker than arsenate of lead, but all three were effective from the practical standpoint.

The yield was smaller on the northern side and increased gradually towards the southern side. The yields were fairly uniform on adjoining plots and the average of the results showed practically no differences in the yield from the plots treated with different insecticides. The loss due to rot was something less than 10 per cent of the total yield on most plots. Because of depressions on plots 6-9, the soil was not as well drained and the rot was increased to about 15 per cent.

The potatoes all had a high starch content, with but little differences. There was no apparent relation between the starch content and the kind of insecticide used. In general the plots having the largest yield had the largest potatoes and the lowest starch content.

The potatoes from plots which were treated with Paris green at the rate of 8 and 12 pounds per acre and arsenate of lead at the rate of 16 and 24 pounds were tested for arsenic and were found to be entirely free.

EXPERIMENTS BY MR. ROGERS OF BRUNSWICK.

Two experiments comparing Paris green, Bug Death and arsenate of lead were made in 1902 by Mr. E. A. Rogers of Brunswick. One of these experiments was conducted at Brunswick and the other was made for the Danforth Chemical Company in Caribou. Mr. Rogers furnished the Station the full report of these experiments, but as they have been printed in detail in the Maine Farmer only a summary is here given of the experiments and Mr. Rogers' conclusions.

TABLE SHOWING PLAN AND YIELD PER ACRE IN EXPERIMENT AT BRUNSWICK.

Plots.	Insecticides Used, Kind.	Pounds per acre.	Yield per Acre in Bushels.			Total.
			Marketable—large.	Rotten.	Small.	
2	Bug Death	125	415	11	16	442
3	Arsenate of lead	15	358½	4	18½	381
4	Paris green	7½	354	8	22½	384½
5	Bug death	125	369	5	15½	389½
6	Arsenate of lead	15	328	7	20½	355½
7	Paris green	7½	330½	¼	18½	349¼
8	Bug Death	125	362	⅛	20½	382⅝
9	Arsenate of lead	15	320	1½	23¼	344¾
10	Paris green	7½	279	1½	18½	299
	Average marketable.	Bush.				
	Bug Death	382				
	Arsenate of lead	335½				
	Paris green	321⅛				

TABLE SHOWING PLAN AND YIELD PER ACRE IN EXPERIMENT AT CARIBOU.

Plot number.	INSECTICIDES USED, KIND.	Pounds.	Yield per acre in bushels.		Total.
			Marketable.	Small and rotten.	
1	Bug Death	100	279	66	345
2	Paris green	4	247	74	321
3	Bug Death	100	282	77	359
4	Arsenate of lead	8	245	78	323
5	Bug Death	100	303	53	356
		Bush.			
	Total average yield per acre for Bug Death	353⅓			
	Total av. (Plot 2) yield per acre for Paris green—	321			
	Total av. (Plot 4) yield per acre for arsenate of lead	323			

In both of the experiments conducted by Mr. Rogers the yields were considerably larger on the Bug Death plots than on the Paris green or arsenate of lead plots. From the experiments at Brunswick and Caribou Mr. Rogers draws the conclusion that Bug Death was much the best insecticide used; that it did its work much better and cleaner than either Paris green or arsenate of lead; that Bug Death preserves the life of the vines and that the increased yield from the use of Bug Death would more than pay its cost.

In the Station experiments at Houlton, Paris green was the most efficacious of the three insecticides used, although Bug Death at the rate of 15 pounds and arsenate of lead at the rate of 2 pounds to the acre in each application were efficacious for all practical purposes. There was no difference in the appearance of the vines due to the different insecticides during the growth, nor in the yield of potatoes. One desiring to use an insecticide for plants free from arsenic will, according to our experience, find Bug Death satisfactory when applied in sufficient quantities. Bug Death can be readily applied with Bordeaux mixture up to 40 pounds to the barrel. According to our experience, 15 pounds per acre at each application is nearly as effective as a larger amount.

OAT SMUT AND ITS PREVENTION.

CHAS. D. WOODS.

Farmers' Bulletin No. 75 of the U. S. Department of Agriculture describes the grain smuts and explains how they may be prevented. This bulletin may be obtained by addressing the Secretary of Agriculture, Washington, D. C., from your Congressman or from the Maine Experiment Station.

The following, selected from the "summary" of bulletin 75, outlines the disease, its cause and its prevention:

Smuts of cereals are caused by minute parasitic fungi, the spores or seed-like bodies of which form the black, dusty mass which takes the place of the kernels or the entire head.

The spores are very minute and are easily blown about, often adhering to the kernel before it is planted. When such kernels sprout, the spores also germinate and send delicate threads into the young seedlings. These threads follow the growth of the plant, fill the head as soon as formed, and there develop a mass of spores instead of kernels.

Loose smut of wheat attacks the whole head and converts it into a mass of loose, dusty spores. It causes considerable damage in some localities and is more difficult to prevent than other smuts.

Loose smut of oats is very similar to loose smut of wheat and probably causes an annual loss in the United States of more than $18,000,000.

Barley is attacked by two smuts and rye by one. Corn smut is widespread, but fortunately it usually causes only very slight loss. As yet no effective remedy is known for corn smut.

The formalin treatment has been found very effective in preventing stinking smuts of wheat and oat smut. It consists in soaking the seed for two hours in a solution of 1 pound of formalin to 50 to 60 gallons of water. The strong formalin is poisonous, and great care should be exercised in its use. [For a full description of how to use the formalin see page 149.]

The stinking smuts of wheat and oat smut can also be prevented by treating the seed with hot water at 132° for ten minutes.

Loose smut of wheat and barley smuts can be prevented by soaking the seed in cold water for four hours, allowing it to stand four hours more in wet sacks, and then treating for five minutes in water at 132°.

The potassium-sulphide treatment is thoroughly effective for loose smut of oats. It consists in soaking, say, 3 bushels of seed for twenty-four hours in a solution of 1½ pounds of potassium sulphide to 25 gallons of water. Liver of sulphur should be used and the solution should be kept in a tightly closed vessel to protect it from the air.

To dry the grain after any of the treatments described, spread it on a clean floor, or on canvas sheets spread in the sun, preferably on a raised lattice work, say, 2 or 3 inches deep, and turn it over at least twice a day.

In treating oats for smut by either potassium sulphide or hot water an increase in yield is obtained beyond and above the amount that would result from replacing the smutted heads with sound ones. The increase in yield from seed treatment is usually two or three times as much as the apparent loss from smut in untreated fields.

The Wisconsin Experiment Station* found oats smut very prevalent in that state and estimated the loss from this disease in 1901 to have exceeded six million dollars. They have successfully experimented with formaldehyde with the following results.

SUMMARY OF EXPERIMENTS AT WISCONSIN STATION.

Seed oats submerged for	In a solution	Smut found.
Twenty minutes	1 lb. formaldehyde to 50 gal. water	0.0 per ct.
Sixty minutes	1 lb. formaldehyde to 200 gal. water	20.0 per ct.
Ten minutes.	1 lb. formaldehyde to 50 gal. water	1.0 per ct.
Forty minutes	1 lb. formaldehyde to 100 gal. water	4.3 per ct.
Twenty minutes	1 lb. formaldehyde to 100 gal. water	5.0 per ct.
Not treated	....	....

* Bulletin 91 Wisconsin Experiment Station.

HOW TO TREAT SEED OATS TO PREVENT SMUT.

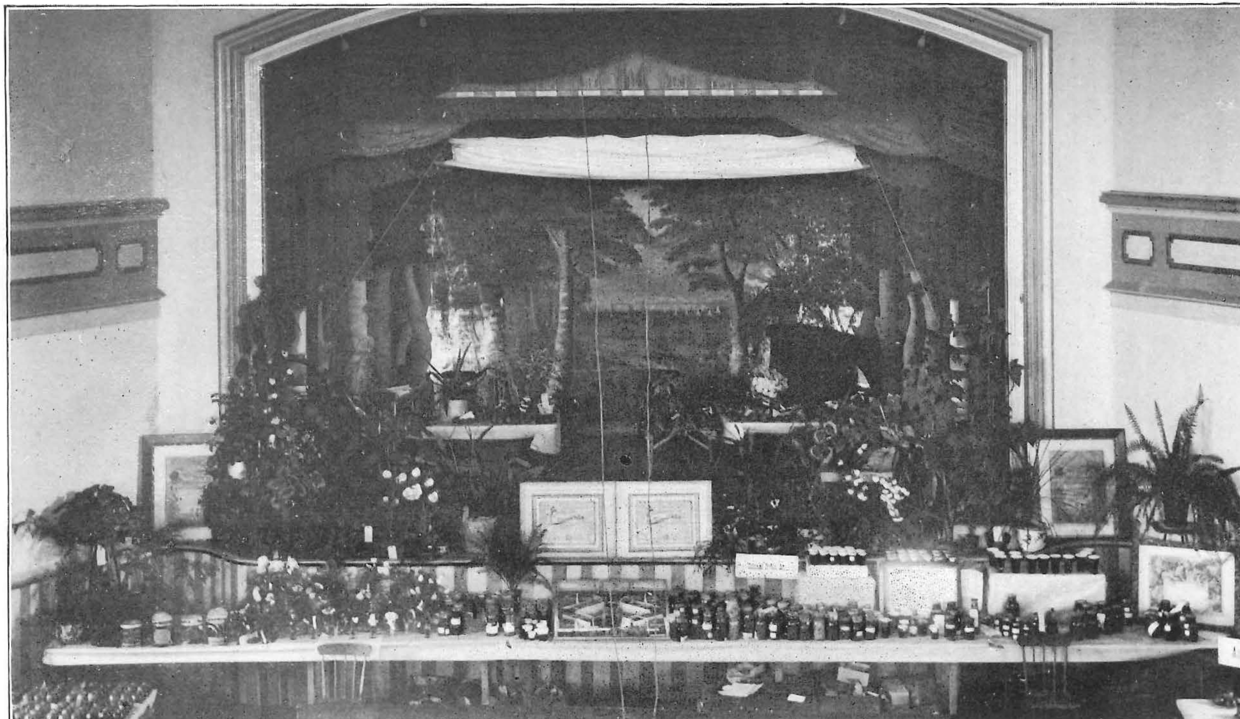
As the result of field experiments the Wisconsin Station recommends the following:

"If 50 bushels of seed oats are to be treated, secure from a drug store one pound or a pint of formaldehyde (sometimes called formalin.) Speak to your druggist in advance so that he may secure the formaldehyde in time, if he does not have it on hand. Put into a barrel or cask 50 gallons of water and pour in the one pound of formaldehyde liquid to make the proper solution. Dip out about one-half of the solution into another cask in order to treat two sacks of oats at the same time, thus facilitating the work. Place about two bushels of oats in each of two gunny sacks or large bags and submerge the oats in the solution for twenty minutes; then lift the sacks from the casks and let drain for a minute or two so as to save the solution. Empty the oats on a threshing floor or on a canvas to dry and proceed as before, using the same sacks for the remainder of the oats."

"The solution as used is not poisonous and will not injure the sacks or clothing coming in contact with it. Formaldehyde is a gas generated by burning wood alcohol. It is readily soluble in water, which will hold 40 per cent of it in solution. This solution is sold by most drug stores under the name of formaldehyde or formalin at about 50 cents per pound."

"It is well to treat the seed oats two or three days before sowing to give ample time to dry. If the oats are shoveled over a few times it will facilitate the drying very much and no difficulty will be experienced sowing with seeder or drill. The treated oats can be sown with a force-feed drill or seeder when quite damp, but the machine should be set so that it will indicate sowing about a peck more than the quantity desired per acre, as the oats are swollen and will not run quite as freely as dry oats."

"The treatment of seed oats seems to facilitate the sprouting; a difference of from two to four days in favor of the oats treated will be noticeable."



Annual Exhibition at Farmington, November, 1902. Showing stage with plant decorations.

APPENDIX.

Annual Report of the State Pomological Society

1902—1903.

CONTENTS.

SECRETARY'S ANNUAL REPORT.

There are many things in fruit growing that none of us can explain. One of these was the phenomenal crop of 1901—phenomenal in this respect: that there were few orchards where all the trees bore fruit, while parts of orchards and localities bore very little fruit. Some one describing the crop said it was "patchy." This year some of the same conditions prevail, and while there are no localities in Maine with a full crop, there are not many where there are above 50 per cent. This year like last the spring was cold, wet and late. The bloom was not a very full one, and the bee men say it was too cold for the bees to work among the flowers, while others think the rain may have prevented polination.

Fortunately, perhaps, the blossoms and foliage came late, so that nowhere in the State does it appear that the apple trees were injured by the freeze on the nights of May 9 and 10. The cool weather of the season appears to have been favorable for the growth of the trees and size of fruit: at the same time it made the maturity of the fruit quite a couple of weeks later than in ordinary years. As illustrative of this the Ben Davis was small and "unwilling" to be plucked from the tree, and it would seem in consequence that this variety would compare more unfavorably than usual with those grown further south.

There have not been so many insects to prey upon the foliage as usual, and the frequent rains in some cases interfered with spraying. It is further noticeable that the orchards that have been best cultivated in years past have been the most fruitful this year; a fact that confirms what our society has taught for the thirty years of its existence.

Our people are indebted to the agricultural papers as well as the Pomological Society for the prices at which apples sold early in the season. The reports sent out by the buyers seemed misleading as to the quantity of fruit in the country, but later it developed that the crop in other states was even larger than the earlier reports indicated. The earlier prices received were from $1.25 to $2.00, but the shippers claim that they all lost money, which your secretary thinks must have been more than made up to them later in the season. Many apples that were held in cellars came out badly from the effects of scab. We are not aware that this applies to sprayed fruit.

BETTER CULTURE AND MORE TREES.

The high price last year did much to encourage better culture, and all over the State reports indicate that many neglected orchards are being cared for. The trees are being pruned; hogs and sheep have been pastured to advantage among the trees; trees have been mulched; and other dressing applied, and in many cases the orchards have been plowed and some effort made in growing clover and other cover crops. The trees responding to this treatment, have made a rapid growth during this season, and at the present time make a most promising appearance.

Many trees were set last spring and many more would have been set had it been possible to obtain them. The immense demand upon the nurseries for western and southwestern planting completely exhausted many of the most desirable varieties. Perhaps this may have been some advantage in Maine, for many gave special attention to working over the natural fruit trees and those varieties that had proved to be unprofitable.

THE SMALL FRUITS.

The winter of 1901-2 was very unfavorable for strawberries, and the plants were seriously injured and many killed outright. The crop was in consequence a small one and of inferior quality, but the price was rather more than usual. Of the bush fruits the crop was better and the cool damp weather made the season much longer than usual, the blackberries lasting as late as the middle of September. It is a pleasure to note that the growing of these delicacies has largely increased in the home gardens of the State. Many such have enjoyed the satisfaction of having all the small fruits the family could eat, and for the surplus have found a cash demand.

On the way to the Horticultural School at New Gloucester. Team driven by T. M. Merrill, laden with the school from his part of the town. The building in the background is the old Shaker Meeting House, more than 100 years old, at Sabbathday Lake. Photograph by Mr. D. C. Wilson.

MEETINGS OF THE EXECUTIVE COMMITTEE.

The executive committee have held meetings as follows: at Augusta, January 23, when the work for the year was outlined and discussed; at Buckfield, March 27th, in connection with the meeting held there; at Bangor, August 20, at which our annual meeting was located and arranged for. There has been a most cordial feeling among the members and a hearty co-operation in all matters affecting the welfare of the society and the interests of Maine fruit growers. The members have cheerfully given their time, hoping thus to share largely in the developing of the industry in Maine. The fruit growers owe them a debt which I am sure will some time be paid a hundredfold.

MEETINGS HELD BY THE SOCIETY.

The spring meeting was held in Nezinscott Hall, Buckfield, March 28th, by invitation of Mr. V. P. DeCoster, who had in charge the immediate local arrangements of the meeting. Prof. F. A. Waugh of the Vermont Experiment Station was the only speaker outside of the State, and the people were delighted to meet him and hear him speak. The programme was well carried out. The exhibition of fruit was very good, and the plants contributed by the ladies of Buckfield added much to the attraction of the exhibition. Altogether the meeting was one of the best local meetings held by the society.

THE HORTICULTURAL SCHOOL.

For several years the secretary has urged the importance of teaching the children the art of fruit and flower culture. The medium through which this can best be done is the public school. Mr. John W. True of New Gloucester who has so long served the society in an official capacity invited us to hold such a school in New Gloucester, assuring us that all would be done locally to make such a meeting successful. Mr. T. M. Merrill, one of our members, is also a member of the school board, and to him and his associates we are indebted for the loan of the school children for a couple of days. The first day, May 1st, the school was held in the town hall. The children were brought in hayracks and double hitches from all parts of the town. The Shakers came from Sabbathday Lake, their quiet and beautiful home. They brought lunch baskets and dinner pails along with them, and the jolly good time they had together will be long remembered. The second day the school was held in Centennial Hall, Upper Gloucester, and was well attended by the children. The topics presented to the children were as follows:

1. Plant life.
2. How plants are propagated.
3. Leaves, flowers, fruits.
4. Setting out plants, sowing seed, etc.
5. The study of plants on the farm.
6. Insects—friends and foes.
7. The care of the fruit for home and market.
8. How to make plants grow to produce flowers and fruit.

The children brought note books and pencils, and their little fingers were busy taking down the outlines presented by the speakers. In the instruction we were ably assisted by Fred W. Card, Professor of Horticulture in Rhode Island College of Agriculture and Mechanic Arts; Prof. W. M. Munson of the University of Maine and Mrs. V. P. DeCoster of Buckfield.

The instruction of Prof. Card who has done so much to promote nature study among children was particularly acceptable to the children and others present.

May 1st being Arbor Day President Gilbert planted a tree upon the lawn as an appropriate memorial of the first horticultural school for children; the closing exercise of which was the singing of the following Arbor Day song:

Strike deep thy rootlets down,
Spread forth thy leafy crown,
    Make fair this place,
Richly by Nature blest,
Shelter the song-bird's nest,
Shadow the traveler's rest,
    With airy grace.

Upright as truth, oh tree,
Widespread as charity,
    Rooted in love,
Though skies be blue or gray,
Reach farther day by day,
Bare boughs or leaves of May,
    Ever above.

When hands that turn the soil
Rest from life's care and toil
Let thy leaves fall,
Russet or red and gold,
Covering the barren mold
With beauty fold on fold,
Heaven over all.

—MARTHA J. HAWKINS.

A few days later a letter came from Sister Ada Cummings, the teacher of the Shaker school, in which she wrote of the great pleasure they had enjoyed in attending the horticultural school, and that as a fitting memorial of the event the Shakers planted three trees, and as a mark of their appreciation had named them for Prof. Card, Prof. Munson and the secretary of the Pomological Society. This expression of good will will be cherished as perhaps the most delicate compliment received during the service of your secretary.

In some form I hope that there may be each year, somewhere in the State, a horticultural school for the instruction of our boys and girls. The children enjoy this work and nothing suits them better than to learn to plant and care for fruits and flowers. The old, alas, as some of us know, cling to old ways and are slow to learn new ways. Soon the boys and girls will be men and women, and it is our sacred duty to train them in the art of horticulture and the full enjoyment of all that nature may afford.

ANNUAL MEETING.

Several invitations were received for the annual meeting, and after due consideration the executive committee accepted the invitation from the Franklin County Agricultural Society to hold the meeting in Farmington. The meeting was accordingly held in Music Hall, November 5 and 6. The officers of the society and the citizens were most cordial in their reception to the society and visitors. The programme was a popular one and the meeting was largely attended. The exhibition of fruit was one of the best ever shown in the State representing no less than 100 exhibitors. The ladies of Farmington sent in many choice plants which were very tastefully arranged about the stage, and added much to the appearance of the hall. Good opportunity was given for the examination of the fruit, and when all was over the visitors left for their homes after a most delightful meeting. The spirit of sociability was everywhere, and when results are summed up this last annual meeting and exhibition were well nigh the best in the history of the society.

CHERRYFIELD MEETING.

A one day local meeting of the society was arranged for by Mr. D. W. Campbell of Cherryfield, and it was held November 13th. It was attended by Pres. Gilbert, Messrs. Libbey and Arnold and the secretary. The fruit growers of Washington county were glad to have us meet with them. Of this meeting the Maine Farmer said:

The meeting was well attended through the day by the growers of fruit, and by those who want to grow it, from all parts of the county, the railroad courteously granting half rates to all attending over its line, while in the evening the spacious town hall was well filled with a mixed audience interested to take part in the meeting.

A surprisingly large and creditable collection of apples and pears was drawn together, giving a better idea of what is being done in that locality in the production of fruit than could have been gained by the use of words alone. Of a considerable number of standard varieties specimens were shown that would do credit to any section of the State.

The exercises of the day were intentionally somewhat informal, being a familiar interchange of views in most part on varieties adapted to the locality and their characteristic merits. President Gilbert in opening the exercises stated that one object in view in arranging the meeting was to give the officers an opportunity to learn more of the fruit industry in that locality. He expressed himself as gratified at the progress being made and the evidence found of the success reached. In the afternoon C. A. Arnold of the executive committee read a carefully prepared paper on care and cultivation of orchards. In the evening, Secretary Knowlton filled the first half hour with an interesting illustrated lecture with the title "Here and there among the Fruit Growers." The remainder of the evening was given to an off hand talk on the important matter of "Small Fruits for the Home and the Market," by R. H. Libbey, Newport.

OTHER MATTERS.

The following pages contain much that was presented at the meetings held during the year. The papers are of unusual merit and bear directly on the interests of Maine fruit growing.

It has been a pleasure to have with us during the year the representatives of four different experiment stations: Prof. F. A. Waugh, Vermont; Prof. Fred W. Card, New Jersey; Prof. W. M. Munson, Orono, and Prof. John Craig, Ithaca, N. Y. The names are so familiar in horticultural literature it seemed like meeting old friends. It was a great disappointment to many that Prof. Corbett of the Department of Agriculture at Washington was detained by a severe cold. It has been the effort of the management of the society to bring Maine fruit growers into touch with the best horticultural teachings of the country. The papers published will give the reader some idea of what these teachings are.

D. H. KNOWLTON.

FARMINGTON, December, 1902.

OFFICERS FOR 1902

President.

Z. A. GILBERT, North Greene.

Vice-Presidents.

D. P. TRUE, Leeds Center,
H. L. LELAND, East Sangerville.

Secretary.

D. H. KNOWLTON, Farmington.

Treasurer.

CHARLES S. POPE, Manchester.

Executive Committee.

President and secretary, *ex-officio*, R. H. Libbey, Newport; V. P. DeCoster, Buckfield; C. A. Arnold, Arnold.

Trustees.

Androscoggin county, A. C. Day, South Turner.
Aroostook county, John W. Dudley, Mapleton.
Franklin county, E. F. Purington, Farmington.
Cumberland county, John W. True, New Gloucester.
Hancock county, E. W. Wooster, Hancock.
Kennebec county, E. A. Lapham, Pittston.
Knox county, Alonzo Butler, Union.
Lincoln county, H. J. A. Simmons, Waldoboro.
Oxford county, Lemuel Gurney, Hebron.
Penobscot county, A. A. Eastman, Dexter.
Piscataquis county, W. E. Leland, Sangerville.
Sagadahoc county, A. P. Ring, Richmond Corner.
Somerset county, F. E. Emery, Skowhegan.
Waldo county, Fred Atwood, Winterport.
Washington county, D. W. Campbell, Cherryfield.
York county, C. A. Hooper, Eliot.

Member of Experiment Station Council.

CHARLES S. POPE, Manchester.

MEMBERS OF THE SOCIETY.

NOTE.—Any errors or changes of residence should be promptly reported to the Secretary. Members will also confer a favor by furnishing the Secretary with their full Christian names where initials only are given.

LIFE MEMBERS.

Andrews, A. Emery............Gardiner
Andrews, Charles E............ Auburn
Arnold, C. A ....Arnold
Atherton, Wm. P. ....Hallowell
Atkins, Charles G ....Bucksport
Atwood, Fred. ....Winterport
Averill, David C ....Temple
Bailey, W. G....... .... Freeport
Bennoch, John E ....Orono
Bickford, Lewis I ..... Dixmont Center
Bisbee, George E .... Auburn
Blanchard, Mrs. E. M ....Lewiston
Boardman, Samuel L.. ....Bangor
Briggs, John . ...Turner
Burr, John ....Freeport
Butler, Alonzo.........................Union
Chandler, Mrs. Lucy A . ...Freeport
Chase, Henry M., 103 Federal St., Portland
Chase, Martin V. B ....Augusta
Corbett, Herman .... Farmington
Crafts, Moses .... Auburn
Crowell, John H ....Farmington
Cummings, Mrs. Anthony ...... Auburn
Dana, Woodbury S.......... ...Portland
Dawes, S. H ....Harrison
DeRocher, Peter ......Bradentown, Fla.
Dirwanger, Joseph A...........Portland
Dunham, W. W ....North Paris
Dyer, Milton ....Cape Elizabeth
Emerson, Charles L ....South Turner
Farnsworth, B. B ....Portland
Frost, Oscar F................Monmouth
Gardiner, Robert H............Gardiner
George, C. H .... .Hebron
Gilbert, Z. A . ...North Greene
Goddard, Lewis C ....Woodfords
Grover, Franklin D ....Bean
Gurney, Lemuel ....Hebron
Hackett, E. C ....West Gloucester
Hall, Mrs. H. A...... ....Brewer
Hanscom, John ....Saco
Harris, William M ....Auburn
Hoxie, James S.......... North Fairfield
Hoyt, Mrs. Francis. ....Winthrop
Jackson, F. A...... ....Winthrop
Johnson, Isaac A ....Auburn
Keene, Charles S ....Turner
Knowlton, D. H.............Farmington
Lapham, E. A..... ....Pittston
Lincoln, E. L ....Wayne
Litchfield, J. H .... Auburn
Litchfield, Mrs. L. K ....Winthrop
Lombard, Thurston M ....Auburn
Luce, Willis A ....South Union
McLaughlin, Henry ....Bangor
McManus, John ....Brunswick
Merrill, T. M ....Sabbathday Lake
Mitchell, Frederick H..... ....Turner
Moody, Charles H ....Turner
Moore, William G ....Monmouth
Moor, F. A .... Waterville
Morton, J. A ....Bethel
Munson, W. M .... Orono
Page, F. W ....Augusta
Parsons, Howard G.......Turner Center
Perley, Chas. I ....Cross Hill
Pope, Charles S ....Manchester
Prince, Edward M....West Farmington
Pulsifer, D. W ....Poland
Purington, E. F ....West Farmington
Richards, John T................Gardiner
Ricker, A. S..... ....Turner
Roak, George M .... Auburn
Sanborn, Miss G. P ... .Augusta
Sawyer, Andrew S.......Cape Elizabeth
Sawyer, George B . ...Wiscasset
Simmons, H. J. A .... Waldoboro
Skillings, C. W.............North Auburn
Smith, Henry S ....Monmouth

LIFE MEMBERS—Concluded.

Snow, Mary S.... .... Bangor
Starrett, L. F........ Warren
Stetson, Henry........ Auburn
Stanley, O. E........ Winthrop
Stilphen, Asbury C........ Gardiner
Strout, S. F........ West Falmouth
Taylor, Miss L. L., (Lakeside) Belgrade
Thomas, William W., Jr........ Portland
Thomas, D. S. .... North Auburn
Thurston, Edwin .... West Farmington
Tilton, William S. .... Boston, Mass
Townsend, Mrs. B. T........ Freeport
True, Davis P........ Leeds Center
True, John W........ New Gloucester
Twitchell, Geo. M........ Augusta
Vickery, James........ Portland
Vickery, John........ Auburn
Wade, Patrick........ Portland
Walker, Charles S........ Peru
Walker, Elmer V........ Oxford
Waterman, Willard H........ East Auburn
Waugh, F. A........ Amherst, Mass
Wheeler, Charles E........ Chesterville
Whitney, Edward K........ Harrison
Yeaton, Samuel F........ West Farmington

ANNUAL MEMBERS, 1900.

Bradbury, J. W........ Norway
Bryant, Mrs. E. F........ Buckfield
Carsley, Mrs. A. S........ New Gloucester
Chadbourne, Mrs. J. A...North Bridgton
Chandler, Mrs. A. C........ New Gloucester
Cox, O. N........ North Norway
Day, A. C........ South Turner
DeCoster, Mrs. V. P........ Buckfield
Dudley, John W........ Mapleton
Edwards, S. D........ Oxford
Marsh, Mrs. W. S........ Intervale
McAllister, Z........ Lovell
Merchant, S. L........ Winthrop
Noble, Mrs. Frank G........ Norway
Richards, Mrs. A. L........ New Gloucester
Ricker, J. W........ East Auburn
Roberts, J. A........ Norway
Rollins, F. H........ Farmington Falls
Sweetser, S. F........ New Gloucester
Tarr, Edward........ Mapleton
Toothaker, L. P........ Simpson's Corner
Tucker, Benj........ Norway
Tucker, Herbert M........ South Paris
Upton, Mrs. O. B........ Norway
Wooster, E. W........ Hancock

ANNUAL MEMBERS, 1901.

Austin, Alfred........ Parkman
Austin, Chas........ South Berwick
Beal, Mrs. Altana........ North Fairfield
Clark, Chas. H........ Wells Branch
Copeland, Llewellyn........ Dexter
Davis, Fred........ Newport
Day, A. C........ South Turner
DeCoster, V. P........ Buckfield
DeCoster, Mrs. V. P........ Buckfield
Dudley, John W........ Mapleton
Dunn, A. L........ Buckfield
Eastman, A. A........ Dexter
Edwards, R. G........ Brooks
Emery, Frank E........ Laramie, Wyoming
Fogg, Alvan H........ Rockland
Greenleaf, A. C........ Farmington
Haines, J. W........ Dexter
Hall, Chas. G........ Cedar Grove
Hayden, Chas. H........ Dexter
Johnson, C. F........ Dexter
Jose, S. O........ Dexter
Leland, H. L........ East Sangerville
Leland, Will E........ Sangerville
Libbey, R. H........ Newport
Libbey, Mrs. R. H........ Newport
Litchfield, L. K........ Winthrop
Mathers, Mrs. A. C........ Rockland
Merchant, S. L........ Winthrop
Munson, W. M........ Orono
Nowell, F. E........ Fairfield
Phillips, W. H........ Hancock Point
Plummer, Stanley........ Dexter
Roberts, M. W........ Brooks
Robinson, O. M........ Dexter
Rowe, W. C........ Brooks
Spear, Mrs. Carus T........ Rockland
Stoddard, Mrs. Alma S........ Farmington
Titcomb, B. M........ Farmington
Waterman, L. C........ Buckfield
Whittier, Phineas........ Farmington Falls
Wooster, E. W........ Hancock

* Deceased.

ANNUAL MEMBERS, 1902.

Adams, J. W..................East Wilton
Alden, R........................Winthrop
Allen, E. F... ....Columbia Falls
Austin, Mrs. A. F....... ....Farmington
Bradley, Mrs. Myrtie E ....Vienna
Brown, Mrs. C. O............ East Wilton
Campbell, David. ....Cherryfield
Campbell, D. W .... Cherryfield
Clark, Chas. H..............West Branch
Conant, S. E ... .Buckfield
Day, A. C........ .. .. South Turner
DeCoster, V. P......... .... Buckfield
DeCoster, Mrs. V. P ....Buckfield
Dudley, John W.................Mapleton
Dummer, Chas. G.. ....Weld
Eastman, A. A. ....Dexter
Field, George W............ North Vienna
Furbush, Mrs. E. F...........East Wilton
Gould, E. W................Bean's Corner
Greenleaf, A. C... .... Farmington
Greenwood, Emilie..........Farmington
Hall, Chas. G..... ....Cedar Grove
Hiscock, Mrs. W. L. ....Farmington
Holley, W. B............ .... Farmington
Jenkins, Mrs. Elmira .. .. .Temple
Jennings, Mrs. R. B. ....Farmington
Jewell, H. D......... .. ....Farmington
Jordan Ira..................... Milbridge
Leland, Will E..........East Sangerville
Libbey, R. H................... .Newport
Libbey, Mrs. R. H............. Newport
Lincoln, E. L .... Wayne
Mayo, E. R.. ....Manchester
McAllister, Zacheus .. ..Lovell
McCleery, Robert............Farmington
Merchant, S. L.................Winthrop
Niles, S. H .... North Jay
Odell, Mrs. A. J..... ....Farmington
Plummer, H. A...... ... ... Addison
Purington, Mrs. E. F........Farmington
Ricker, H. C..... .. ..Buckfield
Robinson, O. M.... ....Dexter
Rodbird, W. W....................Dryden
Sampson, R. S................Farmington
Simmons, Mrs. J. V......... Farmington
Small, E. C....................Cherryfield
Stetson, C. S.. ....Abbot
Stewart, Mrs. A. M..........Farmington
Stewart, John ....Cherryfield
Tarr, Edward.................. Mapleton
Titcomb, B. M............... Farmington
Toothaker, L. P....... Simpson's Corner
Tucker, Benj..... .... North Norway
Tufts, Laforest ....Farmington
Von Herff, B ....93 Nassau St., New York
White, Edward L .... Bowdoinham
Whittier, Phineas. ...Farmington Falls
Wilbur, Georgine ....Phillips
Willey, A. B...................Cherryfield
Wiswell, M. H......... ....East Machias
Withington, Mrs. Chas.........Buckfield
Rollins, Frank H......Farmington Falls

BUSINESS TRANSACTIONS.

MEETINGS OF THE EXECUTIVE COMMITTEE.

AUGUSTA, January 23, 1902.

Voted, That the membership to the New York Fruit Growers Association, for the member of our society, who has in charge of the collection of facts bearing on the fruit crop of the country and reporting the same to Maine fruit growers, be paid by our society.

The secretary presented to the committee the Wilder Medal awarded our society by the American Pomological Society, for the display of apples made at the last biennial meeting in Buffalo in September, 1901.

The secretary presented an invitation for the trustees of the Franklin County Agricultural Society to hold the next annual meeting in Farmington, and it was laid on the table for future consideration.

Voted, That the members present favor the binding of a volume of about 500 pages of recent transactions consisting of transactions 1897, 1898, 1899, 1900, etc., provided the cost of same does not exceed $50.

Voted, To hold during the year a winter or spring meeting, a Horticultural school, a summer meeting and the annual meeting.

Voted, That the president and secretary be instructed to determine dates and locations and arrange programs for the first three meetings.

Voted, That a schedule of premiums be prepared and printed with announcements for the above meetings.

BUCKFIELD, March 27, 1903.

Voted, To have 150 copies of the society's transactions bound, the volume to consist of enough years' transactions to make a good sized volume. The unbound sheets to which this vote refers being now in the possession of Mr. Chas. S. Pope, he is hereby instructed to carry this vote into effect. That said volumes are to be placed in the hands of the secretary to be distributed as the executive committee may direct.

Voted, That the holding, locating and date of a summer meeting be referred to the president and secretary, as well as the program for said meeting.

The secretary presented medal received from the Paris Exposition.

Invitations have also been received from E. W. Wooster of Hancock to hold the annual meeting in that county.

BANGOR, August 20, 1902.

Mr. Arnold presented an invitation from John W. Dudley to hold the annual meeting in Aroostook county.

Voted, To hold the next meeting (annual) at Farmington in the month of November, sometime previous to the 10th.

Voted, To refer the preparation of program for annual meeting and exact date to the president and secretary.

Voted, That the secretary be instructed to procure a certificate of membership from original design and that 200 copies of same be printed.

FARMINGTON, November 4, 1902.

Voted, That the following parties be employed as judges of fruit: A. C. Day, South Turner; L. H. Blossom, Turner Center. As judges of flowers: Prof. W. M. Munson, Orono. As judges of canned fruits, jellies, etc.: W. D. Baker, Quincy, N. H.; Mrs. J. A. Tilton, Farmington.

PUBLIC MEETINGS.

The spring meeting of the society was held in Nezinscot Hall, Buckfield, March 28. The meeting was excellent. There was a small exhibition of fruit, and a good collection of local grown plants. The attendance was good in the afternoon and evening. The program was as follows:

Prayer by Rev. H. C. Munson; address of welcome by Senator Prince, and response by the secretary; Fruits of Southern Penobscot and Waldo Counties, by C. A. Arnold, Arnold; The Ben Davis and What It Stands For, by Prof. F. A. Waugh, Burlington, Vt. Illustrated lecture in the evening by Prof. Waugh.

HORTICULTURAL SCHOOL.

This school—the first of the sort so far as your secretary knows—was held in New Gloucester, May 1st and 2d. For full mention of this school reference is made to the secretary's report. (See p. 7.)

ANNUAL MEETING.

The annual meeting was held in Farmington, November 5 and 6. The program was as follows:

OPENING SESSION—Prayer by Rev. E. R. Smith, Farmington; address of welcome, Major S. Clifford Belcher, Farmington; response, R. H. Libbey, Newport; president's annual address, Z. A. Gilbert, North Greene.

WEDNESDAY AFTERNOON—Fruit Growing in Piscataquis County, Will E. Leland, East Sangerville; discussion of popular varieties; Evaporating Apples, W. H. Keith, East Monmouth; discussion on this topic and canning apples, opened by E. H. Dingley, West Farmington; Plum Culture, E. R. Mayo, Manchester; discussion on the paper and desirability of the newer varieties.

WEDNESDAY EVENING—Among Fruit Growers Here and There, illustrated with lantern slides, first part, D. H. Knowlton, Farmington; second part, Prof. John Craig, Ithaca, N. Y.; Home Decorations, Prof. L. C. Corbett, Washington, D. C.

THURSDAY MORNING—Business meeting; report of treasurer, Chas. S. Pope, Manchester; report of secretary, D. H. Knowlton; election of officers; miscellaneous business.

THURSDAY AFTERNOON—A Woman Among Small Fruits, Lilla M. Scales, Temple; discussion of paper; Culture and Marketing of Fruits, Prof. W. M. Munson; discussion of paper and topics related to it; Insecticides and Manner of Treating, Dr.

George M. Twitchell, Augusta; discussion of practical work in use of insecticides.

THURSDAY EVENING—A Practical Nature Talk, Mrs. V. P. DeCoster, Buckfield; Fruit and Flower Study in its Relation to the Primary Schools, illustrated, Prof. John Craig, Ithaca, N. Y.

The following officers were elected for 1903:

President—Z. A. Gilbert, North Greene.

Vice Presidents—D. P. True, Leeds Center; H. L. Leland, East Sangerville.

Secretary—D. H. Knowlton, Farmington.

Treasurer—Chas. S. Pope, Manchester.

Executive Committee—The president and secretary, *ex-officio;* R. H. Libbey, Newport; V. P. DeCoster, Buckfield; C. A. Arnold, Arnold.

Trustees—Androscoggin county, A. C. Day, South Turner; Aroostook, John W. Dudley, Mapleton; Cumberland, John W. True, New Gloucester; Franklin, E. F. Purington, Farmington; Hancock, E. W. Wooster, Hancock; Kennebec, E. A. Lapham, Pittston; Knox, Alonzo Butler, Union; Lincoln, H. J. A. Simmons, Waldoboro; Oxford, Lemuel Gurney, Hebron; Penobscot, A. A. Eastman, Dexter; Piscataquis, W. E. Leland, East Sangerville; Sagadahoc, Edward L. White, Bowdoinham; Somerset, F. E. Nowell, Fairfield; Waldo, F. A. Putnam, Jackson; Washington, D. W. Campbell, Cherryfield; York, C. A. Hooper, Eliot.

Auditor for 1901 and 1902—Dr. George M. Twitchell, Augusta.

Member of Experiment Station Council—Chas. S. Pope, Manchester.

Mr. C. A. Arnold submitted the following amendment to Sect. 1, Art. II of the by-laws of the society: That the elective members of the executive committee upon the adoption of this amendment be elected one for one year, one for two years, and one for three years, and thereafter one member shall be elected annually for three years.

Voted, To lay the same on the table for consideration at the next annual meeting.

Voted, That a committee of three be appointed to take into consideration the advisability of awarding some appropriate testimonial for a sweepstakes prize; and the Chair appointed Dr. Geo. M. Twitchell, Mrs. V. P. DeCoster and Mrs. Lucy A. Chandler.

Voted, That the executive committee be instructed to investigate the subject of legislation to secure an inspector of fruit, as outlined by Prof. Munson. Also, to prepare and present to the Legislature, and if possible, secure the passage of an act to provide for the protection of our State against the bringing in of nursery stock which may be infected with the San Jose scale or other injurious insects.

Voted, That the matter of making an exhibit at the Exposition (St. Louis) in 1904, and the securing of funds for the same, be referred to the executive committee with discretionary power to act.

Resolved, That the Maine State Pomological Society desires to express its hearty appreciation of the earnest efforts of Commissioner Gilman of the State Department of Agriculture to advance the standard of farm work and scientific investigation.

Resolved, That we testify our appreciation of the continued favors granted exhibitors and visitors at our exhibitions by the Maine Central Railroad.

Resolved, That in the size and quality of this exhibition we find additional cause for congratulation over the development of the fruit industry in Maine and realize as never before the necessity for more active efforts in the future.

Resolved, That we express our obligations to the citizens of Farmington for their hearty co-operation in arranging Music Hall, and especially to the Sunshine Club and students of the State Normal School for their most valued assistance and choice music furnished our sessions.

Resolved, That the thanks of this society be tendered to Franklin County Agricultural Society for its generosity in furnishing Music Hall for these sessions and the assistance of its members in the preparation and oversight of the same.

G. M. TWITCHELL,
E. L. LINCOLN,
S. H. DAWES,
Committee on Resolutions.

PAPERS, ADDRESSES AND DISCUSSIONS OFFERED AT VARIOUS MEETINGS OF THE SOCIETY.

ANNUAL INVOCATION AT ANNUAL MEETING.

By REV. E. R. SMITH, of Farmington.

O Lord, our God, thou art very great. Thou art clothed with honor and majesty. Thou coverest thyself with light, as with a garment. Thou stretchest out the heavens as a curtain. Thou makest the winds thy messengers and the flaming fire thy minister. Thou hast laid the foundations of the earth. Thou coverest it with the deep as with a garment. Thou sendest springs into the valleys to run among the mountains. They give drink to every beast of the field. By them the fowl of the heaven have their habitation. The earth is satisfied with the fruit of thy works. Thou causeth the grass to grow for the cattle and herb for the service of man. Seedtime and harvest fail not. Thou givest to all their meat in due season. O Lord, how manifold are thy works. In wisdom hast thou made them all. The earth is full of thy riches. Therefore we praise thee, as did one of old, for the precious things of the heavens, and the dew and for the deep which coucheth beneath. For the precious things of the fruits of the sun and for the precious things of the growth of the moons. And for the chief things of the ancient mountains and for the precious things of the everlasting hills. And for the precious things of the earth and the fulness thereof. And for the good will of him that dwelt in the bush.

We praise thee because we may think of thee as over all and in all, and our Father. We invoke thy blessing upon all honorable industry. We thank thee for the privilege of labor and for the certainty of our being able to work with thee for the enrichment and the beautifying of thy world. We invoke thy blessing upon this society with its noble motives and important object. We pray that while its members tarry with us they may find it good to be here. We remember our country and all in authority. May our country become increasingly one whose people are mindful of God. Grant that we may not forget thee. With all our gettings may we find understanding and the fear which is the beginning of wisdom. May human societies and associations of men become one in spirit with thee. May that ancient vision of society be fulfilled, that vision of the New Jerusalem wherein was the river of the water of life; on either side of which grew the tree of life, yielding its fruit every month and having its leaves for the healing of the nations.

Thus may thy kingdom come and thy will be done, for thy Name's sake, Amen.

ADDRESS OF WELCOME.

By Major S. Clifford Belcher, Farmington.

The pleasant service has been assigned to me by the Franklin County Agricultural Society, whose guest you are, of welcoming you to our county.

Our agricultural society has recently held its sixty-third annual exhibition and rejoices in continued prosperity. It is believed that no similar society in the State excels us in our annual displays of agricultural products, while our fine herds of blooded cattle, sheep, swine, poultry and fleet and docile horses are a source of pride to all our citizens.

The county of Franklin, bounded on the north by the Dominion of Canada, is practically bounded on the east by the Kennebec river and on the south and west by the Androscoggin. Its northern half is still a wilderness,—the forest primeval,—containing a wealth of lumber that is constantly finding its way to the great centers of population, while its solitudes, filled with numerous lakes and streams, abounding in game and fish, are the paradise of sportsmen, and may well be termed the Adirondacks of Maine.

But it is the valley of our Sandy river, all of which is within our county, which constitutes our agricultural wealth. The broad intervales, extending its entire length, as level and as free from stone as western prairies, and nearly as fertile, produce abundant crops of hay for our herds, while the hillsides, extending back from the intervales, furnish sweet and succulent pasturage; while few farms are without suitable sites for trees producing fruit adapted to our climate. In particular, we are successful in the culture of the apple, the prince of fruits of northern climes.

The hills, back from the river, are covered with noble forests of rock-maple from which our industrious husbandmen extract great quantities of maple syrup, which finds a ready market in the cities of the country, while Titcomb's maple candy is known in Boston and New York as the criterion by which other makes are judged.

Sweet corn is one of our most profitable products and some eight or ten establishments are devoted to canning it, and I think I may say, without fear of contradiction, that Franklin county canned corn is the best in the world.

In recent years more attention has been paid to the products of the dairy, and the herds of beautiful Jerseys and Guernseys, which meet the eye on every hand, as we drive through the country, attest the intelligent interest shown by our farmers in this industry.

The raising of oxen for labor and for the beef market has always commended itself to our farmers. The huge forms of the white-faced Herefords, the black-and-white Holsteins and the clean red Durhams always compete for the blue ribbons at our annual exhibitions.

We have made some progress in the cultivation of apples, and while we may not excel in this particular branch of agriculture, yet I see that your secretary estimates that we sold over $200,000 worth of apples last year; and the names of Whittier, Purington, Knowlton and others, members of your society, show that we have intelligent and practical pomologists among us.

We are accustomed to speak of our Sandy River Valley as the garden of Maine and we believe we are justified in our estimate of our beautiful valley.

We welcome you to Farmington, the shire town of our county, its commercial and geographical center and its most populous town. We show you here a town without factories, without shipping or foreign commerce; simply a town supported by agriculture and the labors of the husbandman. You will find no indication of great wealth, for we do not have it; nor will you find great poverty, for we are happily exempt from it. We show you a typical agricultural town, with its schools, its libraries and its churches; its neat homes and convenient business establishments; and believe we illustrate that if farming does not "pay," to use the usual formula, yet a community, whose chief industry is tilling the soil, may be intelligent, prosperous and happy.

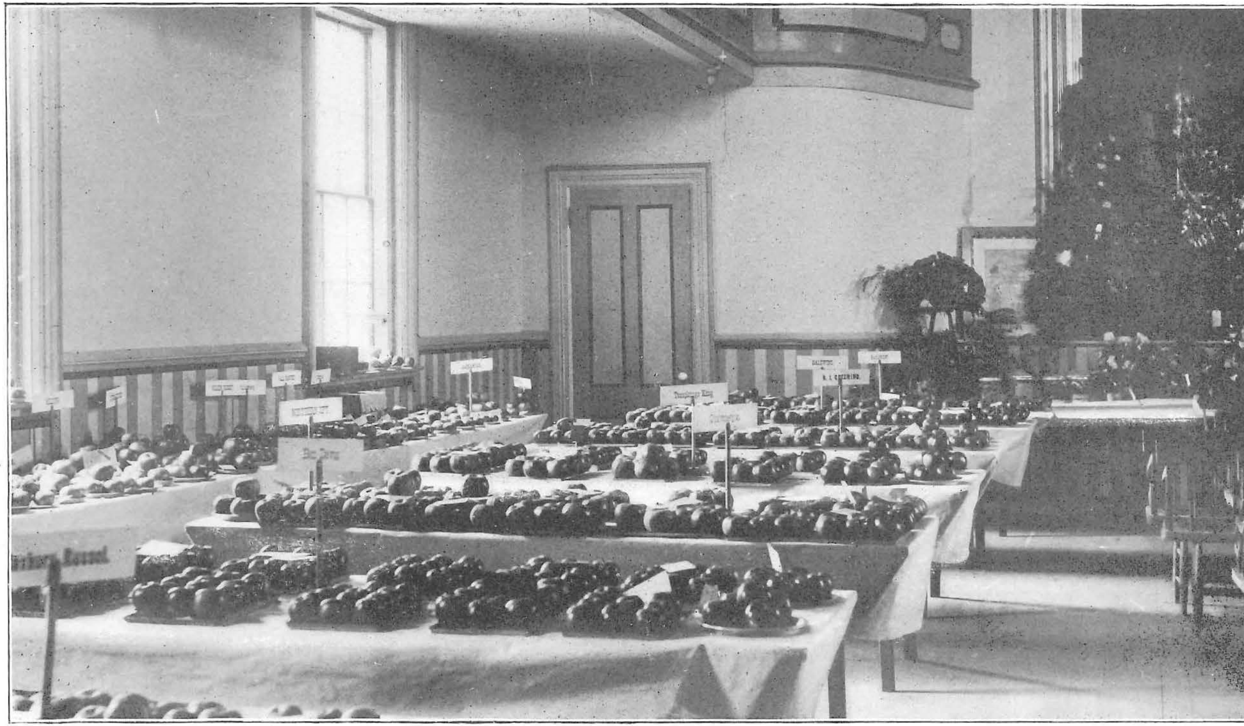
Today, when the measure of success is gauged by dollars, when the captains of industry are regarded as those who forge iron, weave textiles or dig coal, it may be well to consider whether the man who obeys the divine injunction given to our first father, when put upon the earth, to dress it and keep it, is not worthy of honor, and whether, after all, the old idea of comfort and happiness may not be true—namely, "to sit under one's own vine and fig tree."

Again, gentlemen, I welcome you, and trust that this visit of Pomona to Ceres may be agreeable and profitable.

RESPONSE TO ADDRESS OF WELCOME.

By R. H. Libbey, of Newport.

From the very fact of our invitation to meet in Farmington to exhibit, we knew that we should be welcome; and we knew it later, when we arrived, by the warm shake of the hand and the individual interest that the people of Farmington took in us in escorting us to the best houses in town. These were further evidences of our welcome to the town of Farmington, as was also our reception at our secretary's, in his spacious rooms in which the best citizens of Farmington were collected. And then, when we came to meet the good citizens of Farmington in the hall, we had still further evidences of welcome. It is unnecessary to take up time in saying that we appreciate it, and in behalf of the Maine State Pomological Society, I thank the citizens for their cordial welcome and for the kindly efforts they have made to receive us.



Annual Exhibition at Farmington, November, 1902. Showing some of the "special plates."

ANNUAL ADDRESS.

By Z. A. Gilbert, President, North Greene.

In accordance with a custom adhered to from the first organization of this society it devolves upon me to call your attention at this time to some of the conditions bearing upon and affecting the success of the fruit industry as carried on within our State at the present time, and suggest, if may be, such changes and improvements as seem to offer still further success to those who are engaged in prosecuting the fruit industry among us. While in the past there have been seasons of disappointment and of discouragement, years of special invasion of insect and cryptogamic enemies that have in greater or less degree defeated the well-directed efforts of intelligent growers, yet through it all the industry stands triumphant. Up to the present time there has always been a silver lining to the cloud that for a time has turned its darker shadows over our vision and obscured the pathway of progress. But intelligent study and persevering effort has at all times sooner or later lightened the way to continued success. After all the obstacles encountered in the way the fruit industry never held out a more inviting prospect to intelligent effort than at the present time. Whatever may be encountered in the future it is perfectly safe to claim that the industry will come through all obstacles triumphant. The people need fruit. It is ordained that they shall have it, and they are going to have it—more and more, and better and better as the years go on and wealth increases.

The apple crop of the present year has not been served in like bounty throughout the fruit growing sections of the State. Through this northern belt of the State where the crop was so bountiful a year ago, namely, Northern Oxford and Northern Androscoggin, Franklin, Somerset, a section of Kennebec and all of Penobscot, Piscataquis and Waldo counties, the crop this year has proved comparatively a light one. But in all that part of the State south of the territory named the crop has proved, not one of the largest, but close to a full one. At the same time the fruit was of large size and unusually free from imperfections. While the "scab" threatened for a time serious damage, yet finally its effects proved to be general only in a limited territory along our eastern coast.

While the crop of apples throughout the country at large was more general and therefore largely in excess of last year, yet the market has been in a healthy, active condition and prices have ruled fairly good in home market, and specially good for the early season across the water. At this time there is no reason apparent why the entire crop of Maine apples will not be cleaned up in good season at prices that will return the growers a reasonable profit. In the market abroad, while there have been forwarded larger shipments of American apples than ever before known in the same time in the history of the trade, yet good fruit has continued to command high prices, while the latest cable dispatches are to the effect that prices on that class of fruit are well sustained and the demand likely to increase to the end of the season.

Growers of fruit this season have been kept well posted on the range of the markets and comparatively few have disposed of their fruit at prices under its real market value at the time when sold. Access to reliable information of the extent of the fruit crop in the country at large and the promise of the market is now so easy, that there seems to be no reason for any grower to become uneasy and sell at under rates before a price is established. There will always be an outlet for Maine apples and there is no call for any grower to rush his fruit on the market in an effort to get there first.

The public work of our society in recent years has been largely directed toward the encouragement and promotion of increased production. The abundant evidence abroad all through the State of the effect of such effort is a gratifying feature. Fruit production is on the increase in all its branches.

At this thirtieth milestone of our organized effort I wish to raise the question whether we may not well break away from the beaten path we have been so intently and successfully pursuing for a decade and strike out on a new and yet equally important tangent.

MARKETING FRUIT

Is at least as important as producing it. From the standpoint of the grower as a source of revenue it is of far more importance. At the recent annual exhibition and convention of the New Hampshire Horticultural Society, which I had the privilege of attending, every speaker from the ranks of the growers dwelt at length on the market end of his subject. One I recall declared emphatically that "marketing was more than half the problem of success in fruit growing." A careful weighing of the matter in all its bearings will confirm the soundness of the claim set forth by this New Hampshire fruit grower. This being the case the apple growers especially of our State, and this society, may well for a time direct our efforts to the market side of our fruit industry. We have been dwelling on every feature of this industry save this one, the most important of all. The Dominion government, in an effort to increase certain lines of products on the farms of its subjects, first of all went to work to provide suitable market facilities for the same. To make it desirable to produce these products they must be well disposed of, was the sensible and reasonable argument. The California deciduous fruit growers were driven to the wall till they organized facilities for connecting the products of their orchards with the markets of the East. Growers in the Erie grape belt were driven to the necessity of systematizing the marketing of their grapes. Delaware peach growers found their profits all in the coffers of the commission men till they rose to the necessity of organizing a different system of selling. Where were the fruit growers of Maine in '96 with one of the finest and most beautiful crops of apples ever picked from trees, and with no protection to the market side of the situation? Where are we today but in the hands of the commission men, save only that here and there a man dares risk his crop shipped at a hazard on his own private account? Certainly it is quite time that attention was given to the market side of Maine fruit-growing.

As now conducted, it is one great hustle of the shippers to get growing, all the fruit possible afloat ahead of "the other feller," without regard to conditions of the market, and just as though the devil was sure to take the hindermost.

COLD STORAGE.

One of the great needs of the fruit industry of our State, and the first calling for attention at this stage of our progress, is cold storage. There are millions of barrels of choice fruit seeking a market and not a cold storage warehouse in the State, and scarcely a suitable place for the temporary storage of a single barrel! This is the situation in Maine today. If we propose to continue in the business of fruit growing, and especially if we intend to increase it and make it a special feature of our efforts, as this society has been and now is urging, there should be facilities provided for suitable storage.

Not only in the shipping trade abroad is this cold storage necessary, but it is even more important in catering to the home markets. Cold storage is now controlling in large measure the markets for all perishable products, and none of them more than fruit. Maine is a fruit growing State. Its fruit products are now of sufficient value to be taken care of. This fruit production, through the influence of this society and the general advance of a knowledge of the profits of the business is sure to largely increase in the future. The sooner provision is made to care for it in a manner to insure largest returns to the grower the better. If money is needed to provide such facilities as are needed we have it in plenty seeking investment. Money from the farms going into our savings banks, thence to distant states for investment would better far be used to extend, improve, perfect and render still more profitable the business that made it.

Just what facilities for storage may be needed under existing conditions is a question that this society may well, for the benefit of the industry, investigate. First of all, I do not hesitate to suggest, better storage at the farm where the fruit is grown is called for. Fruit as soon as taken from the trees should go directly into cold storage, or if not into technically "cold storage," then into a storage that though only moderately cold would store from changes of atmosphere to which nearly all our home storage is now subject. This provision alone would be an important step in advance. Fruit houses on the farm, or in the orchard, constructed with absolutely air tight surroundings, would prove of great value and are not costly. Several neighbors could unite in their erection and each share in their advantages. In some fruit growing sections of the country store houses of a similar kind are provided for neighborhood privileges. These advantages are all within the reach of any individual fruit grower, or a neighborhood of growers, and would be found of great advantage to the industry.

But further than home storage and local storage there should be cold storage warehouses provided at shipping points. To such extent has this matter of making temperature, if I may be allowed such an expression, been perfected that the cost of such storage is not now heavy and is entirely within the advantages gained by it. The sooner Maine fruit growers get on to the advantages of cold storage in some form the more will they be in control of their business and the greater the profits they will realize out of it.

The Washington Department of Agriculture is engaged in experimental cold storage of fruits, and while up to the present time reports of its work are nothing more than reports of progress, yet without doubt we shall soon be furnished with information of great value on this important matter. The department is also engaged in conducting experimental shipment storage abroad, which it is hoped may lead to improved storage of fruit in our export trade. Certainly it is gratifying to know that the general government is looking after the interests of the fruit growers.

Attention is called to these matters that our fruit growers may be gradually growing up to the idea that the caring for and marketing of fruit after it is grown is a part of the business quite as important to the grower as the production itself.

In closing, I wish in behalf of this society to acknowledge the efforts being put forth by our state agricultural department in behalf of our fruit producing interests. The commissioner at its head is bringing into the state in his institute work authorities trained by experience in fruit growing, thereby adding much to the work our society has in hand. We welcome all aid to the fruit growing interests of the State.

EVAPORATING APPLES.

By W. H. KEITH of North Monmouth.

My subject is "Evaporating Apples" and my paper is very brief as you will see when I get through. It needs more attention than it has at present in the State of Maine, first, for the sake of economy, second for utility, and third it being the means of manufacturing less drunkards.

Some twenty-three years ago, or soon after I located on a farm in Winthrop, I found that very much fruit was going to waste, and I inquired if there was not some way whereby it could be utilized for the use of the household. The process of evaporating came to my attention, and I invested in a $75 American evaporator. By so doing my otherwise waste product of apples was used to my satisfaction. The process, however, was slow as only three or four bushels of apples per day could be used. Later I bought a larger one which handled from fifteen to thirty bushels a day. This enabled me to handle my own waste product,—I use the term "waste product," for the cider mill was the only outlet for us then—as well as some for my neighbors.

The question is often asked, "Does it pay?" I here submit a statement that will allow each and every one to make his own figures and condense his own conclusions. I have already named the cost of the small evaporator. To run this requires the work of one girl at a cost of from $3.50 to $4 per week; repairing machine, 75 cents; fuel and sulphur per week, $1.00; fruit per bushel, 20 cents; evaporated per week, 18 bushels; total expense besides the wear of machinery of $8.30 to $8.80 per week.

Contra.

Eighteen bushels, 5 lbs. per bushel, 90 lbs., at 10 cents, $9.00. Giving a close margin of 20 to 70 cents.

But you have sold your apples at 20 cents per bushel which would otherwise have gone to waste or to the cider mill ultimately for making vinegar or drunkards.

Now comes in the utilitarian part of it, if you have a family of boys and girls to bring them into service.

Now to come to the subject as mapped out for discussion, viz: the popular varieties for evaporation: First, Red Astrachan; second, the Duchess; third, Baldwins, and Greenings and Roxbury Russets, and finally any variety which proves itself a desirable cooking apple. In preparing the product it is much better to pack each variety by itself to make the product more uniform.

With increased capacity you are enabled to utilize a larger quantity of the waste product and this brings us face to face with the factory system of evaporating apples. New York heretofore has led in this respect. When however, this is adopted, the quality of the product is impaired and the price reduced. Middlemen will handle the product that gives them the best showing for profit. I am inclined to the opinion that a more satisfactory return for second quality apples can be obtained by some individual running the business to use the neighborhood waste instead of the enlarged factory system. The sale of evaporated apple is much like the sale of vinegar. Middlemen will handle vinegar made of anything but apple juice if the margin of profit meets their ideas. So it is with the product of evaporated apple. But when the product of either is A 1 and the salesman is up with the times in pleasing customers, you have the best end of the trade. Canned fruit takes the lead and the apple and pear can be more easily used under the factory system, but there is still a vacancy for a good product of evaporated apple, if properly put upon the market.

The most satisfactory way of placing the product of evaporated apple on the market for the retail trade that I could adopt was to use strong paper bags containing two pounds each, with such printing on them as would make them attractive, and pack them in sugar barrels and ship where wanted. It was then easily and conveniently handled both for the retailer and consumer.

Q. I don't remember that the item of fuel came in at all for evaporating apples.

Mr. KEITH: Fuel and sulphur $1 per week. That is on the small evaporator, on the larger one of course it would require more. The whole expense is reported in my statement here as near as I can get at it.

I will just say here, gentlemen, that it would be much better in my opinion, and I prefer to do it myself, to feed my second quality apples to my cows rather than to have them put up and shipped for sale either by myself or by buyers. I think it is one of the set-backs to us in obtaining a good price for our apples, to allow our second quality apples to go in for sale. Many of the buyers pack pretty mean apples.

Q. About how much would you dare to feed your cows in quantity?

A. I would commence small and feed a peck or more a day without any hesitation at all. I have fed hundreds of bushels of apples to my cows by beginning in a small way of course, and when I had fed out the last apples I noticed a perceptible falling off in the quantity of my milk. I don't claim any great nutriment in apples, but you all know who keep cows or any stock where they can get at them, that they will walk a good ways for an apple. I am feeding apples to my cows now, or the eleven that I am milking; I am feeding them a bushel at the present time.

Q. Do you cut them?

A. No, sir. Feed them to them right in the stall where you feed your hay and there is not much danger of their getting choked. Where they can throw their heads up there is some danger.

Q. Why don't you ship the second quality?

A. It is a mean product to put upon the market. Some handlers of apples claim that they can get just as much as for the good ones and you can imagine what the effect would be upon the good ones. I have conceptions of my own about this matter, of course others have the same right. I wish there never could be a second quality apple put upon the market at all.

Mr. Cook: It seems as if this was quite an important matter, and as my opinion differs from the gentleman's it will do no harm to express it. We want the cheap apples on the market. What are all the poor people going to do for apples if there isn't some second quality on the market that they can buy that is within their reach? What are these cheap boarding-houses going to do for mince pies if you don't ship the No. 2 apples? Now this is important. We have got to have cheap boarding-houses in our large cities and they have got to get their apples down low so they can afford to board these working people at a low price, and it is important that they have access to these poorer apples; and they don't come in competition with the first-class apple. The same people don't buy them. It seems to me that it is a great mistake to leave at home your second quality apples.

Mr. KEITH: I am glad the brother has brought up that point. I think there can be plenty of cheap apples supplied for those who cannot afford to buy the better ones. Now what I mean by second quality apple is to put in an apple that has from one to half a dozen worm holes in it. Now we have a class of apples, a size of apples when we are packing that is not suitable to go in with a No. 1 apple, with which we can supply the market for a cheap apple,—put in an apple that is a little inferior for a No. 1, what we call a No. 1, and somewhat smaller if they are smooth, perfect apples, and you have a good No. 2 apple. I wouldn't object to buying a barrel of them myself if they were free from worm holes at a reduced price. Now I think that that vacancy that the brother speaks about could be easily filled without putting in so many wormy, bruised, wind-fall apples. I hope if any one has a point to bring out on this they will for I feel this is quite an important question and one that ought to be talked up among the farmers. I know the evaporated apple has received a set-back. I could always receive for my evaporated apple, without bragging about it, from two to four and five cents more on a pound than others did who put them up in 50 ℔. boxes and put up cores, worm-holes and skins on the apples. Our ladies no doubt who have used evaporated apples know this to be a fact, that they always have to look the apples over and trim them before they can be cooked—you don't want a mess of apples with cores in them, they don't relish very well with me.

Q. Wouldn't that class of apples that you speak of come under third rate rather than second—the wormy, bruised, windfalls?

A. Well, it might be classed, sir, anywhere they saw fit, but in shipping there are only two qualities named.

Q. Well, we don't generally ship that quality of apples, the bruised windfalls.

A. I don't know about that.

Mr. GILBERT: A bushel or barrel of apples is our unit of measure. I would like to ask Mr. Keith how many pounds of evaporated apple he can secure from a bushel, or barrel measure, as he sees fit.

A. In my statement I have mentioned that apples vary in the number of pounds. The Roxbury Russet will evaporate the largest number of pounds of any apple that I have evaporated.

Mr. GILBERT: What would you state as the smaller and the larger prices ordinarily from year to year in the market—what you sell yourself—talking about your own manufacture?

A. I can only answer that question in accordance with what I have done in the past. I have never sold them for less than ten cents and sometimes as high as fifteen or seventeen. Of course it depends upon the supply, but from ten to twelve cents is the price that I almost invariably obtain.

Mr. GILBERT: Or fify to sixty cents a bushel after evaporated?

A. Yes, sir.

Mr. KNOWLTON: I would like to ask Mr. Keith a question and it is this: whether any effort, so far as he knows, has been made towards packing apples in pound packages in practically air-tight cartons? I have in mind what the ladies here are all familiar with and that is the packages in which the seeded raisins come to the market from California. They are pressed first into some kind of a mold with sufficient pressure to make them solid, and then wrapped with a wax paper and then the package inclosed in a paper box or paper carton,—you know what I mean. I have seen evaporated apples packed in pound cartons, I don't know but what two, but they were loosely packed and no protection whatever except what the loosely made carton affords. I have in mind this, that packed in that way the product could be kept indefinitely.

A. It would probably discolor somewhat. When apples are kept over more than one year they get discolored.

Q. Let me ask a question there, isn't that due to the fact that the package containing it is not air-tight?

A. Well, it may be so, I never have practiced that. It would of course add to the expense of getting them into the market. The cheapest way that I know of is the way that I mentioned, to put them into strong paper bags. These paper bags are filled up so that they are comparatively tight. I think very likely the package that Bro. Knowlton speaks about may be preferable, but it would add to the expense of getting them into the market which of course is an item that always has to be taken into consideration.

Q. I would like to ask if natural fruit apples would be just as good as grafted fruit?

A. Any variety of apples, as far as I have observed, that proves itself to be a good cooking apple is all right for evaporating.

Q. How small would it pay to use them?

A. Well, in paring apples we reckon an apple that is an inch and a half or two inches in size would be all right, and an apple that you don't want to put into a barrel of apples of course would be all right for that, but the larger the apples the better the product, the more to the bushel.

Mr. POPE: I have had a little experience in evaporating apples. I found first that the Maine fruit well evaporated and well handled would bring a bigger price than the Western fruit. There is more acid in the Maine apple than there is in the Western apple, and as you all know an apple in drying loses its acidity, and that is one of the difficulties. There is not acid enough in the Western apple for a nice cooking apple, therefore the Maine fruit being more acid is worth more in the Boston market than the Western fruit for this reason. Then again the Maine fruit put up by the farmer, if he is a mind to take the pains with it, will make a whiter, nicer product and will bring a larger profit. Therefore the chance for money in evaporating our Maine apples is in putting up a little nicer article than the general article in the market. And we found, and others in Maine have found, that two or three cents a pound extra can be procured on nice Maine evaporated apples in the Boston market. The only way that we have been able to make much money out of it was in evaporating in the years when apples were so plenty that the product was absolutely worthless, you might say, worth nothing except to feed to stock. Put it up in fine shape, bleach it before it goes into the evaporator, take out all the skins, cores and worm holes, and put up nice apples, well bleached. Then place it in cold storage and hold it till the next season, when you are almost sure to have a short crop when evaporated apples being up higher will pay for all this extra work. In that way you have secured some profit. But in a season like this when apples are high and scarce there is hardly enough of it to be worth while to start an evaporator. And when I speak of starting an evaporator, I wouldn't advise putting in a little plant where you would run a little hand paring machine. A man who is going to do much in that line wants to put in an evaporator that will handle twenty bushels a day. One girl instead of paring a few bushels can just as easily pare twenty-five bushels a day. We all know that a party handling twenty-five bushels a day can do it much cheaper than where only three or four bushels a day are handled.

Mr. ROLLINS: I think it is just twenty years ago this fall when I first started evaporating apples, and I think that in almost any year it has been a profitable business to be carried on. Especially is it profitable, as the first speaker has said, to work up the second quality apples. I wouldn't advocate using a small apple or a poor apple for the purpose. Those that are only an inch and a half through, when you take the core out and the peeling off and dry the remainder, you don't have anything left practically. Nothing less than an apple two inches in diameter should be used for that purpose.

I think it will be an excellent plan, as some one has suggested, to pack them in cartons, putting them up in pound packages in some kind of way that will exclude the air and light, and that will preserve them from discoloring. It is a very hard matter to keep evaporated apple over to use the second year, however, unless it is kept in cold storage through the summer.

Mr. GILBERT: The chair would like to inquire of Mr. Rollins how the value received for that quality of apples compares with the sale of those apples in their natural form in the market?

Mr. ROLLINS: Well, perhaps the last one or two years would be an exception, but generally the class of apples we put through the evaporator would be worth but very little to put into the general market. For instance, in shipping to Boston, the expense will be as much as the apples will sell for generally on that class of apples. So that almost without exception that class of apples should be utilized in some other way than putting them on the general market,—either by evaporating or canning.

In some years it will pay to dry the cores and skins, if the facilities are large enough to dry the apple and also have room for this other purpose. Generally speaking, they will sell for $40 a ton, two cents a pound, the cores and skins dried and packed in barrels in Boston, while the expense is very little in simply putting them into the dryer and barrelling. Forty dollars a ton gives very good returns, but in some years they do not bring as much as that. This is used and known as jelly stock and it is the basis of nearly all the commercial jellies that we use, cranberry, strawberry, currant and all those jellies.

CANNING APPLES.

By E. HERBERT DINGLEY, West Farmington.

Although the apple canning industry is steadily and rapidly increasing in the "Pine Tree State," it will be some time before Maine will come up to the state of New York on quantity or quality of product. While the packers in this State can justly boast of the superiority of their canned corn, they still have to step back when the question of canning apples arises. This is due to the fact that, in the markets of London, Liverpool, Manchester, and Glasgow, the Maine goods come into competition with those packed in New York, Ontario, and Nova Scotia. Probably one-half or two-thirds of all canned apples go across the water same as the green fruit, and England rules the price.

New York uses a large amount of fall fruit such as Red Astrachans, Duchess, and others for early canning. These apples are nearly worthless in the orchards as the demand is so small compared with the supply. I am told that fall fruit is often given away in the apple section of New York on the agreement that it will be cleanly picked. This places New York in a better competitive position for trade than Maine.

Early or fall fruit will not make as saleable goods as the hard winter varieties for the early apples become darker when canned. It is an erroneous idea that *anything* will answer to can. The best apples for canning purposes are the Harveys, Greenings, and Baldwins. While all other winter fruit is good, the three which I have just mentioned are preferable and rank in the order named. We will readily see that the Maine apple growers cannot sell these varieties to the canners at prices sufficiently low for them to compete with York state and Canadian packed goods.

I have a friend who has been in the canned goods business for a great many years. While he has packed all kinds of fruit and vegetables, he has made a specialty of apple canning. I received a letter from him recently, and he wrote the following in regard to one season's pack in Canada:

"The writer met with the most satisfactory results, one year when fall fruit was nearly useless, in buying eight thousand barrels, all one kind, 'Duchess of Oldenburg,' number ones, and hand picked, at fifty cents per barrel (without the barrel) and canning them all inside of four weeks, beginning August 22nd. Sold same in Liverpool and Glasgow at a fair profit. This was done in a section where help was plenty—over a hundred girls being employed."

With the foregoing facts in view, we readily see why the Maine packed apples are not up to the other packs in quality. In this State, the growers cannot afford to sell their number one grafted fruit at canning prices, nor can the canners afford to pay the prices which the growers must get for their grafts.

The question which now arises is, What kind of fruit must be canned in Maine? Certain kinds of natural fruit make very fair goods, indeed. They must be of good size, smooth, hard, and free from bruises.

The size of canning apples must be two inches or over in diameter. There is, also, as much danger of the apples being too large as too small. An apple which is over three inches in diameter will swing the knife-arm of the paring machine out so far that the knife will not touch the skin at all. Such apples have to be pared with a hand knife. The best size for paring is two and one-half inches.

The apples should, also, be smooth as the uneven and rough ones will not pare well. The parer knife will jump over all of the hollows and the apple has to be pared again with the hand knife. It is also impossible to centre these apples on the machine so that the corer will not take out good apple and leave the core and hulls. This causes the apples to cut to waste. If an apple is soft, it is of no use at all. When it is pressed upon the forks of the machine, it begins to break and when the knife takes hold, the whole goes to pieces and falls into the basket with the parings.

A sweet apple is worse than useless for canning purposes. One piece of sweet apple will turn a whole can of the best of apples almost black. Discolored apples are unsaleable.

Because the housewife can make nice apple sauce from almost anything in the shape of an apple, is no reason that the canner can use the same grade of fruit with any success. We must bear in mind that the canner is not making apple sauce. He must pack such apples—and only such—as the great markets of England and America demand. The standard for canned apple, is large fruit cleanly pared and cored; free from bruised or dark spots; cut in quarters; and cooked only enough to keep it from fermenting. The apple must look white, and be firm enough to take out of the can and cut in slices, if desired, or used in quarters, re-cooked for sauce, or served with cream for dessert.

We must keep in mind that York State, with her grafted fruit, will lead Maine, and we must use our natural fruit so that it will come up as nearly as possible to the New York goods. One great difficulty in canning natural fruit is in getting goods that are uniform in solidity. In using *many kinds* and *many* different degrees of hardiness, it is impossible to process the can so that the apple will cut out uniformly. The packer cannot wholly overcome this. The best that he can do is to insist that all of the apples brought in shall be hard and firm.

One of the worst things with which the packers have to contend when buying natural fruit, is the manner in which they are handled. The apples should, whenever practicable, be handled and hauled in barrels; if barrels and large boxes are not obtainable, they should be hauled in bulk in a cart body; they should never be handled or hauled, no matter how short the distance, in sacks. In almost every instance, it is by handling them in sacks that we get the bruised and battered apples.

Any of you here, upon opening a can of apple and finding the brown spots, would know that they were caused by slight bruises. It is not so with the city buyers' and consumers. They know no difference between these bruised spots and decayed spots. When they find the bruises, no argument will convince them that these discolorations were not caused by decay. It, therefore, stands every packer in hand to be careful, when buying, to see that he gets only such apples as are free from bruises.

It has been called to my notice many times how careless and negligent the farmers are of their roadside and natural fruit. Unless the apples are properly handled and cared for, they are not suitable for canning purposes. If they are not fit for canning, they certainly are good for nothing except for cider; and it seems too bad to let them go to waste and sell for practically nothing, when, with proper care, they could be sold to canneries.

There are some varieties of grafted apples which bring very low prices when shipped into market green. These would be equally as profitable if sold for canning. When you ship them, you have to furnish the barrels, sort and pack them, be more particular in sorting, and pay the freight to market. Taking all this into consideration, one market will about balance the other.

I wish to impress these three things upon your mind, viz: you should take better care of your natural fruit, pick the apples early before they begin to soften, and use more care in handling them.

Mr. WHEELER: Mr. President, I don't want any fruit grower to go away and flatter himself that he can get a good price for four or five wormholes in an apple not an inch and a half through. When you come to work up an inferior grade or fruit for canning purposes, the help that you employ, in the first place the man that runs the machine to pare that apple, when he comes to a small apple or one-sided one, drops it into the waste basket. He isn't going to spend his time on it unless you stand right there by him, he is going to drop it, and I don't blame him. When you come to the girl who trims it, if there are quite a number of worm holes in it, why she doesn't want to spend her time and she throws it out. I am almost glad she does. I don't want her to spend her time on that apple and get but very little out of it. So don't think you are going to get something out of nothing. You can't do it. When you take a good fair grade of apple that will cost about seventy-five cents a barrel this year, of natural fruit, and have a good crew to work them along, there is some fun in seeing the stuff go through, if nothing more.

Mr. DINGLEY: In reply to the last speaker, I would say I heartily agree with everything he has said. I would not give the impression that we want this grade of apple, the No. 3 and like that; but as we said in regard to evaporating apples, the No. 2 grafted fruit was classed as the smaller, running a little below the shipping size, and the No. 3 took in the one-sided, bruised and wormy fruit. I would agree with him in saying that it is not profitable for the canner to try to use wormy or bruised and one-sided fruit. When this one-sided fruit comes to the paring knife, it will skip over it, it won't take off all the paring and it has to be trimmed by hand. And then another thing, it is impossible to center this one-sided fruit on the fork of the parers so that when the core knife passes in it will take out mostly good apple and leave the greater part of the core. This causes considerable waste and considerable more time spent in trimming the apple.

Mr. GILBERT: Reference is being made by the speakers to natural fruit. Of course we are not posted as to how much of that natural fruit is available here in Franklin county, but in the principal sections outside of Franklin county the fruit is substantially all of the choice grafted varieties, and the question comes in connection with that, how this fruit that is not suitable to go into the barrel for market is to be disposed of. I have today a hundred bushels more or less—a good deal more than that—of good cooking apples, coming out from such representatives as we have upon the tables here, that up to the present time have not been worth picking up and they lay under the trees on the ground,—good sized fruit, bruised fruit, that which fell from the trees too early and is not suitable to put into market. Now what shall I do with that fruit, and how much can I get out of that fruit, and can I turn that fruit into a certain measure of money? It is an important question. It is a fact that in the great manufacturing industries all the money today substantially is represented as being secured from the saving and use of waste products, that formerly went to waste, and in all of these great industries the profits are represented by the savings. Now then, are we not wasting a good deal of material that ought to be worth something to us in some other form, to say nothing about the seedling apples, natural fruit, anything of that kind, in connection with our fruit industry?

Mr. TITCOMB: If I understand correctly, that you have many apples laying on the ground in your orchard, I think you are making a great mistake there. You are just leaving a breeding place for the worms.

Prof. MUNSON: I want to emphasize the point that Mr. Titcomb made a few moments ago. It was passed off as a kind of a joke that the wormy fruit which is left on the ground is a source of danger to future crops. We have heard a great deal in this State in the past few years about the trypeta and the codling moth and the canker worm and other insect pests. We have not heard quite so much, although we might well have done so, about the apple scab and rot and so on. But do you know that these wormy fruits and these windfalls that are upon the ground are indeed a very serious menace to our future crops? and it will pay our orchardists to destroy that fruit even if they have to do it by hand instead of turning in the hogs and sheep, or turning those fruits into cider. As a safeguard to future crops then, destroy refuse fruit.

Mr. GILBERT: That is just the reason we have this subject upon the program. We want to find out the way to get something to pay us for picking up this fruit.

Prof. MUNSON: Do it whether you get pay for it or not. You and your children will get the pay in the future if you don't this year.

Mr. WHITTIER: The way we have disposed of that fruit, such as we leave on the ground—it is not fit for canning nor evaporating, it is not worth picking up for anything except to feed out, and the way we have done, we have left it on the ground and let in a lot of hogs and pigs to pick it up for us and it don't cost us much in that way.

Mr. COOK: In regard to these inferior apples and drops, as they are sometimes called, if you have the right variety of apples, if you have Baldwins and Ben Davis, the windfall apples that are large enough and are not too wormy will do to ship to your Boston markets, and what won't do to ship are not fit for the cannery or for anything else unless it is the cider mill or stock. The gentleman spoke about No. 2 apples and then went on to describe No. 7 apples. When he spoke of apples slightly ill-formed, gnarly, one worm-hole in them, a little under size, that was really the No. 2 apple, but the apple with a number of worm holes that he talked about, bruised, and but an inch and a half in diameter, those are not No. 2 apples, not second quality apples at all, but are only fit for waste, whatever use you make of your waste. I let the sheep and hogs and young cattle and colts in my orchard all the time from May till December. I think it is a good plan, that I get more apples from it, and get rid of these worms in that way. I remember once we had a wind that blew off a large percentage of the crop the last day of August. A good many of those apples in the vicinity where I am acquainted were packed and sent to Liverpool. The windfall apples in the section where I am acquainted are very largely taken care of, picked up and put into the cellar in separate piles from the hand picked apples, and the buyer is supposed to run them through and get perhaps 50% out of them to put in barrels. And when you ask what you get for your No. 2 apples, you get a good price for them. I suppose you sell your apples the same price for ones and twos and that you think the twos hurt the market enough, make the price enough lower so that you don't really get much for them. But it seems to me that that is a mistake. I have had No. 2 apples bring more in Liverpool than No. 1's. They did in one shipment last winter. The No. 2 apple is usually smaller, they go a good deal by weight there and the heavier barrels will bring the most sometimes. They do in Liverpool, and that is what we want to cater to. Our apples here in Maine mostly go to Liverpool—if it wasn't for the Liverpool market our apples wouldn't be worth the gathering—and we want to cater to that market, and they use late keeping, shipping apples, and there will be very little waste, surprisingly little if you have those varieties for that market. They don't discriminate as they do in New York and Chicago and those large American markets. They pay a very good price for a No. 2 apple there in Liverpool, and don't stop shipping your No. 2 Baldwins and Ben Davis and other good apples. If you have this soft stuff, half of which is exhibited here, it don't matter what becomes of it—graft your trees. If you have good natural fruit, no matter if it is five hundred years old, and it is still good and healthy, do as the Bible said by the tree and you will have a young tree again, the tree will renew itself. All these trees should be grafted, and when you get these hard, late-keeping, winter varieties you won't be troubled with waste and the evaporator and the canner will have to change his business and go into something else. There will be no more future for him here in Maine. And as to canning apples, just by way of matter of interest they are paying in New York now twenty-five cents a bushel for good grafted fruit apples, Baldwins and Greenings, to go into the canning shop. Some of those factories can 1,500 bushels a day and that is only a little of their business, they are canning so much other stuff, and pay only fifty cents a hundred pounds or twenty-five cents a bushel and they get good large Baldwins and Greenings, as large as your fist, most of the trouble they have the smut or fungus on them, and while we calculate to crate up our smutty, fungus apples, they haul them to the evaporator.

Mr. WHITTIER: I want to say one word more about getting rid of the trypeta by using up the poor apples. The first trypetas I ever saw anywhere round near my premises was the year after I bought apples to evaporate. I got quite a lot of apples with trypetas in them. I had more cores and skins than I could use up with my stock and I dumped them out into the orchard and other places around. Well, the apples that had trypetas in them and were not fit to use were dumped out into the orchard and the next year I had trypetas in my early fruit, and it is the first I ever had. You will have noticed that the first trypetas that ever appeared here in the county appeared near the villages. One year we had a scarcity of apples, they were imported from Massachusetts and they have had trypetas there I know more than fifty years, and we got apples here from Massachusetts that had trypetas in them; people around in the villages bought them,—but very few were bought in the country around, but in the villages they bought them and dumped the waste at their back doors and other places, and thus trypetas were brought around the villages, and that is where they appeared first. We never knew them before that in this county or in this State. Thus you see they can be carried in these poor apples, and thrown out as waste and dumped, the trypetas have a chance to live. Picking up these apples and using them for canning or evaporating, and dumping the waste out, will not get rid of the trypetas; but if you let the hogs and sheep eat them I think perhaps you might get rid of them.

Mr. DECOSTER: I believe that clean culture will destroy the trypetas. I have one orchard in a sheep pasture. I raise in that orchard from four to six hundred bushels every year and never have I found a trypeta apple in that orchard. In my orchard at home I am troubled very much with the trypeta, for the very reason that I don't do my duty, and I am trying to solve the problem. I think by practicing clean culture we will get rid of the trypeta.

FRUIT GROWING IN PISCATAQUIS COUNTY.

By WILL E. LELAND of East Sangerville.

I am aware that the fruit industry of Piscataquis county is not of sufficient importance in comparison with the rest of the State to occupy very much of your time.

Piscataquis county has an area of 3,780 square miles, more than three and one-half times as large as the state of Rhode Island. With all this great territory the population is the least of any county in the State.

The southern part only is at all thickly settled. The northern part, still covered with the forest primeval, with numerous streams and lakes, is a paradise for lumbermen and sportsmen.

It is owing to these conditions that the apple crop of the county is not especially considered in making an estimate of the crop of the State, and not that we are too far north for orchards to do well.

The first family came into the county nearly one hundred years ago. Many trees planted by the early settlers are still standing. Their fruit is of small value but their large size and evident vigor go to show that we are well within the limit of profitable fruit production. Nearly every farmer has his orchard, usually small. An orchard, that has reached the bearing age, of more than two or three acres is rarely seen. The Rhode Island Greening, Spy, Hubbardston, Milding, Nodhead, Fameuse, Rolfe, Talman's Sweet and Hurlbut are found in most of these orchards. The crop this year is hardly more than sufficient to supply the local market.

Within the past few years the attention of farmers has been turned more in this direction and many young orchards have been set, some of them quite large. I know of one of about eighteen hundred trees and occupying thirty acres. These younger orchards are usually Ben Davis or Stark, and of late the Arctic is being set to some extent. In some cases the Ben Davis and Stark will be topworked into Baldwin. We have been brought up to think the Baldwin could not be profitably grown with us. Proper care and cultivation have proved the error of this belief. I have seen Baldwin trees in Sangerville as well loaded and with fruit of as good quality as I ever saw in Readfield, and there was a time when I was quite familiar with a few orchards in the neighborhood of Kent's Hill. The cultivation, however, cannot be neglected.

The Rhode Island Greening is another variety that gives good returns if well cared for, bearing annually a fair crop free from scab.

The Northern Spy, were it not for its shy habit of bearing, would be esteemed above the Stark or any of the newer varieties as it combines good keeping qualities and flavor.

The Fameuse at one time were largely set. The trees are being grafted over in most orchards, as the scab makes the fruit nearly worthless in an ordinary season.

The Milding, or Winter Gravenstein, gives promise of being a very desirable variety in the county. The tree proves hardy, a prolific bearer and vigorous grower. As the trees grow older there seems to be a tendency for the fruit to scab somewhat.

The Rolfe originated in the county and at one time there was a large call for scions. Both tree and fruit are subject to the fungus and of late the trypeta has greatly damaged the crop.

The Hurlbut is not a late keeper and is probably not being set to any extent at present. It is a good bearer and has been one of the most profitable apples in our orchard.

The large crop in our section last year and good prices gave new interest and an unusually large number of trees were set last spring, while old orchards received such a trimming and fixing up as they never had before.

I have had but few years of experience but am convinced of the necessity of thorough care of the orchard. We all know the value of manure. It is plant food. A little of it makes a big apple instead of a small one. Which is worth more? We need to practice more what we already know. It takes courage to raise nothing but apples in the orchard with the barn full of stock, and yet we know that one crop is enough to expect if we wish it to be the best possible.

There is a question in the minds of Piscataquis orchardists whether or not we are making a mistake in setting these newer varieties that are not considered of first quality in the home market. I hope to learn something on that point from the experienced fruit growers here today. Also how long a time the young trees should be left before topworking when that is the end in view?

Q. I would like to inquire of the gentleman if there are any canning and evaporating plants in the county?

A. Not of apples; we have a corn establishment but they don't handle anything but sweet corn.

Prof. MUNSON: I would like to ask the speaker how far north in the county of Piscataquis these more hardy varieties may be grown? They certainly do well at Sangerville, which is just adjacent to Penobscot county, but how far north in Piscataquis will they grow?

A. I am familiar with the lower part of the county only; in fact, the northern part, as I said, is hardly settled. I was at Greenville this fall and saw a few trees, but I think there are no orchards much above Parkman, although I am not certain. I see no reason why they could not be grown as far north as it is now settled.

Mr. GILBERT: Mr. Leland has raised the question of the Arctic apple. I would like to know if there has been any experience in connection with the growing of this variety that can be reported here at this meeting, of the fruitage of that variety and the growth and character of the trees?

Prof. MUNSON: I may say that in the orchard of the Experiment Station, we have trees at the present time which have been planted ten years. We have two trees. One tree bore about a barrel of fruit last year, the other bore nearly as much this year. It is not a strictly annual bearer, but both trees bear some fruit every year. In general I may say the tree is very vigorous, is very hardy, and is a fairly good producer. The fruit has somewhat the appearance of a Baldwin,—not as well colored, not of as good quality, but where the Baldwin cannot be grown, the Arctic I should suppose would perhaps be the nearest variety to take its place.

Mr. COOK: I would like to ask the speaker why he would topwork a Stark tree?

A. I didn't say I would wholly, but they were being set, I said, in some cases to topwork into Baldwins. We have been growing the Baldwin quite successfully within a few years and we are afraid that the Stark is not of sufficient merit. I think it is certainly behind the Baldwin in our orchard for quality. There is a variety, the Milding or Winter Gravenstein, that we think considerable of. The tree is very hardy and is a vigorous grower and prolific bearer. The fruit as the trees grow older—this year in particular—has seemed to scab somewhat though; but as I said before we would like to get an apple of better quality, or an apple that suits the home market better. The Northern Spy, if it were not such a shy bearer, would suit, I think, the best of anything yet found, as it combines good keeping qualities and flavor.

Mr. GILBERT: Mr. Leland speaks of topworking the Ben Davis. The Chair has several times raised the question whether the Ben Davis stock was a satisfactory wood to graft upon. If any one has had any experience in changing the Ben Davis apple to some other variety by grafting, we would like to have it drawn out. I met a gentleman a few days ago who made the statement that it was not a good stock to graft on, that is, that many varieties would not do well and stand well grown on Ben Davis wood. You are aware that but few varieties of apples will grow on crab stock successfully, and he claims that the same difficulty to a certain extent is connected with the Ben Davis wood. These are facts of importance if we can establish them as facts.

Member: One Ben Davis I grafted with Gravensteins. I didn't have good success. They bore some but haven't done so well as other trees.

Q. I would like to ask Mr. Cook, who seems to have some knowledge of shipping apples, if he thinks it is going to be necessary to rework our Ben Davis apple trees?

Mr. COOK: I set 200 Ben Davis trees last spring. I have some thought that I may set 500 next spring. I do what I think is best for myself, and that I think is to set Ben Davis. In answer to the chairman's question, I have had no experience grafting anything else on to Ben Davis wood; I have had quite a little grafting Ben Davis on to other things. Ben Davis does very well grafted on to other varieties, but there is an objection to grafting some varieties at least into Ben Davis stock. Baldwin, for instance, I should not think would do well grafted in a Ben Davis tree, for the reason that the Ben Davis is not anywhere near as large a grower as the Baldwin. The Baldwin is a very vigorous grower when it has a good chance and will grow into a large tree. The Ben Davis is not comparatively so large a grower as the Baldwin, and I think you would get too heavy a top for the trunk in grafting the Baldwin into Ben Davis, but that is something I never should want to do myself. As to the gentleman's question, if he is catering to the local market he is all right, he wants an apple of good quality, but if you are contemplating a commercial orchard you don't want any apples of good quality. You can't mention an apple of good quality that is a first class commercial apple. The one that comes nearest to it perhaps is the Northern Spy. There are so many objections to the Northern Spy that I will not mention but one or two. In the first place they are too long coming to bearing. You want to plant something that will come to bearing before a great while. If you are planting Northern Spies, you are planting for posterity, and posterity never did me any good and I don't owe posterity anything; they must look out for themselves,—I did. To be sure, when I pass away I shall leave my Ben Davis trees, and I shan't regret the apples very much if I do, and you won't find anybody that will. But this matter of the Ben Davis, this scare if you may call it so about the Ben Davis, it seems to me is all nonsense. We don't come into competition with the western Ben Davis. There has been so much talk about the western Ben Davis, they raise so many out there; and their heads are level in doing it, that is the way they make money, but the season of the western Ben Davis is fall and early winter unless it is in cold storage. In Kentucky the Ben Davis is a fall apple, while ours keep, as you know, till spring; and no matter how much of a glut there may be in the market,—and we are face to face with a condition very much like that of 1896 now this minute,—if you have your cellar full of Ben Davis you needn't worry about that condition,—you may forget you have them and let them stay there until this glut, this overstocked market has all gone by, and then sell your Ben Davis for a good price. In 1896 you remember we had such a condition, and worse perhaps than it is now, and apples were not practically worth anything; the first two carloads I shipped in 1896 didn't bring me anything, I lost work, apples, barrels and everything, the freight just about offset what they brought in Liverpool. But I had some Ben Davis, and they sold when it came time to ship Ben Davis for seventeen shillings, more than $4, and netted back about $3. That is a good deal better. Your Ben Davis will bring you good money if you keep, them, as you can. Your Baldwins won't quite keep past the glut. They do very well, it is a grand apple, a great apple. And it is just so with other varieties of fruit. The best quality of pears are not the commercial pears, are not the ones you can make the most money out of raising. You can't make so much money out of raising them and they don't do it in the great pear growing sections, they don't raise the Bartlett and the Sheldon and those pears; they make their money out of the Kieffer and the Kieffer pear is of poorer quality than the Ben Davis apple; and in berries,—strawberries, blackberries, it is just the same. If you want quality, sentiment and poetry and all that, go into some big apple like the Alexander and Wolfe River and those things,—that is sentiment, I don't quarrel with that, but if you are after money, you want some late-keeping, hardy apples that bear young and are abundant bearers, and not too large, and as solid as bricks, and that will keep by the glut, and that haven't very good quality—of such is the kingdom of Ben Davis apple.

Mr. Solon Chase: The Northern Spy is good enough for me.

Mr. Gilbert: Is it a fact that the Northern Spy is generally troubled with trypeta?

Member: Very frequently ruined entirely on account of the trypeta.

Mr. Chase: I have got 250 barrels of Northern Spies in my cellar and I will give one dollar apiece for every trypeta found in them.

Member: That is all right. It is true just the same that the trypeta very frequently gets into the Northern Spy, and almost as frequently as into some of the fall apples.

Mr. Gilbert: That doesn't accord with the experience of some of our members at all. I would like to inquire whether that statement generally holds true. We have got to be a little careful in regard to the instruction we throw out in regard to varieties. Is it true that the trypeta menaces seriously the Northern Spy apples?

Mr. Blossom: I will say that up to this year ever since the trypeta appeared among us, I have lost my Northern Spies—utterly worthless up to this year. This year they are all right.

Member: In Cumberland county they are very chary about buying them. They are generally infested with trypeta.

Mr. BAKER: I overheard some remarks of the president in regard to an apple called the Arctic. I fail to see a sample of it here in the hall. I will say that we raised the apple or tried to, that is, and have been at work at it about fifteen years. We have discarded it. It is a handsome apple, the tree a vigorous grower, but it is an apple that goes off very quickly, appears one week to be solid as a rock, the next is gone by. The result is that we are discarding the Arctic apple. Perhaps they will do better here in Maine, but from my experience I would advise you to go slow. They are a very pretty apple, but an apple has to have something besides good looks on the outside to recommend it.

Mr. ————: I am interested in the Arctic apple. Last winter I had a bulletin sent me from the Orono State College. They called the Arctic apple one of the best, if not the best winter apples. This spring a man came along selling those apple trees and I bought fifty on what they said there. I would like to hear a little more about it so I can understand it a little better.

Prof. MUNSON: I am responsible for that bulletin. Whatever was said in that bulletin I will stand by. I don't think if the gentleman will read the bulletin over again he will find that it is called one of the *best* apples.

Mr. ————: That is the way I understood it.

Prof. MUNSON: But I do say that where you cannot grow the Baldwin that may take the place of the Baldwin as being somewhat of a similar type and a good selling apple. I do not regard it, and never did regard it as one of the best apples intrinsically.

Q. Is it a good keeper?

A. It is a good keeper. It kept with us last year until March or April, very well indeed.

Q. Is it larger than the Baldwin, redder and better flavored?

A. No, it will average fully as large as the Baldwin. It will not be a distinctively red apple, not as red as the best Baldwin. The color however, of course, as you understand, would depend very largely on the soil and location.

Q. Would you think it would be policy to set out more of these apple trees?

A. We have not grown it long enough to be sure what its characteristics are going to be. We have trees in the station orchard which have been planted twelve years—trees set in 1891, three-year-old trees at that time. That tree bore a barrel of fruit last year; it is a large, vigorous tree, and very healthy.

BEN DAVIS AND WHAT IT STANDS FOR.

By F. A. WAUGH, Burlington, Vt.

It is hardly necessary that I should introduce Ben Davis to this audience. He is already well known to most of you. I have no doubt but that many of you already regard him as a friend. Personally, he is to me more than a friend. He was, in fact, my school-fellow. Every day at noon-time when I opened the little tin dinner-pail I found Ben Davis smiling up at me. He nearly always came to dinner with me, and though he usually fared the worse for it, he was there on hand the next day, as bright and ruddy as ever. I ought to say that my school days were spent in Kansas,—that sunny southwest land which is known everywhere as the home and peculiar province of Ben Davis. It might not be surprising, therefore, if I were somewhat prejudiced in favor of my old school-fellow. At any rate I shall not accuse him needlessly. What I want to do is simply to tell you a few things about him which you already know, and then to enter on the greater and much more important question of what he stands for.

Ben Davis is regarded as a westerner, belonging especially to the central Mississippi states, Illinois, Missouri and Kansas, but we all know that Ben Davis is cosmopolitan. His range is almost as wide as the total range of apple culture. Within the last six months I have eaten specimens from the state of Washington, from Kansas, Oklahoma, New York, Canada and all the way to Nova Scotia and Prince Edward Island. Moreover Ben Davis is being somewhat largely planted on the other side of the world, in New Zealand and Australia; and in every large European nursery one can find it and the Baldwin growing side by side as representatives of the American apple industry.

In spite of Ben Davis's cosmopolitan character it has been repeatedly asserted that he was not especially at home outside the neighborhood of its origin. I have often heard it said, and I think it likely I have said myself, that Ben Davis would not succeed so well in this northeastern country as he does in the southwest, and that it is, therefore, manifestly bad policy for us to encourage him here. If it is indeed true that Ben Davis does not do so well here, we would simply be putting ourselves at a disadvantage in competing with men who grow the supposedly better fruit on cheaper soil and at much less expense. This view of the case has appealed to me very strongly until within quite recent times. During the last few months I have met a good deal of evidence which has shaken this belief profoundly. At a fruit exhibit in Ontario, Canada, this winter, where I had the honor of acting as judge, I was called upon to pass upon some samples of Ben Davis just taken out of sixteen months storage. They were as fine and firm as any fruit I ever saw. When the boxes were opened less than two per cent of the fruit had to be discarded from the exhibition table. That is, ninety-eight per cent was not only saleable, but was up to exhibition standard. Moreover, the color of the fruit was equal to any I ever saw in Missouri. Still later in the winter I was again judge on a fruit exhibit at a meeting of the Nova Scotia Fruit Growers Association, where Ben Davis was again strongly in evidence. Once more I found the fruit remarkable for soundness, firmness, smoothness and color. The specimens which took first prize were grown in Prince Edward Island, which is about as far to the northeast as the apple business can be carried in this country. There were no exhibits from Labrador nor Greenland, but I have no doubt but that if word had been sent in time some specimens could have been secured, and they certainly would have been Ben Davis, too. The Prince Edward Island specimens were as large and well colored as those shown from Illinois and Missouri at the Pan-American Exposition. Here on the exhibition tables today you will find a number of samples of Ben Davis, all of them good, and many of them extra good from the standpoint of the commercial dealer. They are not extra large, but the dealer does not prefer large apples. He likes smooth, uniform, sound, late-keeping fruit, and these specimens here before me fill those requirements to the very letter.

You will notice that I have thus far said nothing about the matter of quality. I am often told that we cannot grow Ben

Davis of so good quality in the East as we can in the West. I think this notion is wrong also. Whether it is or not makes no difference, because quality cuts no figure in the sale of Ben Davis. When a buyer has no more discrimination than to buy Ben Davis, he knows nothing about quality. Ben Davis is sold on its looks, not on its flavor. Quality does not count.

The statement is often made that the present tendency toward planting Ben Davis is merely a temporary fad. They say that the popularity of Ben Davis will very soon wane. People will find out about its bad qualities and will refuse to buy it. With regard to this matter of Ben Davis's popularity I wish to submit a few figures that were secured in an extended statistical inquiry made throughout the New England states. The figures which are herewith given show the percentages of certain popular varieties both in the old bearing orchards and in the young orchards which have not yet borne. By noticing whether the young orchards show a greater or less proportion of the given varieties, one may judge whether they are increasing or decreasing in popularity.

The Baldwin apple, for example, has been a prime favorite in the New England states, and especially in Massachusetts, but its vogue seems to be giving way somewhat before the merits of other varieties. The following figures show the percentage of Baldwin trees in the orchards reported. The first column gives the percentage of bearing trees which are Baldwins, and the second column shows in percentages the proportion of Baldwins among trees too young to bear.

BALDWIN.

	Bearing.	Young.
Vermont	5	10
New Hampshire	63	58
Maine	51	34
Massachusetts	65	48
Connecticut	61	79
Rhode Island	47	64

The percentage of Baldwins is notably reduced in Massachusetts which has been the principal New England producer of this variety. In Vermont the proportion of Baldwins is greater among newly planted trees than in old orchards; but this has little significance, since Baldwin has never been a leading variety in Vermont.

Rhode Island Greening, another New England favorite, does not make the showing which might be expected. The figures are as follows:

GREENING.

	Bearing.	Young.
Vermont	18	4
New Hampshire	2	3
Maine	5	1
Massachusetts	4	1
Connecticut	4	1
Rhode Island	13	0

It will be seen that Rhode Island Greening has been practically ignored in the planting of young orchards, even in Rhode Island.

The figures for Northern Spy are as follows:

NORTHERN SPY.

	Bearing.	Young.
Vermont	7	9
New Hampshire	1	3
Maine	5	7
Massachusetts	1	0
Connecticut	3	0
Rhode Island	2	0

These figures show that Northern Spy is holding its own, or perhaps gaining a little, in Northern New England; but that it has been discarded in Massachusetts, Connecticut and Rhode Island.

When compared with these three standard New England varieties, the figures for Ben Davis are particularly instructive. They follow:

BEN DAVIS.

	Bearing.	Young.
Vermont	10	48
New Hampshire	1	1
Maine	5	23
Massachusetts	0	13
Connecticut	5	3
Rhode Island	6	15

In other words, Ben Davis outnumbers all the varieties previously named in the recent orchard plantings of nearly every state. In Maine and Vermont the drift toward Ben Davis is especially pronounced; while even in Massachusetts, it is rapidly gaining on Baldwin.

So much for Ben Davis. Now let us examine more closely what he stands for. It is perfectly plain, of course, that all the discussion which has been going on in the horticultural papers and the various spirited arguments which take place in the various horticultural meetings are not drawn out by the merits or the demerits of Ben Davis alone. There is something back of him. He is simply the fellow who stands up in front and takes all the knocks.

The fact is, Ben Davis stands for an entire class. He stands, first, for a certain group of apples such as Stark, Gano, and Beach, and others. All these apples are remarkable for many things, but none of them is prized for quality. There are many other fruits which are successful market sorts but which are at the same time of inferior flavor and not really satisfactory to the fastidious horticultural palate.

The question is thus a question of quality. In fact the whole argument in which Ben Davis figures so prominently is the plea of quality vs. looks, and the simple question is whether or not it is ever advisable to grow a vigorous, thrifty fruit which is short in this one point of quality. That is the plain, simple issue. It is, in fact, the sharpest and most critical issue ever discussed in the horticultural forum. It is a question of fundamental importance and of wide reaching application. We need not be surprised, therefore, that it comes up for warm discussion in every horticultural meeting, and we can well give our time today to the consideration of this broad, general, fundamental, serious and far reaching question for which the Ben Davis apple stands.

When we propose a solution for this question we shall find it best to lay aside for a short time the merits of Ben Davis itself, and to proceed to a consideration of certain other factors which greatly influence our conclusion. The first important matter to which I would direct your attention is this: that there are two fundamentally different markets in America or in Europe to which we send our fruits. The one is the general, open, wholesale or indirect market, in which the grower sells to a commission man or to a travelling buyer, and in which under no circumstances does he come into direct contact with the consumer. The other is the private retail, direct market, in which the grower turns over his fruit more or less immediately into the hands of the consumer. It is sometimes difficult to keep these two markets separate—sometimes a little hard for a man to see whether he is carrying on his business in the one or in the other. Yet the two are fundamentally and entirely distinct, and the differences between them, even when not easily observable, are of first importance. In the wholesale market fruit is handled somewhat roughly in large packages and in comparatively large quantities. It is stored for long periods in warehouses; it is opened on the docks; sold in the market places; hawked about on the push-carts by the Italians, and in general treated as a commodity of common commerce. In the direct market the grower carries his fruit fresh and clean from the tree or from his own storage house into the hands of the buyer and holds himself personally responsible for the quality and condition of the fruit until it is delivered. The differences between these conditions cannot be easily overestimated.

Now it is not difficult to see that in the direct or personal market Ben Davis is placed at a disadvantage. If a man has a private customer whom he is anxious to please and to whom he wants to sell apples again next year, he certainly will not be so unwise as to give that customer Ben Davis this year. The man who cares for quality is not going to buy Ben Davis but once. On the other hand, in the wholesale market Ben Davis takes the lead, as everybody already knows. It will stand any amount of storage and misuse and still come up smiling and sound at the end of the journey just as good as ever. These statements are matters of common knowledge.

The question then, of whether it is best to plant Ben Davis or not is seen to be very largely a question as to whether a man expects to sell his apples off the trees to some stray buyer or perhaps ship them to some commission man, or whether he expects to sell them in his own town or in Boston or in New York to his own private customers. It is a question of market and not of variety.

We must all remember, furthermore, that the question as to whether it is best to grow a certain variety or not is always influenced very much by the soil, climate and other circumstances in which it is to be grown. And also equally as much by the character of the man who is to grow it. In fact these three things which I have named are of greater importance—any one of them is of greater importance—than the merits of the variety itself. The market, the general circumstances, and the apple grower are three factors all of which are to be considered before we come at all to the question of what varieties are best to plant. It is no doubt a serious matter for a man to make up his mind when he is setting out a new orchard whether he shall plant Baldwin, Spy, Spitzenburg, Greening or Ben Davis, but that question cannot be taken up until these others have been settled. It is all very well to treat this variety question thoughtfully, but it is all wrong to emphasize it over these other matters all of which are of greater importance and all of which must precede it in order of consideration.

In conclusion I wish to say most emphatically that I hope none of you will go away from here and say that I recommended Ben Davis. On the other hand I should not want you to say that I have spoken against Ben Davis. I have tried not to do either one. They say it is a very difficult thing to straddle a question gracefully, and perhaps I have not done it in this case, yet I own that that is precisely what I tried to do. My real and original intention was to take both sides of the question. It has two sides, and both sides are right. It is all right to plant Ben Davis if that variety suits the planter and if he has the sort of conditions for it and if he sells in the general market; and it is all wrong to plant Ben Davis if the apple grower does not like that variety and has a market for Baldwin, Spy and Spitzenburg.

Secretary Knowlton said Prof. Waugh had treated the subject very fairly and he was pleased to have the matter considered. There is one objection to the Ben Davis; it blossoms late and the season is frequently so short that the fruit does not mature well. Whatever conclusions might be reached in this discussion he wished it understood that the Pomological Society has always stood for quality in fruit and he was not yet ready to have the standard lowered. This year more than ever before Maine Baldwins and Greenings have come in competition with the Ben

Davis in the foreign markets, and if the sales are followed it will be seen there has been a decided gain in favor of the Maine fruit. In not a few cases Baldwins and Greenings have led the Missouri Ben Davis. In the end he believed quality would lead, and then it would not pay to grow any others. He urged honest packing and called attention to the Canadian law bearing upon this subject. He did not know how the law was going to work, but if it would make people mark their fruit as it was packed it would be of great advantage.

PLUM CULTURE.

By E. R. Mayo, Manchester.

When this topic was first mentioned I thought that our secretary had made two mistakes, one in the person to whom the assignment was made, and the other in the choice of that particular topic, plum culture, for we have just seen the discouraging sight of bushels of plums being wasted for lack of a market; but after further thought I concluded the topic was a timely one, and that there were some lessons to be learned from our experience as plum growers this season. One conclusion arrived at by me is that there is a demand for more fruit than we are able to supply, but we must look more closely after the matter of the distribution of the crop. Some sections were unable to use all the plums put upon the market, while other sections were left with no fruit or a meager supply. Of course every one present today knows how to cultivate fruit trees of all varieties, and some doubtless put that knowledge into active use, but the successful methods in use in plum culture differ somewhat from those usually employed in growing other fruits. Plum trees will thrive in almost any soil, provided proper drainage is afforded, either naturally or artificially.

In selecting trees choose those which are not more than two years of age, and one-year trees are even better. Plums may be set from ten to fifteen feet apart, according to the habit of growth of the variety set. If an upright grower, the nearer they can be placed the better success, but if of a spreading habit of growth they must be allowed more room. Now I approach a branch of my subject which has been much discussed in recent years, that of pruning. When shall we prune? how shall we prune? and for what purpose do we prune? I maintain that after the first few years in the life of an apple tree very little pruning is necessary, but it is very different with the plum and we have found some pruning was needed by them each year in order to control the tree in its growth. Most of the pruning is done while the tree is dormant, as it is for the purpose of controlling growth, but it sometimes becomes necessary to prune to bring a tree to fruiting. This is done by pinching off the growing shoots in June and July and if circumstances are favorable a crop of fruit may be expected the following year.

There is no work in the orchard which requires so much thought, judgment, and we may well say, common sense, as pruning. Some growers never prune a tree even when first received from the nursery. They claim that if left to itself Nature will do all the pruning needed. It is true that Nature is constantly at work shaping the growing tree, but the finished product of Nature is very different from the tree we expect to see in our fruit bearing orchards. If it is possible to avoid the removal of large branches, do so, as a tree is injured by cutting them out. Generally there are three reasons for pruning. First, to change the direction of the growth. This is accomplished by cutting to a bud which will grow in the required direction. Second, to cause the formation of more small branches of lateral growth for fruiting. Third, to remove undesirable branches, that is, those which from their position are an injury to the tree, and all suckers and water sprouts should be removed early, as soon as discovered.

Plums are very productive, and therefore must receive heavy applications of fertilizer to keep them in good condition. We are now topdressing heavily with barn dressing and also using all the ashes we can get, and the results are satisfactory. There are some very serious obstacles to plum growing and of these evils the black knot is the worst. There is no remedy as yet discovered. It makes a very unsightly appearance, and if allowed to run its course unchecked will in a short time destroy the tree or render it worthless. No effectual remedy or preventive has as yet been discovered. When trees are hopelessly affected they should be removed and destroyed. If the knot is cut out when first seen and burned a tree so affected may be preserved many years. The black knot does not affect the fruit only as it affects the vigor and vitality of the tree. Some varieties are more subject to the attacks of the knot than others, the Japans least of any. There is another pest nearly as serious in its effects as the lack knot, that is the brown rot which affects the fruit and sometimes destroys a crop completely. It is a fungous disease which lives through the winter in the dried-up fruit left on the trees and also in the ground. The dead and diseased fruit should all be destroyed, and care taken to set those trees which are least subject to its ravages. Some growers claim that Bordeaux used early will keep it in check, but we have not been much benefited by its use. Severe thinning of the fruit is a great help.

One of the worst evils which plum raisers encounter is the curculio. We have never been much troubled by the insect. Some fruit is stung each year but enough is left for a crop. We have a small orchard in a large hen yard and there the fruit is smooth and fine. Some varieties are less subject to the attacks of the curculio than others owing to the toughness of the skin of the fruit as for instance the Lincoln, Spaulding and all of the Japans.

Now I wish to touch lightly on thinning the fruit. How many growers have ever tried to ascertain by practice what the effect of thinning the fruit on plum trees is and what influence it might exert in relieving a congested market? There is always a ready sale for fine fruit even when there is a large crop, while poor fruit will receive no attention.

A tree which overbears must produce small fruit, salable only at a low price and causing a loss to the grower, and also making a heavy draft upon the tree itself. For these reasons we advocate and practice thinning fruit especially of the plum as it is sure to overbear. We picked and dropped on the ground from a Burbank tree this season at a close estimate three bushels of fruit and then sold over five bushels from the same tree. In order to raise strictly fancy fruit plums should be left at a distance of two or three inches from each other, they will then grow too large for canning but sell quickly for table use, and we must cater more to the growing demand for fine plums for eating out of hand, and what more delicious fruit is grown than a well grown, well ripened specimen of Lomard, Abundance, Lincoln or McLaughlin plum.

Perhaps a few words might be said with reference to a choice of varieties. Do not set too many varieties. Ten kinds are enough for a commercial orchard. In choosing have reference to season. Early, medium, and late and as far as possible select kinds which succeed in your own section. If you have room for only one tree let it be a Lombard. I suppose it is not necessary to extol the merits of this well known variety, but we so often see it left out in making a selection that I think people do not know what they want. An orchard of Lombards will give results pleasing to anyone. I do not advise setting all Lombards, that would be a mistake, but a large part of the trees should be of that variety. Now you may ask why give this advise, because it adapts itself to any soil or location, it is extremely hardy, it is a vigorous and strong growing tree and it is remarkably productive. My trees of this variety have yielded more fruit in a given number of years than any other except the Burbank, and the fruit is of good quality and when properly thinned makes a fine eating plum. I also would recommend Reine Claude and two of its seedlings, Lincoln and Spaulding. The Lincoln is one of the largest of plums, and fine for eating. It is in color a reddish purple with a delicate bloom; very bright and attractive and is very juicy, rich and sweet; season last of August. The Spaulding resembles its parent in color, a yellowish green; the flesh is sweet and delicious, parts readily from the stone and is not injured by the curculio; season September. The best plum for canning with which we are acquainted is the Satsuma. It is a Japan and one of the latest of them. For late plums, York State Prune and Grand Duke are desirable. There is one of the Japans recently introduced, the Wickson, which I am sure will prove very desirable for a fancy table fruit, and it is quite productive. But whatever the choice may be do not neglect the trees, but give them a chance and strive to do all things in season, and remember that fruit growing offers today not only a better chance for money getting than any other branch of farming but also a better opportunity for quickening the thoughts and strengthening the mind, for in order to succeed we must be alert, quick to see and grasp an idea and willing to devote some time to study. The successful fruit grower must make it the leading branch of his work and all other lines subservient to it and must always be awake to the opportunities given him for learning the great results of nature and must note and make use of everything of value to him or his coworkers. Observation, study, and industry are the essentials to success.

Mr. Pope: I have had little experience as compared with some here in the hall but I don't quite agree with Mr. Mayo on varieties. While the Lombard is a great bearer, the quality of the fruit is not equal to quite a number of others, and with me the black knot has worked worse on the Lombard than any other variety I had. If you have any idea of shipping plums to Boston, the Lombard would be rather a poor plum to sell. They want the Green Gage, as we generally speak of it in Maine, but they would call it the Reine Claude. This and the Damson are the plums for the Boston market. The common blue damson is subject to the black knot so that it is almost impossible to raise it, but the little red damson is not affected so badly. I should raise for a table plum for my own eating, first the McLaughlin, secondly perhaps the Empire.

I agree with him in many points, particularly in the pruning and the thinning. Where trees are grown on soil rich as it should be it certainly is very important that, well, generally one-half or two-thirds of the plums be picked from the trees in order to raise fruit of decent size or good quality, for if the tree is overloaded you get plums of very poor quality as well as small size. Nearly all varieties of the plum, of course we will except the Japan, nearly all of the European varieties incline to make a heavy growth, shoots three, four, five feet long, very irregular; therefore every spring go through and cut off one-half of the new growth—keep your trees down—make a good round-shaped top. I made a mistake in the first I set, I didn't trim them at all, the trees went right straight up in the way they will, when heavily loaded the limbs were breaking off. Instead of that, cut off half of that heavy growth, keep your trees short, stocky-growth trees where you can reach them.

Q. What would Mr. Pope say in regard to the Satsuma?

A. I would say that a great many people will be disappointed in this unless they are acquainted with it, in picking it too early. It makes a very good canning plum but it must remain on the tree after it begins to color for about three weeks. The Satsuma will color about three weeks before it is ripe but when it remains on the tree until it is finally ripe, that brilliant purple color through the flesh seen as it is on the outside makes it a very fine looking plum, and it is a very good canning plum, but not equal to the Reine Claude, which is one of the richest plums for canning. None of the Japans compare with the European plum Reine Claude. Prune plum trees in the spring before the leaves come out.

Q. I would like to ask if the plum can be grown successfully on low, intervale land, and on heavy soil? If so, what variety?

A. Almost any variety, particularly of the European, if the ground is thoroughly underdrained, but like any other tree it will not bear wet feet. If it is underdrained so the water will drain off, there is no difficulty in growing it on low clayey soil.

Dr. TWITCHELL: I was glad to hear Mr. Pope say what he did or hint at his thought in regard to the varieties. It seems to me that we have been running wild after foreign varieties and have lost sight of the fact that while we perhaps have some additional troubles in the oversight and protection of the European, yet when we want quality we want to sit down by a European plum tree. Perhaps the Burbank may be the easiest to grow of almost any, coming into use early in the season and hanging on the trees until the last of October as they do with me, yet I cannot class it better than inferior except in the early stages for canning. Abundance is a better plum but there is no plum for eating which will take the place of the Green Gage. Whether the climatic conditions this year have been the cause or not, I think all of us who have attempted to grow plums have realized that the black knot was afflicting us more than usual. During the last eight or ten years since I have been on the place where I am now, I have been trying to grow a few trees and I have had more trouble this year than in all the time past. The Japanese trees have been afflicted less, but still showing a good deal of trouble and calling for constant watchfulness. In pruning I have practiced nipping the shoots after they had made what I considered good fair growth in the season, nipping them back, and in that way I have been pretty well satisfied with the yield of fruit that has followed in succeeding years.

A SERMON ON THE NORTHERN SPY.

Hon. Solon Chase, Chase's Mills.

Now this is not my first time of appearing before the people of Farmington. I have not been here for some few years, but it don't seem but a very little time since I was here before. I was preaching a sermon at that time and my text was, there was "too much hog in the dollar," and I made a good many of them believe it. I didn't make them all believe it. But conditions have changed, hogs have "riz" and I don't need to preach that sermon any more. Tonight my text is "the Northern Spy,"—the Northern Spy apple. Now I claim to be a man of truth and veracity but sometimes I have had my word disputed a little. That is not strange, for sometimes the truth is too strong to be believed—it wants to be restricted a little, and sometimes it wants to be stretched. But I am going to prove what I say to you about the Northern Spy. I don't want you to take my word for it. I know one time not a very great while ago I got into trouble with the women folks at Chase's Mills, and I would rather have got into trouble with the whole of Farmington. They said I didn't tell the truth. I told a story about the women folks having a rag bee in the winter time at my brother's wife's. There was a snow storm. The men were out breaking the roads with horses. But the snow storm didn't stop the rag bee, they went on snow shoes. I counted the snow shoes in my brother's house and there were seventeen pairs of snow shoes, and I counted them over twice; and when the truth came out afterward, I had lied, there were but sixteen pairs of snow shoes. And ever since then they haven't believed always what I said.

Now what I am going to say about the Northern Spy I am going to prove by no less a person than the president of the Pomological Society of Maine, I can prove my story by him because he has been into my orchard and seen my apples. As I said today a Northern Spy is good enough for me. My Northern Spy orchard is a farm that was abandoned, I wasn't a very large boy, I was a small boy, but I remember all there was left of the house upon that farm was an old cellar, and all there was left of the barn was a few boards—the barn was tumbled down.

That farm must have been abandoned more than twenty-five years at that time and that was as much as seventy-five years ago. That farm was abandoned a hundred years ago and had grown up to woods, and my father bought that farm onto his farm when I was a boy, and I inherited it from him. That is why I am there, and I am right there where I was born.

Thirty-five years ago I decided I would raise an apple orchard on this land. Now where I live, I live right among rocks and hills. Chase's Mills is a little hamlet about as big as it was a hundred years ago. It hasn't grown any that I know of. It is a good place to live in. Down below the rips in the bend of the river is twenty-five acres of clayey loam where there isn't a rock or root. Further down the river, where the land slopes down to the river is a side hill, sandy, loamy land—rocky soil—that is where I raise Northern Spies, half a mile from the house, five acres. Thirty-five years ago I set that land all out to apple trees; I didn't know what they were. The trees grew well for a few years until there came a winter that killed almost all the apple trees in the valley of the river in our section—killed natural fruit trees—didn't kill the apple trees upon the hills but the natural fruit trees. I went over one spring and found the trees most all dead. I didn't think much about them, that is, I thought it was not much use to try to raise apples there, I had got them all started and a good many of them were dead. I went to work raising corn, plowing the land. Some of the trees lived and pretty soon they began to bear, and the trees that began to bear were the Northern Spy. They began to bear when they were small, I found the apples were good and I began to have a little courage. Well, along about that time, I experienced religion, that is I got that "Greenback" religion and for ten years I travelled this country all over, and during that ten years I didn't attend very much to this orchard. The trees grew up and bore some, and the Northern Spies kept growing and kept bearing, bore pretty well.

Finally I went to grafting the living trees that were not Northern Spies, and the trees that had died and sprouts came up. Now three years ago I went into that orchard, and plowed the whole thing over, all set to trees, most of them Northern Spies. This year I raised 250 barrels of Northern Spies and about 100 barrels of other sorts, mostly Baldwins and Greenings. Three years ago I went into that orchard and cut off the lower limbs, trimmed it so I could plow it, and where the large trees were I kept harrowing the ground, and what I have done in orcharding the Northern Spies I have done with a "harrar", plowed that sod and turned it over and where the trees were large kept "harrar-ing" of it all summer.

Now I went to a meeting of this society down in the town of Chase's Mills at our grange hall a good many years ago, I was raising Northern Spies a little then, and there I got an inkling of raising small fruits and I planted small fruits in among these small trees,—strawberries, raspberries, blackberries. As I say, we plowed the orchard and where these large trees were we raised 250 barrels, the most of them from forty trees, and I have done it all with the "harrar," by "harraring" that ground and keeping the grass and everything all down, didn't manure that ground much, it was all in the "harrar." Where the trees were not so that you could get at them I had a Frenchman take a pick and go in and dig and make it mellow. Where the trees were small, I would plant corn in some places, and plant small fruits, but would leave a chance to drive the "harrar" right alongside of the trees. You don't need to make your ground very rich to raise apples. You make your ground so it will bear two tons of hay to the acre and plant Northern Spies and it won't bear an apple; but plant on a gravelly knoll and keep the "harrar" going and you will get enough of them. Now my son Isaac and his wife Jennie and a young Frenchman picked ten barrels of apples in two hours from a Northern Spy tree. Those ten barrels of apples were worth as much as a middling fair-sized hog. Now a hog is a money maker but I want to tell you that Northern Spy farming is more attractive to women folks than hog raising.

Last spring I sowed clover upon that ground, calculated to plow it in next spring, but it has been a good year this year for grass to catch and that clover has grown up and in some parts has headed out, and so day before yesterday we turned over half an acre; we are going to turn the rest of it over in the spring and then we are going to put a "harrar" in—all in the "harrar" that is what it is. Take an old orchard—I don't care where it is—and plow it up and cut off the dead limbs, plow it and keep it "harrared" and you will get apples,—don't care whether Northern Spies or anything else. I am not troubled with the trypetas. When I gather my apples, I pick up the windfalls and put them into the barn and feed them out to the cows a few every day. Clean the ground all off. If you will destroy the windfalls you are going to get rid of them. Another thing, if you will keep your "harrar" going and make your trees grow thrifty, the caterpillars and insects are not going to trouble it; if they find a tree half dead they will go into that and kill it.

Our farmers don't know what a mine of wealth, what a possibility there is for the Maine apple. Here we are right upon the Atlantic coast, here is an export demand for Maine apples, and if we only raise good fruit we will have a market for them. When apples were very low I have sold Spies for five and six dollars a barrel. Last year I sold 100 barrels of Spies for $4.50 a barrel, along in the middle of March. Well, I didn't expect to sell them so soon; I was kind of raising the price, calculated to get more, but a fellow took me up and I let them go. I kept a barrel of those apples to eat just as I brought them from the orchard. I pick the apples carefully in the orchard, I do them up in the orchard—not very hard but so they won't jar any, put them into the cellar and let them lay there until I take them out and pick them over when they are sold. I left one of those barrels in the cellar last spring that laid just as I had picked it in the orchard; I opened it along about the middle of April or the first of April and kept eating out of it. The last of them we ate the middle of June and the next meal we had strawberries on the home table; we had strawberries two or three weeks until haying time and then we had raspberries, and so on. I found just five rotten apples in the bottom of that barrel; that is just how that barrel of apples kept. I take Northern Spies and put them into my cellar and there is no shrink to them after cold weather comes; if there is any shrink it is in the fall. I calculate to keep them cold.

Most of our farmers believe they are not going to get any apples and they don't get them—what they do get they call good luck. They don't go into it in a scientific, common-sense way to make a crop of apples, to make the thing permanent. You take and cultivate an orchard and you are going to get a crop every year. The more manure you put on the better it is, but without manure you will get apples if you use the "harrar" enough, and you will not only get apples but you will make the trees grow and you will be surprised to see how you will do it. I know what I have done there for three years. The orchard didn't bear very much when I began with that work.

When I was setting out trees in my orchard—places where they had died out, some killed by grafting, some vacancies—one of my neighbors said to me: "Why are you setting out trees there, you won't be here when they bear apples." "Well," says I, "I just enjoy religion in setting out those trees, for my doctrine is if a man plants apple trees for the benefit of those not yet born he is making the world better by living in it, and when we do that we can't help having a very good time, and the man that does that and lives that kind of a way he don't grow old any as the years go along."

You don't know anything about how I enjoy religion over in that orchard. I go over there on Whit Sunday and sit down upon a rock, and there is the buzz of the honey bees and the odor of the apple blossoms in the trees, just as white as they can be, trees that I planted with my own hand, and I enjoy religion as well as I could if I was down to my church along with Brother Gilbert all the time.

Now you can get good trees in a pasture, bear apples every year, the cattle running in among them keeps all the grass down. You can't set out a young orchard in a pasture for the cattle would break the trees down. There is lots and lots of good orchard land in Maine. In the Western states there is good hog land that will raise good corn, worth $100 an acre without a sign of a building or a rod of fence on it. We can make our orchard land in this country worth as much to raise winter apples on as the prairie land is to raise hogs. We can do it if we are a mind to, and I believe the time will come and right away. If you cultivate your orchards you are going to get good apples. We can begin and plant new orchards, improve the land and you will find that the railroads will be blocked with apples the same as the Western railroads are blocked with wheat—there will be a demand for them—I can see in the future. Now here we are right next to tide water; it don't cost but a little to carry a barrel of my apples to Liverpool, ocean carriage is cheap. The apple is the only thing that we export. There is no export demand for anything that the Maine farmer raises except apples. Our apples are better than the apples raised in any other of the

United States,—better keeping, finer grain, different entirely—they don't get ripe here till most winter and they are long keeping. Already they have got a reputation in Europe as the best apples that there are. Now what we want to do is to improve the quality all we can. If we can get nice, first-class, long-keeping apples, why the price there is nothing to many people that want the apples. If we can get the apples up to perfection, why I am going to get a good price for them and there is going to be a demand for them all over the civilized world. Already they are shipping them to Germany, shipping them everywhere. Our railroads are handy so we can get right down to the shore, while Western apples have got to come a long distance on the cars. In New York state and Pennsylvania I have seen Baldwins and Greenings rotting on the trees, get ripe and rot right down. Here in this State of Maine they ripen after we pick them and there is where we have the advantage. We can keep them.

CULTURE AND MARKETING OF FRUITS.

By Prof. W. M. Munson.

I have talked to you for ten years about the culture of fruits. Some of you, I have no doubt, are getting a little tired of the same old story. You have heard some of the things that I have been talking about during these years corroborated by many of your local growers during this and previous meetings. You have seen some of the results of culture in New York state and in other states and in the Provinces, as exhibited by the slides which were presented last night. Some of you are aware that for several years past we have been doing something in the way of culture of orchards down in Kennebec county. I have a number of slides which have been prepared within the last few days, illustrating that work, and some of the methods of orchard culture which we recommend. I should be very glad to show these slides to you at this time but that we are without electricity. I shall try and show them to-night, however. So I am not going to take your time this afternoon in talking very much about the culture of fruits. Suffice it to say, you now believe, as I am convinced from seeing your orchards, that culture does pay. If you cannot cultivate with the plow, you can cultivate with the hogs; and there is no question that the use of hogs in the orchard, aside from loosening the soil and stimulating the growth of the trees, will be of lasting benefit to the future product of the orchard by destroying the injurious insect pests.

Culture, spraying, marketing, are three of the important considerations in the successful management of orchards. We have heard a great deal about culture, we have heard a great deal about spraying. There is no longer any question as to the desirability of spraying our trees so long as we bear in mind what we are spraying for, in other words why we spray. But I want this afternoon to present to you just a few suggestions, rather to bring out some points which you yourselves already know than to offer anything new or original, upon some of the points connected with the marketing of fruits. For I believe that the business end of horticulture is at the present time one of the most important factors in the success of that industry. Our Maine orchardists can produce fruit—who dare say otherwise after looking around this room—but do our Maine orchardists who sell to the first man who comes along follow out the best business principles? You know as well as I do that you do not. Now there are some exceptions, I will admit, but as a whole you know as well as I do that you are not following the best business methods in the marketing of your products. So then, I say:

The average grower of fruits and vegetables is in greater need of education upon the subject of marketing his product than upon the best methods of production. Many a man is stranded on the rock of ignorance, carelessness or absolute falsification in the business end of his operations. The dealer to whom he consigns his products, fearing to be misunderstood, sells the goods on a low margin and makes no suggestions. Criticism doesn't pay, and may result in the loss of a shipper, and is therefore considered not worth while. It is, however, well worth the while of any wide-awake fruit grower to take the time and incur the expense of a trip to some leading market center, as Portland or Boston, for the special purpose of studying the requirements and methods of the market to which he is to ship. Dealers will be found only too ready to show every attention and give every facility for investigation to prospective shippers.

What to grow for market, is to a certain extent an individual matter. The markets of the world, however, want the best, and will always pay a fair price for it. It is well to remember that an attractive appearance counts for very much in the sale of fruits; but this is not all. Ben Davis, which for years has sold almost wholly on its appearance, is now coming to be recognized at its true worth. We may honestly differ as to the essentials which make for the success of any given variety, but all will agree that the higher the intrinsic merit of any product, and the more honestly and attractively it is marketed, the greater will be the chance for success and profit.

What the markets want first is quality—including appearance—and quantity is the next consideration; for the successful shipper must have enough fruit to command the attention of the market. The fruit should be carefully graded, placed in new *full-sized* packages, and full measure should be guaranteed.

The so-called "short" berry box or grape basket, apple barrel or box, is an abomination and a disgrace to the American grower or shipper who uses it. The flour barrel, which is largely in use in Maine, is of good generous size and is perfectly legitimate, but it should always be thoroughly washed and dried before use. The flour dust upon the fruit is regarded with suspicion by buyers, and will often cause a cut of 25 or 50 cents in price. Only a few years ago the practice of spraying fruits in this country was severely condemned by certain of the English papers because, it was said, "the fruit in the London markets showed the poison on the surface of the fruit in the form of a fine greyish or whitish powder." The trouble was that flour barrels had been used by the shipper.

Now because of the geographical position of New England, the foreign apple trade, which amounts to about one and one half million barrels a year, is of the greatest importance. We all know that in this trade, as well as in the home trade, there is a great deal of dishonest packing, but because of the method of selling in European markets fruit is there placed more nearly on its merits and any dishonesty is at once disclosed. Our Canadian friends have learned the lesson that the policy of honesty on the part of individual packers must be enforced or the commercial reputation of the country as a whole is endangered. Is Maine less progressive than her neighbor, and will she sit quietly by and see the markets of the world discriminate against her simply because of her inertia?

STATE REGULATION.

A brief resume of the provisions of the much talked of "Fruit Marks Act" of Canada may not be out of place in this connection. The act, as passed in 1901 and amended the following year, provides:

(1) That the face of all fruit packages must fairly represent the fruit throughout.

(2) Closed boxes and barrels must be marked with the name and address of the packer, the variety of fruit, and its grade.

(3) It is an offense, within the meaning of the act, to dispose of, or have in possession for sale, fraudulently packed or marked fruit even when buyer and seller are ignorant of the fact.

(4) The act provides that No. 1 or XXX fruit "shall consist of well-grown specimens of one variety, sound, of nearly uniform size, of good color for the variety, of normal shape and not less than 90 per cent free from scab, worm holes, bruises and other defects, and properly packed," but does not prevent the packing or selling of any grade that is properly marked. There is no definition of grades marked "No. 2" or "XX" and "No. 3" or "X."

(5) Commission merchants who, after notice, handle fruit put up contrary to law will be prosecuted; but the act makes no provision for the inspection of particular lots at the "request of buyer or seller."

The penalty for a violation of the law, with reference to packing and marking, is not less than 25 cents nor more than $1.00 per package; for removing an inspector's brand, $40.00; for obstructing an inspector, $25 to $500; the fines being equally divided between the informant and the government. Merchants are held responsible for the fruit in their hands, but in every case the original offender is prosecuted if found.

The beneficial effects of this law are already being felt across the border, and it can but result in giving a tremendous impetus to the fruit industry of the Dominion. Shall Maine lead in a similar movement in our own country? Is it not within the province of this society to go before the State Legislature at its next session and urge the passage of some measure which shall tend to protect the reputation of Maine as a fruit producing state? I am aware that such a measure would meet with opposition, and have little hope that action of the nature indicated can, at present, be secured; but the suggestion is presented for the serious consideration of the fruit growers here assembled. Nearly all of the raw material which the farmer buys,—his fertilizers, his seeds, his feeds—are subject to legislative restrictions; shall he then object if the products he offers for sale are placed under similar restrictions? Do those who object to such a measure dare stand up and give their real reason for such objection?

CO-OPERATIVE MARKETING.

For many years the farmers of New England have recognized the importance of co-operation in purchasing their supplies. The importance of the Grange in this direction is too well known to require discussion. But in the co-operative marketing of produce little advance has been made. This is a day of trusts, combines and syndicates, and in order to protect his interests, decrease expenditures and facilitate the distribution of his products, the farmer and fruit grower must fall into line. Co-operative creameries and cheese factories with or without the aid of outside capital, have been tried with varying degrees of success. In every instance, however, so far as I am aware, failure has come as a result of petty bickerings and jealousies and failure to grasp the full measure of the situation. The same principle might well be applied to the marketing of fruits, vegetables and other farm products. In this direction we may learn from the experiences of our friends in California, where some fifty co-operative marketing societies are doing business at present, and where the individual is so severely handicapped by expense of transportation that practically all of the business is done through these associations. Now I am aware that the millenium has not yet arrived, and that there are serious difficulties to overcome, nevertheless there is no doubt that untold benefits will result if the fruit growers of the State of Maine will unite in larger or smaller groups, establish cold storage plants, charter cars and if necessary vessels, employ trusted agents to look after the details of transportation and distributing points, and guarantee the quality of the goods put upon the market. I can at this time touch but briefly some of the more important points here suggested, and

Baldwin tree in Munroe County, N. Y. Record in 1902, twenty barrels hand picked apples.
Photograph by Prof. John Craig.

in no case would co-operation affect in any way the importance of the general principle of State regulation.

STORAGE.

From the little town of Vassalboro there are shipped annually 5,000 to 10,000 barrels of apples and similar amounts from Winthrop, Monmouth, and other stations along the line of the railroads. This fruit comes in lots of from 10 to 500 or 1,000 barrels each, and is shipped at various times, in various ways, and at various prices. Many farmers have no facilities for storage and too often accept the first offer received for the crop and rush it on to the market at a sacrifice; others store in warm cellars or other improper places and lose much from deterioration and decay. In any case, the unnecessary middle-man comes in for his share of the profit—and we may be sure it is not a small share. The gist of the whole matter may be given in one homely phrase: Don't pay the other fellow for doing what you should do yourself.

Now by the establishment of cold-storage houses at frequent shipping points, the growers themselves may take advantage of the inevitable rise in prices as the season advances. If they can not agree on terms for co-operative shipments, which it is most desirable they should do if possible, they can at least erect storage plants, engage a competent man to take charge, and make a *pro rata* assessment for its maintenance.

Fruit for storage should be graded in the orchard, and only the best grade put into refrigeration and that without delay. The lower grades will not pay for the time and extra cost of holding; for it should be remembered that fruit is not improved by cold storage. If it is in prime condition on entering the refrigerator it will be likely to come out in proportionately as good condition, but if defective on going in, it will be equally as bad, and will "go to pieces" very quickly, on coming out.

SHIPPING.

In the transportation of fruits it goes without saying that the larger quantities will be able to command better rates, better facilities, and more immediate attention than will small, isolated lots. In the case of car loads intended for shipment to England, from any point in the State, the only handling received is in loading on to the car and again in removing from the car to the hold of the ship, as the railroad tracks run right along side of the vessel and all cartage is thus avoided. With such lots, also, it is possible to secure heater cars, and removal by through train, so that the minimum of time is spent upon the road. In the case of small lots, on the other hand, several transfers from one car to another, or even removal across the city by truck, may be necessary and the consequent bruising will often result in very serious damage. The freight rates will also be higher, and the length of time for shipment will be longer, and there is an added danger of freezing if fruits are shipped in the winter. In case the fruit is to be marketed in Boston or New York, water shipment is preferable to rail, because of the more reasonable rates. The handling, however, may be quite as rough in the one case as in the other and it is doubtful of any great gain is made by this method of shipment.

It is evident, with these facts in mind, that much advantage will result if growers can unite in a co-operative shipment instead of acting as individuals. The California Shippers' Association usually has one or more agents in various parts of the country whose business it is to keep watch of the different markets and from various points direct the fruits to the best markets. On a smaller scale the same feature may be adopted to advantage in our own State.

PACKAGES.

The selection of packages in which to market choice fruit is often a factor of no small importance in the returns. At the present time this question, so far as Maine is concerned, is largely a question of whether boxes or barrels shall be used for our best apples. Upon this point there are wide differences of opinion. But certain it is that whatever the style of package, the size should be uniform so that the buyer may know just what he is paying for.

There can be no doubt that, in the majority of cases, consumers prefer the box to the barrel as an apple package, for various reasons. In the first place the fear of "deaconing" is very general—and not wholly without reason. The opportunity for such a disreputable practice is much smaller when the box is used. Another, and in some cases stronger, argument against the barrel is its size. Many a man would buy a bushel or a half-bushel of choice fruit who could not afford a barrel, or who would have no use for so large a quantity. The term barrel is also of very indefinite significance. It may refer to the straight-sided cement cask, the typical apple barrel of regulation size, or the generous flour barrel. The buyer is never certain which size he will get when giving an order. The original cost of package is, however, in favor of the barrel.

The size of boxes also varies considerably and should be regulated by law. The bushel box used quite commonly in Chicago is 11½x11½x18 inches inside measurements, and is endorsed for strictly fancy fruit. The Canadian box is 10½x11½x22 inches inside and gives good generous measure. The California box, on the other hand, is only 10x11x20 inches in the clear, thus holding only about 40 pounds of fruit. The Northwestern Fruit Growers' Association, embracing Oregon, Washington, Idaho, Montana and British Columbia, have adopted the standard size of 10½x11½x18 inches in the clear. Some of the Colorado growers have adopted a size which seems one of the best. This is 11¼x11¾x18 inches in the clear and holds about 51 pounds of Winesap or other choice apples and 44 pounds of Ben Davis—or just a little more than a bushel. The sides, top and bottom of this box are made of ¼-inch boards and the ends of 13-16-inch with a cleft on each end. Concerning its use, Mr. J. H. Crowley of Rocky Ford, Colo., says: "In packing we put the top and cleats on, face with double faces, then fill in full; lay bottom boards on, put in press and nail bottom; turn box over and stamp name and variety on end to show face side up. For fancy apples we pack in layers, four layers and four tiers. In storing, hauling or loading on cars, the boxes should be cleated in tiers. This box, or one very nearly like it, is the coming package."

From these and other reports it will be seen that there is need of some agreement as to the size of boxes used; but in almost every instance where boxes have been used both shipper and consumer have been pleased with the results. Is there not in this fact a suggestion to the progressive apple growers of Maine? May we not, with advantage to all concerned, put our strictly fancy Spys, Kings, Baldwins and other highly colored fruits in such attractive form that they shall command quick sales at a great advance over the general market?

A WOMAN AMONG SMALL FRUITS.

By Miss Lilla M. Scales, Temple.

When T. B. Reed was Speaker of the House, a representative from Michigan who wished to carry a measure which he knew Mr. Reed strenuously opposed, kept reiterating during a lengthy speech: "And this the gentleman from Maine well knows." Finally Mr. Reed's patience became exhausted and he drawled out in his inimitable manner: "Will the gentleman from Michigan tell the gentleman from Maine something he does not know?" And as we (my sister and myself) are only amateurs in one of the most delightful and beautiful of arts, that of gardening, no doubt you will all appreciate Mr. Reed's remark and wish I would say something *you* do not know. Although always having a natural inclination for the work, we had done but little in that line until less than four years ago when we came into possession of a small intervale farm—which we still carry on; our interests consequently are as varied and numerous as those of the man, who on being asked his occupation, replied that he fished a little, tinkered a little, farmed a little, and preached a little, and our fruit raising thus far has been only supplementary to the regular farm routine.

We have been experimenting along various lines in order to ascertain what fruits are best adapted to the soil and most profitable for markets. Blackberry culture is impossible to any extent, the land is too low, the soil too moist. We planted Snyder and Kittatiny. The canes grew enormously large, but were mostly ruined by the cane borer. Those that remained would snap off at the base when laid down in the fall; rarely would a plant survive the winter. We have also given up the blackcap raspberry for the same reason. The Cuthbert raspberry grows and fruits finely, but like the blackberry requires protection through the winter. Golden Queen is a little hardier; would not advise planting it except for home use. It is a delicious table berry but discolors if kept over night. Some peculiar disease affects this raspberry with us. We have never noticed any signs of it until after the blooming season has passed. The leaves turn whitish and curl closely up under the midrib, the fruit is small and only partially matures. There are no apparent indications of an insect at work on leaf, stem or root. Occasionally a Cuthbert is similarly affected, and last summer in a distant pasture I found some plants of the wild raspberry in the same condition. I would like to know the cause and remedy if there is one—have feared it might eventually destroy all our varieties.

Our Loudons have shown no signs of the disease, if it should be so called. They have proved perfectly hardy, remaining upright through the winter without any protection and leafing out to the tips in the spring. The fruit ripens a little earlier than the Cuthbert, which makes it very desirable. We have never raised any for market. Mr. E. P. Powell says it is not to be recommended for that purpose, as it does not bear shipping.

Of currants we have several varieties: Fay, Cherry, Versailles, both red and white, Old Dutch and some unnamed. Our best white currant is a seedling found growing wild in the field years ago. If the rows are kept clean and heavily dressed, the bushes properly pruned, the currant worm subjugated, provided a heavy frost does not occur when the plants are in bloom, a luxuriant crop is the result.

Our currant plot always reminds me of Rip Van Winkle's garden, which he said was the most pestilent little piece of ground in the whole country—for witch grass will insidiously creep in and all at once the bushes are smothered. Mulching only encourages the grass to grow and flourish. Will some one please suggest a remedy?

We have had no success whatever with the gooseberry. It neither grows nor fruits. The cause to us is unknown. Our main crop is the strawberry. A number of years ago before we began farming, a friend gave us some plants of the Charles Downing. Knowing absolutely nothing of strawberry culture, we set them carefully out. The more they were tended, the greater were our trials. The runners overspread all our little plot in a hopeless tangle, the berries were few and far between, no larger than wild ones; thus our first attempt proved a perfect failure. The next fall, a neighbor on moving away told us to help ourselves from a bed which he had fruited. It was considerably grown up to weeds and grass, but finding many beautiful looking plants with large, fresh foliage, we proceeded to take up a hundred without disturbing the roots, carefully protected them during the winter, kept them free from weeds, with the (to us) surprising result that such fine plants should produce only a few mis-shapen berries. Later we found they were the Sharpless, almost utterly worthless except for fertilizers on our soil. As this was another complete failure, we resolved to try again and the next spring purchased 175 Crescent seedlings and still grow that variety for market and home use. The Sharpless was soon discarded for Lovett's Early, which has a beautiful crimson color. It fruits finely, even small runners set late in the fall will bear the next spring.

All other varieties which we have tried have proved of little or no value. Among them are the Epping, Louise, Gandy, Parker Earle, Parker Earle, Jr., Wilson's, Albany and Bismarck. The Clyde has been highly recommended to us and we have grown it for two seasons. Either the plants were not true to name or the soil is too moist; it does not grow vigorously, the foliage is of a pale, sickly yellow color, berries light red and very acid. It fruited well but the leaf stems were so short that the fruit was unprotected and the greater part actually cooked by the sun. The past season has been so unfavorable we shall give it one more trial. Our land is so infested with witch grass that it is almost impossible to find a spot where we can grow strawberries in considerable quantities.

Three years ago we had two pieces of run-out land on the very edge of a swamp ploughed up. Each contained less than one-fourth of an acre, neither had probably been cultivated or dressed for half a century. In the spring stable dressing was spread on lightly and harrowed in; one we planted to potatoes, the other to strawberries, using also ashes and commercial fertilizers. In the fall the plants were carefully covered. They came through the winter in first class condition, yielding over 22 bushels of fine fruit.

Last year we set out the other plot, the one on which we raised potatoes the preceding year. Being nearer the swamp it was more moist than the first. I never saw plants grow so enormously. A portion of the land was so wet water stood between the rows nearly all summer. During the spring while the frost was coming out of the ground a part of several rows were six inches under water, and at picking time were no dryer than when first set. This proved the best portion of the bed.

Owing to circumstances over which we had no control, only half of our plants had been covered when winter set in. This with the severe freeze early in May proved very disastrous and a half crop was the result.

This year we are using the same ground as two years ago. I know the best authorities say, "Strawberries should not be succeeded by strawberries." No other spot seemed available and as a heavy stand of green clover was ploughed under we thought the soil would be in good condition for another season.

The greatest menace to our strawberry culture is the white grub, and the only remedy so far has been to lift the plant and destroy the insect, which will usually be found under the plant if taken up in season. Fully one-half of a quarter of an acre we have been obliged to set three times. I heard a person say a few days ago he could not raise strawberries, the angle worms ate his plants all up; it must have been the white grub instead.

Mr. A. M. Purdy in a recent issue of the Tribune Farmer said he should have salt sown on a piece of ground that was to be ploughed for corn this fall, and again in the spring before harrowing, but made no mention of the quantity to be used, only that it was to prevent the ravages of the white grub. I would like more definite information on the subject.

As our strawberry rows must be raised in order to provide the necessary drainage, we use the cultivator but little. If our plot was larger of course all hand culture would be impossible. Three sharp hoes of different sizes, each provided with a long handle so there is no unnecessary stooping, and a good garden rake to use between the rows that no weeds may be left to root down we find sufficient.

I have no patience with the man who on dull days in summer calls out the members of his family and then all proceed to get down on their knees and weed out the strawberry bed. No wonder so many children grow up disliking to work in a garden!

Pine needles make an ideal covering. They are clean, light to handle and no danger of the seeds of weeds or grasses being sown as when straw or hay is used. Instead of covering only the crown and roots as many authorities advise, leaving the tips of the leaves exposed, we prefer to cover the entire plant—

there is no danger of its being smothered under pine needles—and a plant thus protected, even if not set until the latter part of October, will live through the winter and in the spring push right up fresh and bright. No other mulching is necessary to protect the fruit from sand or gravel.

A learned preacher in an Easter sermon said that in the spring all the husbandman needed to do was to plant his ground and then sit down and wait patiently for the harvest. Judging from the appearance of the strawberry bed in the garden of the average farmer, he is evidently of the same opinion, for I do not think any one can raise fruit successfully, and especially the strawberry, without having a natural love for the work, it is such a pleasure to watch the growth of the tiny plant, study its needs, give it careful protection from the ice and snow, and in spring to see the buds gradually unfold till suddenly the rows burst into snow-white bloom, and later to be rewarded with the luscious fruit, gleaming like rubies amid their foliage of green—a sight to delight the eye and gladden the heart.

Prof. Craig: Mr. President, I am afraid that I cannot give expression to the remarks that should be called out by such an excellent paper. It does seem to me that when women come into horticulture they always present a side which we men are apt to overlook. You observe how we men keep talking on the dollars and cents side all the time, but when women take up the question they touch on the more æsthetic side and tell us something about the beauty and the quality of the product. We may notice that the varieties were characterized in the paper and one was set off against the other largely on the basis of quality. I think we consider too much the selling value of fruit. Take the Ben Davis, for instance. If it grows well and sells well, it is a good thing to cultivate. We don't consider the future.

Then there is the other and finer sentimental and æsthetic side to be taken into consideration, the influence on the home and all that, which was suggested by a little touch at the end of the paper we have just heard. These are things that we as fruit growers ought to keep in mind more persistently.

But in this paper the practical sides were also very nicely handled, it seems to me. One thing I should like to say about the strawberry, and that is that it is essentially an amateur fruit, it is essentially a plant which belongs to the home, and if there

Plowing in Mammoth Clover with sulky gang plow at Hillcrest Orchards, owned by Ralph S. Eaton, Kentville, N. S.

is anything which is likely to fix the thoughts of children upon the home it is the growing of plants. There are different sides to that, too. I remember in my own case that my thoughts and memories of the strawberry were not so much connected with the berry and cream side, as it was with the weeding exercise which was mentioned. That was quite an important part of my early experience. The weeding of strawberries and the weeding of carrots were closely associated with my earliest memories of garden work, and as I got down on my knees and followed that row I used to measure it with my eye and mentally subtract each foot from the total length as I progressed. But if we practice modern methods these hand-weeding difficulties of culture may be entirely obviated.

I would like to say that in New York state, in the principal strawberry county in that state, there are now growing up two sets of strawberry growers,—one set which has the ideal of quality before it, the other set which has the ideal of quantity before it. The growers for quality select their varieties, practice certain methods of culture and usually reap higher rewards than the other set. The one is the strawberry farmer, and the other one is the strawberry culturist. In one instance which I knew of very well, the man grows Marshall—I don't know whether the reader of the paper has grown that variety or not, but the Marshall is to the strawberry what the Spitzenberg or the McIntosh Red is to the great class of apples,—it represents to my mind at any rate the acme of excellence, but like many of these finer varieties it is not as productive, and it requires special care. Now the Marshall should be cultivated in narrow rows instead of wide rows. The ordinary way is to cultivate your strawberries in a matted row of two to two and one-half or even three feet wide; and in these rows where the plants are not thinned out, naturally there is a great deal of competition and it is a struggle in which the fittest survives. The general size of the fruit is brought down. But in growing the Marshall this grower, as I say, keeps his rows narrow and thins his plants. He arranges and sets a plant here and carries out four runners at opposite points, making a row about fifteen inches wide, and having the plants spaced as it were, each one is able to take advantage of its circumstances to the fullest extent. So much for the growing.

Of course good tillage and careful covering in the autumn is necessary. Then comes the marketing, which perhaps in his case is the most important part of all. These berries are picked and are graded. They are put up in specially made boxes. These are square quart boxes. The boxes are wrapped in such paper as you use for wrapping your fancy butter, paraffine paper, and four of these boxes are included in one little crate. Now last year he showed me his receipts from the first shipments of Marshalls which came down to Boston from Oswego county. Those four quart boxes brought him $2 gross, 50 cents a box; that would easily net him 35 cents a quart. The second grades went in with the ordinary commercial lot. Now I have recited this in order to show that if you are going to grow for quality you must not stop with cultivation but your work must be carried to the extreme end, and that in order to be successful one must attend to the market side as thoroughly and as carefully as the growing side. Now there are only a few growers doing that, but it suggests to me that there is a profitable avenue in that direction. The great body of growers of the strawberry in Oswego county are growing them on the ordinary commercial plan. They are growing ordinary varieties peculiar to that section and the most popular varieties are Bubach, Glen Mary, Eureka and Atlantic,—those four varieties have the lead there. For high class varieties the one which I have just mentioned, Marshall, and Glen Mary are the two most used.

I was interested in what the writer of the paper said about that raspberry disease. I wonder if it is at all prevalent in this section. We have been investigating it in New York state. The Geneva Experiment Station has done most work on it, and it has been proved to be a fungus disease,—that is to say, a plant parasite. No remedy has been discovered which will hold it in check, that is, no spraying remedy; the only thing that can be done is to treat it as you would an infectious disease,—take up and destroy all plants affected as quickly as the disease is noticed.

I would like to say a word about one or two varieties of currants. I think as a rule we are fond of throwing currants all into one group and say that currants are currants, one is as good as another. Those of us who have tried and tested the different kinds have changed our minds on that. For home use I don't know of any currant which will approach the Moore's Ruby in quality; Wilder or Wilder Red as it is called, is another one peculiarly high in quality. Now there is practically as much difference between a Moore's Ruby and Red Grape or Red Dutch as there is between Ben Davis and Northern Spy.

In the matter of raspberry growing, a grower of my acquaintance markets raspberries in pint boxes and picks them with the hull on. He has his pickers trained so that they snap the berry with the hull on just as you do in picking the strawberry. He picks only his best Cuthberts in that way. He ships his to the Montreal market, of which he is within easy reach—sells them in pint boxes for 15 cents a box and has cultivated quite a large trade which is exceedingly profitable, as you may recognize, at those prices. But you first must find the persons who will purchase your goods.

Now I do not think I have anything more to say,—being called upon hurriedly,—on the general small fruit question beyond the fact that it is, I think, like poultry raising, an industry which is admirably adapted to the energies and ability of women; it is a business which she can carry on very advantageously and in which she often outstrips man in carrying it on successfully.

INSECTICIDES, THEIR USES AND DANGERS.

By Dr. George M. Twitchell, Augusta.

In any discussion of fruit questions at a gathering like this, there are certain facts of such transcendent importance that they cannot be too often nor too forcibly presented. Only as we get these ingrained into the warp and woof of our thought will it be possible for their full significance to work out through our finger tips and in our speech. I present at this time two:—

1st. That a large portion of the State of Maine is peculiarly adapted to fruit culture, especially the growing of apples.

2d. That the quality of Maine fruit, when protected and permitted to perfect itself, is of finer grade than that of any other section of our country.

These are the fundamental facts upon which the changes may well be rung until every boy and girl in this commonwealth is completely filled with their importance.

We have been sitting down and congratulating ourselves over the adaptability of Maine for fruit growing and the quality of our apples, and have overlooked the lesson so apparent to the business man in other lines of work. We have pointed with pride to our exhibits and the volume of their output as though we were doing more than playing about the borders of a great area, rich, promising and certain to give returns.

What is needed now is a thorough awakening to the possibilities of this business as an industry. I said we have been playing about the borders, and that this is true one has but to drive about the country and note the rows of trees by the roadside and the indifferent treatment and care given them by the great majority as compared with what the orchardists of Maine are accomplishing.

Fruit growing is not an industry in Maine save in a few isolated cases, but an adjunct to other lines of work, and hence, not being the essential, fails to receive the attention its importance demands. We forget or fail to keep in mind the two fundamental statements already emphasized. Any presentation of the subject of insects and the use of insecticides hinges upon our conception of these two underlying facts, for if fruit growing be of secondary importance insect pests and their destruction will not claim that close attention necessary to insure highest quality in the fruit. Year after year we are finding the army of these pests seemingly increasing, new varieties appearing, and the scientists at our experiment stations are kept busy studying the life history, habits and method of control or destruction. The greatest obstacle in the way of successful fruit growing is to be found in this great army of destroyers, neglected by so many, diligently fought by so few. Until we come to an appreciation of the possible value of fruit growing as an industry, and realizing the quality sure to follow protection from these pests, give careful attention to spraying, our hold upon the great markets must be more or less insecure. The fact that from the great fruit centres of the West, from Michigan, Minnesota, Illinois and Ohio there has been coming this year an increasing flow of inquiries concerning the volume of our fruit and its quality, only attests the importance of the question before us.

It is impossible to brush away the claim made by the careful student for the thorough and systematic spraying of all fruit trees to destroy the pests which, unmolested, will inevitably destroy the fruit, and also to protect against the fungous diseases which so radically mar the appearance of the crop. Spraying must be resorted to by each and every grower if he hopes to realize from his orchard. To neglect is suicidal, for prices in all the centres are fixed by arbitrary standards, and buyers are critical in the grading of the fruit. Strange as it may seem, the majority seem unmindful of the lessons and negligent of this all-important safeguard.

It is not my province to classify or treat in any way the myriad classes of insect life against which you are obliged to contend, but I desire to discuss this great question of insecticides, with sole reference to public health and the future of this industry. In so doing attention must be called to some familiar facts. When these insect pests first appeared and the cry went up for relief, our scientists naturally turned to the active poisons as affording the easiest, quickest and most effective results. Arsenic, a mineral and a most virulent poison, killed these pests, and at once formulas were prepared and instructions given for the use of different combinations having Paris green (arsenic) as the base. These, intelligently applied, did effective work in destroying insects, and so came to be the chief reliance, until this year throughout the length and breadth of the land the published bulletins on spraying have given implicit and exclusive instructions for the preparation of solutions of arsenic, chiefly in the form of Paris green. No advance has been made during the past twenty-five or thirty years, and none attempted save in appliances. Arsenic, an insoluble mineral poison, is urged to-day as it was then, and is used by nearly every fruit grower who sprays his apple trees, unmindful of the fact that wherever found it becomes a menace to public health, and needs only to be present in sufficient quantity to work positive injury. Its coming was natural, for our experiment stations answered in the shortest possible time the call of the people for help in freeing their trees and growing crops,—its continuance is a severe criticism on our stations in that they have rested on the fact that arsenic kills, and have not sought for other agents, non-poisonous in their nature, capable of destroying the insect pests, and entirely free from the shadow of danger to man or beast.

It is high time that public attention was called to this question, for from every experiment station and through every publication the warning against the ravages of myriad forms of insect life has been repeated until there is coming a condition of dependence upon the formulas presented and indications of their more extended use in the future. This in itself is a matter for congratulation, for it indicates mastery, but it may seriously be questioned to-day whether that mastery must necessarily be gained by the use of agents the sale and use of which is considered so hazardous by the State that special precautions are required to advertise the deadly nature of the contents of every package sold.

Arsenic is insoluble, and, when used in the form of spray, as the liquid evaporates it remains on the leaf and fruit, also on the ground, as when applied dry, to be blown about by the wind, inhaled into the lungs, always a poison and never to be handled without danger. Years have passed during which the trees have been sprayed frequently each season, and no man can state with any degree of certainty when the danger line is reached through the continued use of Paris green.

Another phase of the question is that wherever it rests upon a leaf its sole action is to kill. It may be infinitesimal in quantity and microscopical in effect, but it is there, and no one can pass through an orchard or potato field where Paris green has been used without finding ample evidence of its death dealing power. It will be well if we remember that whatever destroys or retards the perfection of the leaf, in just that ratio prevents perfect fruitage as well as growth of plant or tree. "The leaves of the tree are for the healing of the nation," says the good book, and that the leaves may heal by and through the service they render as lungs to the tree and food collectors for the perfection of fruit, they must be preserved intact to the full harvest time. By the use of solutions for spraying, or dry applications having arsenic as their base, this perfection of leaf-life is impossible and, as a certain result, fruitage is imperfect.

Because we get fruit from our trees and potatoes from the ground after using these arsenical agents to destroy insects or bugs we overlook the fact of injury, or reduced crops, of decreasing vitality, of weakened life of leaf, of early decay and dropping, and a lower grade of quality; yet these are the conditions recorded by the growers who ask whence and why should these things be. Not infrequently does one hear the query: "Is the potato passing out of existence, as shown by the failure to perfect its seed—the potato ball, so called?" The frequency with which letters come to the desk of every publisher of an agricultural paper, asking for information regarding these changes and expressing fears as to possible outcome suggests a widespread feeling of apprehension regarding what is manifest and anxiety as to the future of these important crops.

It will be admitted by all that for complete growth of tree or vine, for largest possible yield and choicest quality of fruit or crop we must at every step conserve the life of stalk and leaf, feed the entire plant or tree to the completion of the harvest time. To do this the preservation of the lungs—the leaves—becomes of supreme importance.

To my mind, as a simple student of this great problem, there is no question of greater importance to the fruit grower of Maine than that involved in this question of insecticides. Investigation and experimentation may well be conducted not to determine the degree of danger, but to search out the agent or agents which will insure complete protection while promoting growth and life of leaf, stem and stalk.

It is not my province to discuss agents save to call attention to the dangers threatening a continuance of present methods and practices. To claim that no other pathway is open to the grower, and that he must still cling to arsenic, proves the man a charlatan and not a student, for under the most careful experiments, conducted by intelligent farmers directly interested in the outcome, it has been clearly demonstrated that there is no call for further reliance on arsenical preparations to destroy insect pests. It is perfectly safe to say that we can promote healthy growth while destroying, not driving away, insect pests.

There is no question as to the truth of this claim, for acres of growing plants and orchards tested in part with solutions of arsenic and in part with non-poisonous compounds tell the story. In the case of Paris green applications the leaves early showed signs of decay and a slight hold on the limb, indicating weak feeding powers, while alongside was a rich, deep, healthy growth, and a yield in fruit as well as crop which fully confirms the lesson, and in every case bears unmistakable evidence of the sure benefits derived from the vigorous, living leaves. Size, quantity and quality are in the balance and unite in emphasizing the necessity for preserving the life of the leaf to the full harvest time. Whether on the peach trees of Massachusetts, the apple trees of the Annapolis valley, or the potato, cucumber, squash, tomato and other vegetable crops of Maine, the testimony born of experience is positive against arsenic and in favor of a non-poisonous agent, and that evidence is presented in such a manner as to reach directly the heart of the grower and lead to his conversion, for it touches his pocketbook and comes in the form of larger yield and finer quality.

I do not stand here to discuss an experiment or advertise in any way the preparation of any corporation or the use of any special drug, but to emphasize an all-important fact, for with the growing importance attaching to spraying there comes the necessity for solutions absolutely harmless to use yet destructive to the pests which attack the fruit and growing crops.

It gives me great pleasure to be able to state that our able, conscientious horticulturist at the experiment station, Prof. Munson, is already at work upon this problem, seeking for such combination as will insure perfect freedom from danger and promote the life, growth and health of tree and plant. I am not an alarmist in any sense, but call attention to this question because of its grave importance and the fact that the public mind is becoming distressed over the question of food adulterations, the use of preservatives which prevent digestion, and the danger to health lurking in the agents relied on to destroy insect pests. We cannot continue on this road with impunity. Pure food is necessary for health. Embalmed beef or preservatives in fruit or jellies are destructive to life, and arsenic used to destroy insect life must be classed as dangerous. The state puts its seal of poison on every ounce sold, thereby giving its warning to the public. Beyond this question of public danger about which there can be no dispute, save as to the time when it is to be met, the financial issues claim attention. Tests made by experienced growers demonstrate that spraying with arsenic injures the leaf, and the destruction of the leaves materially affects the size and essentially the quality of the fruit and crop. Minimized in quantity as it may be the danger is greatly reduced and the effect not so apparent, but the certainty of injurious results sooner or later, and the fact of the deadly nature of the drug, may well be considered. The excuse for its use in earlier days has already been noticed, but that does not hold today.

That spraying both to destroy insect pests and protect from blight, rust and scab must be resorted to by every grower is one of the lessons not yet drilled in, else we should not see so large a per cent of poor fruit or hear so many complaints of rust, blight or scab, and this society can do no better service than to organize an educational campaign along these lines. The danger and loss are not appreciated and surely it cannot be computed.

One man sprays and his neighbors do not and all suffer materially. Insect life will multiply, new forms will doubtless appear, increased complications are sure to arise, and to be forewarned is to be forearmed.

We must prepare to meet the Browntailed Moth, the Gypsy Moth, and without doubt the San Jose Scale. We shall best be prepared to cope with these when we appreciate in largest measure the importance of spraying for the destruction of pests now common among us and for the prevention of diseases so prevalent today.

We have faith in fruit growing, and the certainty of natural conditions of soil and climate being established, it needs only that the industry present itself as a worthy investment for wealth to flow in and the fruit trees multiply. Had a fraction of the treasure which has gone out of this State into orange groves in Florida and California been invested in orchards on these hills of Maine, the bending branches would all these years have yielded their juicy fruit and the dividends would have satisfied far better than the assessments so often met or the occasional returns received from far away slopes.

The cry that Maine is not an agricultural State is dying out, and in its place one hears the whisperings of faith in a future when our varied lines of husbandry shall claim attention and over our hills the petals of the apple trees shall drop in early June like snow flakes in December, and our fruit, guarded from all insect pests and protected by agents which give rather than destroy life, shall go out to satisfy the lover of the richest nectar the gods ever created, whether on native soil, on far off prairie, or on the isles across the sea.

THE STUDY OF PLANTS ON THE FARM.

By Mrs. V. P. DeCoster, Buckfield.

We people who live on farms can study plants in one form or another all the year around. We do not need to wait for a summer vacation or even for summer itself. In winter, we can study the trees and shrubs and buds. For you know that all these bushes by the brooks and the trees which leaf out so early in the spring cannot have time to grow their leaves and blossoms so quickly after the snow is gone. If you examine them in winter, you will find the little buds all formed and covered with a warm waterproof coat.

And the first warm days in spring make them begin to swell and grow and throw off their winter clothes. The first ones children always notice are the pusy-willows, which appear not only to have a water proof cloak, but a fur coat under that. Almost at the same time come the catkins or tassels on the alders and hazel nuts. But these same tassels have been there, dry and hard, on the bushes ever since last summer. I want you to notice the two kinds of blossoms on the alders and hazels. The important ones which bear the seed at first appear to be blighted buds. Then see how many trees will soon be in bloom. The poplars first, so like the pussy-willows then the maples, both red and white, the beautiful lace-like blossoms on the elms, the dainty tassels on the birch, the Balm of Gilead and butternut. But later and most beautiful of all, how we love our fruit tree blossoms!

The pear, the plum and cherry trees fill us with delight. But 'tis when the hillsides of old New England are white with apple blossoms, and the air is heavy with their sweetness, that we have the grandest bloom of all. Life means so much then. We are in tune with nature. We enjoy the present bloom at the same time we enjoy the anticipation of delicious fruit. Much of the sturdy strength as well as mental worth has been gained by the New England people from lessons learned under these old apple trees, as well as from their luscious fruit.

The trouble with most children in studying plants as well as other things, is because they do not keep their eyes open wide enough to see more than a small part of what is all about them.

If you should go to school some day and see a new boy among the scholars would you walk right past him, with scarcely a glance, and pay no attention to him? No, indeed! You would notice that he had blue eyes, a freckled nose, a hole in his jacket, etc. And you would ask someone what the boy's name was, also his father's name, Where does he live? Is he going to stay? What does he do for a living? Has he relatives? And after learning all you could about that boy you would play with him and call at his home and invite him to yours. Someone might tell you he belonged to the Davenport family, and his name was Jonathan. You would call him Johnny or John, for short. Well, now, that is just the way to get acquainted with the flowers. When you are passing through the woods and fields and see a new flower, pick it carefully, root, leaf and all, when possible. Take it home or to school, find out its name, family, habits, etc., just as you did Johnnie's. You will find it belongs to some family as John did to the Davenports. Probably the flower, too, will have some long, hard name, and some short handy English name. You can learn the "nickname" when you are little and gradually as you grow older, you will learn the Latin names too.

Just as you invite Johnny to your home, bring the wild flowers, too. They are shy and bashful often times and not used to the food you may give them but if you will study their tastes you can have a wild flower garden and little spots all about the premises where they can live quite happily and so you may get better acquainted. You scholars often give each other photographs of yourselves, but you may have something even better than those of your flower friends. That is, an herbarium, or a collection of pressed flowers. Begin now, while young, then you will keep adding to it with renewed interest and knowledge as the years go by. And while performing the labor of pressing and mounting them you will fix their names and facts about them in your memory. I have brought you, here, a few sheets of mounted specimens of our earliest flowers, so that you may see just how it is done.

Gather them carefully taking the whole plant, root, stalk, leaf, flower, and seed when possible. Spread them out between sheets of unglazed paper, newspaper will do, although it is better to have something unprinted; then put boards and heavy weights upon them and press them a week or more, until they are perfectly dry. The first day or two they should be changed to dry sheets, two or three times each day, then once a day will do.

Then, when dry, fasten them upon the sheets which you wish to keep by pasting little strips of paper across them. In some cases you can paste the plant itself on and with some large specimens, you can take a few stitches with a needle and thread right in the axil of a leaf. Then down in the right hand corner of the sheet write genus, species, time, place, color, etc.

When you are making botanical excursions on purpose for flowers, it is well to have a closed tin botany can or box in which to carry your specimens and a strong, sharp knife. Also, if not too much trouble to carry, a portfolio or book in which you can lay the most delicate flowers. But, to study plants on the farm, do not confine yourselves to the wild flowers. Study everything about you from the grasses to the corn, from the strawberry blossom to the mellons. When you are sent to weed the strawberry bed or kill the squashbugs, do not call it drudgery, but keep your eyes open. Notice the two kinds of blossoms, the pistillate and staminate. See how busily the bees are doing a two-fold work, not only in securing food for themselves but fertilizing the blossoms by carrying the pollen from one flower to another,—you cannot study flowers long without becoming interested in the insects. For they are very dependent upon each other. It is a wonderful study to see how different flowers employ different methods of attracting the insects best adapted to pollinate their blossoms. And you cannot study the insects without becoming interested in the birds. So that everywhere new fields of delightful study are open to the country boy and girl.

You can learn much from experience without books, but you can advance faster and with more interest by having good reference books to help you out occasionally. In the past few years a wonderful interest has been manifested all over the country in these nature studies. They are being taught in our public schools, and many books are being published as helps, but however much a child may be told, and if he has a whole library for reference it will do him no good, unless he can learn to think and observe for himself; with a sincere love and interest in nature.

If we can teach these girls and boys to love nature, they will not only have a sweeter and happier childhood but they will grow up to be wiser and better men and women. Those who remain on the farms will be better farmers; happier in their work, knowing better what the possibilities of country life may be. And those who go to the towns and cities will be better fitted to enjoy any advantages, while their minds will constantly turn to the pleasant things they learned in childhood. Many of them will return to spend their declining years on the farm.

ORNAMENTAL PLANTING ABOUT THE FARM HOME.

By Prof. Fred W. Card, Kingston, R. I.

The subject of ornamental planting leads at once to the larger subject of landscape gardening. It is proper, therefore, at the beginning to ask ourselves what is landscape gardening and what is it not. Landscape gardening is not the growing of plants for their flowers, however desirable that may be. Neither is it the growing of plants for their individual beauty. Still further, it is not the growing of plants for the production of pattern designs or such effects as might be sought in the decoration of a dinner-table. Landscape gardening may embrace all these but it is first and primarily the production of a picture, a picture of which the home should be the center. This picture differs in many respects from that produced by a painter upon canvas. The artist who produces the garden picture must make it presentable from every point of view. He must reckon with possible damage from insects and fungi, from storms and accidents. He must furthermore produce a picture which is presentable when made and which shall grow in beauty as the years go by. All these things are not easy, yet the results will be far better if a definite object is sought than otherwise. Too often ornamental planting concerns itself only with the individual plants involved, forgetting entirely the effect upon the scene as a whole. The result is more often a promiscuous jumble than a restful picture.

In its development landscape gardening has passed through different stages. In the olden days each man's house was his castle, surrounded by high protecting walls. The garden was limited to the space within these walls. This led of necessity to narrow conceptions, sharp lines and angles and geometric designs.

The child of this style still remains in the so-called Italian school of gardening, which deals chiefly with pattern beds, formal designs and exotic plants. But as time went on, the garden wall disappeared and the garden began to feel its freedom. The beauties of nature came to be more appreciated and the fashion of gardening swung to the opposite extreme of patterning after nature in all things. Beautiful as nature is, she is not without faults, and to copy in the garden is little better than to depart entirely from her teachings. The true garden seeks to interpret nature, to eliminate her faults and to bring out the essence of her message. Herein lies the aim of the present style of gardening, sometimes called the gardenesque. It endeavors to produce a quiet, restful picture, looking to nature for the expressions to be wrought out.

The principles to be followed in producing such a picture are simple. The first is to provide a broad stretch of greensward. This is the canvas upon which the picture is to be painted. Few things are more restful to the eye than a broad stretch of green, yet few mistakes are more common than to fritter away this greensward in meaningless planting. The second principle grows logically out of the first. It is that planting should be about the borders of the grounds or about its permanent features. Only thus can the canvas be preserved. The third principle is that this planting should be in masses and strongly irregular. Herein lies one of the greatest difficulties to the novice. Nothing seems easier than to plant an irregular group of trees or shrubs; in fact, few things are harder. It is far easier to produce a stiff and formal clump than to produce a free and easy group. Courage and boldness are demanded in the planter in order that grace and freedom may appear in the group. Both the ground outline and the sky outline should be strongly irregular. Nature gives many useful hints in this among the groups of her own planting.

Whether in groups or as single specimens the trees and shrubs used should be allowed to grow after their own manner. Nothing detracts more from a picture than the attempt to mold into stiff and formal shapes the plants of which it is made. Particularly bad is the treatment often given to evergreens whereby they are supposed to be made to look trim and neat by trimming them up. An evergreen tree with its lower branches removed is ruined. So too, a shrub which naturally grows drooping and graceful may be spoiled by stiff and formal pruning.

About any home there are objects or views which are unattractive. The picture should be so planned that the groups of planting should shut out these undesirable scenes from the walks and windows most used. Buildings which of themselves are unattractive may often be made to appear attractive if partially screened by foliage. A plain shed or barn if treated in this way loses entirely its undesirable appearance and may really add to the picture. Perhaps no feature of ornamental gardening could be made to contribute more to the beauty of the farm home than this one properly thought out and executed.

Not only are there undesirable scenes to be shut out but there are attractive ones to be brought in. A deed of conveyance carries with it no monopoly of the beauties of a scene provided that scene can come under the eye of an observer from outside. Oftentimes the most beautiful part of a picture may lie beyond our own borders. To shut out such a picture by our own planting would be a great mistake. To bring it in and enhance it by giving it an appropriate framework of foliage is the course to pursue. Many a scene which in itself would possess little of attraction becomes beautiful when seen through a vista of trees. Hence properly planned openings may render what lies beyond much more attractive than it would be if spread out openly to view.

Walks and sometimes drives are a necessity but they should be treated always as a necessity, not as an ornament. Could they be done away with the picture would be better. They should, therefore, be as inconspicuous as possible. They are for utility and should be constructed with that end primarily in view. They should be directed and go where they affect to go. This does not mean that they must be straight. Footpaths are seldom or never straight. A path curved enough to give it lines of beauty and still appear direct. If then a well planned group is placed in the bay of the curve to hide the view of one end of the path from the other, the effect will be good.

If water enters into the picture it should be carefully handled in order not to appear stiff and formal. Nature may here be more closely copied perhaps than in most other places. To correct and smooth up a brook is generally to spoil it. Water can seldom be tamed. If deprived of its freedom it loses its beauty.

Nature may give us many hints regarding the improvement of highways. If allowed to do so she ornaments them well. While in some places straight regular avenues of trees may be the best form of highway planting, the natural growth which comes of itself is often more attractive. A little assistance to such growth may many times add greatly to the beauty of a road.

Church and school grounds are perhaps the most hideous of all places with regard to ornamental features. Church gardening has scarcely been thought of in America yet a very simple treatment would often suffice to almost transform the picture. In the church it is less serious than in the school because people are compelled to stay there but a brief period on Sunday. At the school our children, during the most impressionable period of their lives, are compelled to spend a considerable portion of their waking hours. Is it right that they should spend those hours in such barren and dreary places as they generally must? It is argued that children will destroy whatever is planted, that planting will do no good. That argument has some foundation but far too little to warrant its preventing planting about the school buildings. If the children themselves are interested in the work and are allowed to help do it, the damage wrought will not be too great to admit of easy repair. Do we not owe it to our children that they should have something of beauty in their surroundings during their earlier school years? The treatment need not be elaborate; the simple things growing in the woods and along the fences near by may be just as effective as stock purchased from the nurseryman. Indeed it is often more so. School gardens are coming to be known in our cities, why not oftener in the country?

The home garden is the most important. It is here that we may hope for most and here that we may accomplish most because there may be persistency of effort. It is not necessary that there should be expensive plants and money outlay. It is not necessary that the buildings should be expensive or attractive in themselves. The simplest dwelling with a proper setting may become far more attractive than the costly one without such setting. Taste, love and labor are the only essentials. The woods and fields offer an abundance of material.

FRUIT AND FLOWER STUDY IN ITS RELATION TO THE PRIMARY SCHOOLS, ILLUSTRATED WITH LANTERN SLIDES.

JOHN CRAIG, Professor of Extension Teaching, Cornell University, Ithaca, N. Y.

As the first speaker was so beautifully portraying the delights of nature study before you, a little story which I once read came to mind. The story was told somewhat on this wise: Two men ploughed adjacent fields. The one ploughed straight furrows; he put up his sighting posts and directed his horses accurately to the mark ahead kept his eye on the mark and looked not to the right nor to the left. He did not notice the clouds in the sky nor the flying butterfly; but he ploughed his field well, and harvested richly. His mind was upon the accumulation of wealth. His neighbor across the way ploughed also, but his furrows wandered this way and that way. He sometimes stopped to examine a stone; he occasionally paused to study a weed or plant; a butterfly attracted his attention. The one man grew rich, his son inherited his money, left the farm, went into the world spent it as rapidly as possible. The son of the other man grew up a companion of his father and became one of the most famous of landscape artists. There is a moral in that tale, a moral in which training and heredity play an important part.

And so let us begin our views of nature study, what it is, what it may do, and how we may carry it out, with a picture of various types of homes, because the home being the center of the universe is the place where all culture should begin.

We cannot all have homes of this sumptuous kind. Here nature, and art the handmaiden of nature, have combined to make a picture at once artistic and magnificent. We cannot all have homes like this, nor need any of us in this country have homes like this hovel. That was a home. I took a picture of it myself and it was in New York state. We are not advertising that kind of home in New York state, nevertheless there are such habitations, such places where people dwell, where children are brought up and from which they go out into the world and expecting to take their place in the world, to improve the world.

Query: Do they?

(Illustration a stone mansion.) There are homes of this kind, where wealth creates a grand marble mansion, where money buys beautiful ornaments for the interior, but there is no stamp of the nature lover on that home; there is no mark of the man who loves the things that are in God's out-of-doors, the most beautiful in all the universe. It is simply a creation of man and no man can ever make things as beautiful as nature. He only imitates.

Taking a trip through western New York a few years ago, I stopped at a cross-roads because I was attracted by this little hut on a piece of public property. The thing that really caught my eye was the way in which it was garnished by a covering of vines and growth of the natural creeper which abounds so freely there. I talked with the old man who told me that he had lived alone for thirty-six years in that hut after coming to this country from Scotland, and in quavering tones he told me how he had planted these vines, and that they were the things that now as he approached the parting hour he did not like to leave,—the things that grew up around him, that sheltered and covered him. So that no matter how humble the cottage, we may by getting a little closer to nature make it much more homelike, more restful, and thus impress the children with a love of those things that we wish them to carry through life, and those things which will enable them to feel that they are not alone in any part of the world. Nature study then should begin in the home and should begin as early as we can inculcate the first thought of the bud or the plant or the stone or the star, or anything which makes up the great universe.

Illustration: *"Making garden."*

Here is one of our Cornell students who graduated, and then did the next best thing, got married. He sent me a picture a month or so afterwards and showed me how he was beginning nature study on his farm. His wife was helping, and they were starting off in the proper attitude towards their life work.

Illustration: *Children among animals and plants on the farm.*

I need not pause for a moment to elaborate the wealth of material which those who wish to take up nature study have about them. Just looking at these three slides will bring that point out more forcibly than I am able to. The flowers furnish an inexhaustible wealth of material, and there are so many interesting things about them. We farmers who grow apples have in our own door-yards the most effective material with which to interest children. And let me say, lest I should forget, that nature study is after all the beginning of agricultural knowledge. This point has been well brought out. We sometimes introduce it into schools under the name of "nature study," but we are really teaching agriculture and perhaps more effectively than if it were put into the curriculum as such. It is in fact agriculture disguised. Although "the first farmer was the first man," and although agriculture is the oldest of the arts, it is probably the youngest of the sciences, for it is only within the last twenty years that there has been an awakening to the dignity of farm labor and to the necessity of severe study if one would succeed in agriculture. Just think of it, the student cannot touch a thing in the realm of natural science that does not affect the operations of the farm. So that when the child is admiring the blossom of the apple tree in his father's garden he is unconsciously learning something which will help that child to grow fruit in the future. And the animals. I heard of a curious little incident the other day, and it was told me as a fact by some friends who invited their city cousins to come and visit them. You are aware there is a common notion that the city girls and boys are the smart girls and boys, that the country boy is the boy who knows very little. This notion has grown up because the country boy does not at first shine in the city, but just change the positions and you will get a pretty accurate idea of the real knowledge of each. This particular city child of which the story is told visited her country friends and was very fond of milk. The first day she drank greedily, the second day she liked it very much, but the third day she absolutely objected to taking any milk at all. They asked her why, and she said: "Why, I have been out to the barn, and that milk came from a dirty old cow, and I am not going to take it." That is perhaps an exaggerated illustration of the ignorance of city children regarding the things on the farm; but it is as fair as some of the illustrations which are used to show the ignorance of the country boy when he goes to the city.

Illustration: *Wayside Flowers.*

The woods furnish many of these charming studies. It does not make any difference whether we go out in lady slipper season, in golden rod season, or in aster season, or whether when the snow falls and the ground is covered with snow and the teasel is sticking up from the ground, there are things constantly before us that are attractive and interesting. Here is a club of the beautiful New England aster. And the animals. How many children are afraid of the domestic animals and of snakes and of other things which are really in themselves harmless. This is all due to a lack of familiarity. There should exist a healthy companionship.

Illustration: *Cornell Junior Naturalists Clubs.*

Here is a band of junior naturalists. Now I want to tell you something of the junior naturalist work of the state of New York. A prime object of these organizations is to train up an army of home makers. A friend of mine in Wyoming sent me a picture of a home the other day. It shows the first settler, as he squatted on his claim away out miles and miles from anywhere. No trees, shrubs or cultivated flowers. There is too often a desire on the part of home makers, of those who garnish their homes, to seek the grotesque, unusual or striking, and the picture before us is to illustrate that point. Now the natural things, the pictures which nature creates, are vastly more beautiful than anything which man has done, and that is one reason why landscape gardening as a fine art, is superior in my opinion to painting, because the man who can by using turf as a canvas and plants as pigments make out of them a picture as beautiful as we find nature has made, possesses in my opinion a higher art than the man who can simply with pigments imitate nature on canvas.

Illustration: *Sheared Trees and Italian Gardens.*

Here we have the work of a gardener in trimming or contorting plants into curious shapes, but what is there more beautiful than the way in which nature builds one of our magnificent native elms, whether in winter when it is denuded and bare or in summer when it is clothed with its beautiful drapery of green?

And so the work of the naturalist, of the man who would teach children to love nature, begins with the natural, common things about him.

Illustration: *School Children at Play.*

Here is another example of energy going to waste. Is it not principally a question of directing it into the proper channels? Boys are said to be bad boys because things are not brought to them in the right way. Study is made to appear serious work.

They don't see things from the right attitude. It reminds me of a very homely illustration which I once heard a Prohibition speaker use. A farmer was driving to the hayfield, sitting on his hayrack. As he drove by his neighbor's house, his neighbor's dog ran out, jumped up and attempted to bite him. The farmer on the spur of the moment took his pitchfork, drove the tines into the dog and killed him. The neighbor was very much concerned about it, came out and expostulated with him warmly, ending by saying, "Why didn't you take the other end of the fork?" The farmer scratched his head a moment and replied, "Why didn't the dog come 'tother end to?" The question was one of attitude. Now the picture we have just seen expresses the attitude of a boy who has been told that he has got to go out and do that thing or he will get a whipping. He has not been told that he can have a share in the product, that that row of strawberries is going to yield fine fruit and that he may have a box to sell, or a box to eat, or a box to give his friend, or anything of that kind. There is no inducement, nothing attractive in the proposition. In this illustration we have our boy with quite a different attitude toward the work he has to perform. This man with the hoe comes along jubilantly and thinks it fun, and it is altogether, or largely, the point of view, the way we look at things.

Illustration: *Neglected School Grounds.*

I have tried to emphasize the necessity of beginning nature work in the home, but the school of course is the great cultural cradle of our race, and there we ought to begin the work. Oh, what surroundings! I don't know how Maine is, I don't know whether it would be possible to get a picture of a schoolhouse of this kind in Maine, but I find it not difficult to pick them up quite occasionally in different parts of the country. What inspiration is there for students to come to bare, ungarnished school yards and leave with anything else in their heads or hearts than that which has been pounded into them in the ordinary pedagogic manner. So one of the ways in which we have been attempting to introduce nature study into schools is by improving the school grounds.

[Then followed a series of pictures showing how school grounds might be improved.]

We are attacking the question on the outside. We are attempting to garnish or improve the school yards in order to make them more cheerful and attractive for the children. Children are wonderfully easily led, but it is mighty hard to drive them at times. A movement was begun in Rochester two years ago which had for its purpose the development of school gardens and also gardens in the home. Arrangements were made with one of the city florists whereby pupils could buy packets of flower seeds at a penny apiece. Word was given out in the school that this was possible. Perhaps you would be surprised to know that in a few weeks over 23,000 packets of seeds were sold. In order to find out something of the success of the movement it was decided to hold an exhibition of the products of these seeds at the State Fair at Syracuse the same year. The children were invited to send exhibits. The state promised to pay the express charges on those exhibits. A certain amount of space was set apart in the hall. One man was assigned the duty of placing the exhibits. The day arrived on which the exhibits were to come and they began to roll in by the wagon load. The space that was set aside was not only covered with exhibits but it was piled high, and the fair people just simply held up their hands in horror at the express bills which were handed over to them. I merely relate this to show that children are responsive if approached in the right way. In passing let me cite the excellent work that is being done at the Hampton Institute in Virginia where colored children are taught nature study in a very practical way by the school garden methods.

Illustrations: *Nature Study in Relation to Civic Improvement.*

I wish to point out in passing some of the broader phases of nature study in their application to urban life, to city life. I want to show that man is the destroyer of the beauties of nature, and that unless children are cultured, are taught, are shown how to improve the conditions that our cities will continue to grow uglier. Here is a picture, showing the unattractive side of city life. Possibly you may not be able to duplicate it in Maine, but I didn't find it difficult to secure this picture not very far from Ithaca, from whence a good many of these illustrations emanate. Here in this denuded waterway we have the work of man. By way of contrast let us look at some of the ways in which nature clothes waterways and some of the ways in which man treats waterways. And then many of our city yards are unsightly and unhomelike. They are not playgrounds. I am speaking of these because the work of gardening in the cities is very closely allied to that of civic improvement, and civic improvement is only a larger view of home improvement. The home is a unit, that is all. In all this work the children ought to have a very intimate and close part. How many yards in your town are in this ungarnished condition? Here we have a little bit of nature contrasted with it.

[Then followed a number of pictures showing strikingly beautiful effects mainly brought about by the efforts of children and many eyesores the result of carelessness in country and city homes.]

In the city man appears only anxious to destroy the beautiful things, but is often desirous of erecting positive eyesores. After he erects them, then he garnishes them with signs of various kinds. In some of the cities, the improvement societies, aided by the children, are taking hold of this important work with excellent results. In passing let me say that you can obtain two or three illustrated pamphlets published by the National League for Civic Improvement now established in Chicago, describing the progress of civic advancement.

NATURE STUDY AT CORNELL.

Cornell University, through the bureau of nature study keeps in touch year after year with from twenty-five to thirty-five thousand children in the schools of the cities, of the villages, and in the country. This is done by first having one person take charge of that work; in the second place by issuing a little pamphlet once a month, of which I have given you some sample pages on the slide. This little pamphlet is called "The Junior Naturalist Monthly." The child is very responsive, but he or she must be approached in the right way, they must feel that they are dealing with a tangible person, with something real. So in order to stimulate and foster that idea, we have created a real person in the College of Agriculture, and have given him the name of "Uncle John." Uncle John is the pater familias of this whole movement, the man who has charge of all the work with the children. The Junior Naturalist Monthly is issued each month during the school year. It is intended to deal with the common things that happen to be appropriate at that time—crickets during the cricket season, birds during the bird season, and types of flowers during their season; and to bring out the little things that are ordinarily overlooked. For instance, possibly some of the older people do not know that the crickets are not vocalists, although they thought they had heard their voices, but are fiddlers, that they make music by scraping their legs together. Such little things are brought before the children and attract their attention and they go on and study them and make many interesting observations.

Illustrations: *Junior Naturalist Clubs and Insect Studies.*

The children are banded into groups. Each group is called a club. They can organize a club when they have done certain things. I will show you what we demand of them later. In the meantime we will look at some of the subjects which are used to illustrate these publications. The insects are perhaps the most interesting of all because they furnish in their changing forms great variety. Uncle John writes a letter addressing each child personally, and it is that personal element which holds them together. Here is one of the big horned larva which forms an exceedingly interesting subject. The caterpillars themselves are very interesting subjects; the pupils are most interested in seeing them crack open their skin and crawl out. Here is the larva of the common tomato worm, and he is a pretty business-like chap when he is at work; he uses up the leaf of the tomato in short order. Let us pass through rapidly the various stages which occur in the life history of this one as he passes from the larva to the adult stage, and just here is a most interesting thing. We had a very suggestive paper this afternoon on Insecticides, Their Uses and Dangers. The writer did not tell us just what perhaps he had in his mind altogether, but the suggestion comes to me here now, that we can teach our children many useful things about the way in which nature holds the various forms of animal life in check. Here is this same larva of the tomato worm badly infested with a parasite, and it is interesting to know that the eggs of this parasite are laid in the body of the tomato worm, and that these are the cocoons of the larvæ which after eating through pass into the next stage on the outside of the body. That worm is of course doomed and will never be transformed into a chrysalis or pupa. In that way nature attempts to hold these things in check. So we have fungous diseases of various things. The next stage in the transformation of this particular insect we find in this picture, and then we have the full grown beautiful thing on the wing. And so, I say, insects form beautiful and attractive objects of study.

Illustrations: *The Evergreen Trees.*

I have sometimes thought it would be an excellent thing for horticultural societies to offer prizes for collections of tree seeds. They ripen at this time of year. The seeds should be properly named, and of course the competitors could not do this unless they watched the tree flower, unless they traced it during the season, and then collected the seeds in the fall. If you should offer prizes for collections of native tree seeds, I think it would greatly stimulate interest in the preservation of your native forest trees.

Here we have the common Norway spruce and just one or two examples of things that are a little peculiar. The witch hazel is one of those curious plants which blossom, as we think, quite out of season. You will find these blossoms on your plants now in the fall, after most things are thinking of going into winter quarters. Again in the glory of the maple leaves, we find objects of interest for nature study. I may say that these leaves are also used by the Junior Naturalists in the primary schools as objects for drawing lessons.

We organize clubs in the grammar schools. These clubs are carried on in the same way that ordinary clubs are carried on; that is, the children are made to pay dues. The dues are in the form of original observations on plant, insect or natural life of any kind. I have thrown on the screen here a couple of sample letters from schools. Here is one addressed to "Uncle John," the usual form of address. (Quotation from letter.) Each of these observations is supposed to be original, and are written during the English period so that the nature study lessons serve a double purpose. The pupil is credited by the English teacher on her composition, and then the letter is sent to "Uncle John" at the University, as the payment of monthly dues. Some of the pupils are quite ambitious, as you see, not satisfied with simply writing out a statement, embellish their statement with original drawings. Here we have flowers and this I suppose is intended to be a honey bee. Here is another one. There the thing under observation was a pea; the seed was planted and here we have the various steps in the germination of the plant, described by drawings. Here is the seed, and as it began to spring from the ground notice the crook that first appears above the ground. These things bring the child pretty close to agriculture.

Now the clubs send in their dues—we call these letters their dues—once a month. Every time a naturalist publication appears, it means that they are called upon for dues. They send them in in clubs, the letters all packed together under one cover, and I have shown you a number of sample covers. They are tastily gotten up. The grades are shown on the covers, so you can get an idea of the age of the scholar. Here is another one showing the development of the corn plant, and then some observations on birds, the orioles, catbird, blackbird, bluebird, kingfisher, etc., and notes on insects. When a club which has been formally organized has sent in one set of dues, they obtain this charter,—when they send in their dues with a list of the names as appearing on this roster. Each Junior Naturalist is distinguished by wearing a button. That button is sent to each individual member of the association and is worn with a great deal of pride. They are then attaches as it were of Cornell University.

These clubs are not carried on from year to year. They are disbanded at the end of the school year, so that each season we have a new class of boys and girls coming up, and in that way we reach a large number. Last year we had about nineteen hundred of them in the state, aggregating something over thirty thousand in membership. Of course the great difficulty in organizing these clubs is to find teachers who have the requisite amount of training and who have the desire to take up the work, but teachers who do take it up find that it is no added load, but that it is a great help. They use the organizations for various purposes. If their children are tardy in the morning, they will say, "Now we will have a Junior Naturalist exercise the first thing in the morning," observation on something interesting, and they invariably report that this brings the children in on time. They enjoy it.

We have heard about the possibilities of bulbs as nature study subjects, and they certainly are among the most attractive of plants for children to use. Here is a little class coming out to examine the condition of their bulbs, as they are growing them near the school yards.

Then we have a number of groups of school children. In Elmira a winter school has been doing splendid work. As in other works, you will find certain cities, certain schools taking the lead, and Elmira, Albany and Rochester are three of the big cities in New York which have taken a decided lead in this work. Here is a wonderful lesson. Sometimes the teachers are rather hard put in the winter for material. Twigs, and if they have them, window boxes, furnish useful material, and classes of the more advanced pupils study the winter condition of buds on fruit trees. They probably will have these in flower later on.

This work is not confined to New York, as you have heard to-night. The spirit of nature study is in the air. In the South it is taking hold of the schools. It is making headway, and with even such apparently unpromising material as colored children good work is being done.

Perhaps you will be interested in seeing the faces of two or three persons who have this work very near to their heart and who have been most instrumental in carrying it on. This is Mrs. Anna Bosford Comstock, the wife of Prof. Comstock, author of Insect Life and Comstock's Manual, who is one of the most effective workers at teachers' institutes in the state. The next is Prof. L. H. Bailey, who has always had this work very much at heart.

And now as we are getting along to the end of our series, and you may ask, "Is this work accomplishing anything? Have you any tangible results?" We who are connected with colleges of agriculture naturally wonder if all our efforts are unavailing, if the boys are still going to the cities. It is a very good thing when you come to think of it that a great many of them are going to the cities. It would be a bad thing for the cities if they had to build up of their own material, if they did not draw from the fresh blood of the country from time to time to infuse new life, energy and intellectual vigor into their classes. Is this work then doing anything? You see this letter is dated

October 30, 1902. It was just received a day or two before I left home. It is only one of many which come to our office, and it speaks for itself. It shows that boys are studying and practicing to become farmers. They are the bright boys. This is the encouraging feature of this whole work. The boys are studying and are beginning to believe that agriculture has something in it more than mere drudgery; that there is dignity; that there is as great an opening in it for men as there is in any other walk in life. And this is the kind of doctrine that we ought to teach.

Good-night.

MISCELLANEOUS, ETC.

Mr. GILBERT: Before closing, let me say we have some visitors with us whom we have not had the pleasure of hearing from. We are pleased to have them with us and would not allow them to go away until we have had the pleasure of hearing from them. It is our extreme pleasure to have with us this afternoon the President of the State University, and to listen to him at the present time.

Dr. FELLOWS: Ladies and Gentlemen, the pleasure is mostly mine, I think it probably is entirely mine in being here rather than yours. It gives me the greatest pleasure to meet the people of Maine, and as I am such a new comer to the State I am very anxious to go about in the different parts of the State where there are gatherings that I may become acquainted with the people among whom I am to live, I hope, for the rest of my life. But the speakers who have preceded me this afternoon have an immense advantage over me—they are experts in the line of work and study in which you are engaged. I am scarcely an expert in that line. I have made some beginnings and I hope to know more in the future. At such a meeting as this almost the first thought that comes to me is the significance of it. What does it mean that people from all parts of the State will come here and spend two or three days together, bringing with them the product of their year's work, discussing papers, listening to experts and devoting their attention to one line of study? It simply means that this is the product of civilization and the highest product of civilization, when people who are on the down hill side of life are still studying how to do better that to which they have devoted their lives. I have devoted my life, so far as I have lived yet, to the purpose of education, and the more I see of it the more I think it is a noble work. Now this is education. You are in the business of education. The only difference between those who are actually producing work and furnishing the markets of the world with their products, and those who are teaching school, is that the ones who are teaching the young ones, the children, the beginners, are leading them up so that they may be able afterwards to study and teach themselves. You are teaching yourselves here when you are working on these things, and it is the greatest pleasure to me to see that it is not all young people that are studying and working. It is the salvation of the nation when all the people are studying for better methods. Why, such a meeting as this would have been absolutely impossible a little over a half century ago. Do you know that the first time that any one ever thought of having a comparison of products and industries of two nations was just fifty years ago,—only fifty years ago. A hundred years ago, and two hundred and five hundred years ago, people never got together except to fight. That is a fact. Meetings of savages were for the purpose of fighting. Men never assembled together in savage times except either to prepare for a war or to actually do the fighting. The few who had to labor, for instance, and that in the case of the savages is very often the woman,—were allowed to do and expected to do just enough to maintain life, but the real business of life was war. And the few who had the education and knowledge were a separate set by themselves. So most of the savage tribes had their men who were separate, called soothsayers or medicine men, or whatever they might call them, who in themselves were possessed of all the knowledge of the tribe or nation. And even after great cities were built and after great nations began to grow, the people who considered themselves the people and the leaders of the world and of their nation knew nothing, either in letters or in practical affairs. They left that to those who were especially set aside for it. And in the Middle Ages, learning, agriculture, what little of science there was, was left entirely to the monks in the cloistered monasteries, and no doubt we ought to thank those monks for what they have done for us. The few good gardens were made by the monks in the yards of their monasteries, and if they had not done that I don't know whether the world would have been devoid of fruit now entirely or not, but certainly we would have been starting with developing the wild fruit rather than developing such beautiful specimens as we have here now. But the fact that it was left to the monks to do what little of agriculture there was, to retain what little of learning there was, is a most significant feature of the times. The kings themselves had learned nothing. Why, Charlemagne boasted that he was greater than all kings because he could write his own name, and he employed a man to read to him, but he scarcely got to the point of reading himself, though he could sign his name, and it is said he could read afterwards, and he was a great king over all the land of Germany and France of today, and Italy. But the highest type of civilization is when all the people are studying, studying to do something, studying to do the work which comes to them either because they have deliberately sought it or because something has forced them into it, so they may do it in the highest possible and best way. I do not know that there is anything better that I could say in the few minutes I have to talk to you than to say how heartily my life is in the work of endeavoring to have people do all that they have to do in the best possible way. Now we cannot ourselves do everything in the best possible way of ourselves, because we have not time. If it is your business to raise apples and my business to raise horses and hogs, I have about all I can do to attend to the horses and hogs and you to attend to the apples. You can do some experimenting, I can do some, all of us can do a little along our own lines and we can give the benefit of our experiments to others. There are experiment stations established by the nation, giving us the benefit of their experiments, but all of these are of no value unless they are made available. My experiment will help no one else, the experiment station will help no one else, the experiments of all of you will help no one else, unless we come together in such associations as these and others and there trade our products—thus the knowledge of one becomes the knowledge of all and every one is possessed of the whole sum of human knowledge on any particular subject. A man now lives through in

Baldwins, 40 years old. Stand 60x60 feet. Tilled, manured, sprayed. Has borne six consecutive crops. Situated in Munroe County, N. Y. From photograph by Prof. John Craig.

his short years of schooling, he lives through the whole history of the human race. If each one of us had to start at the beginning and learn by experiment, as some of our earlier ancestors did, we never should arrive at any great result more than they, but we start with the product of all previous ages. The generation that comes after us will have these things to begin with, and it is our duty to leave to the coming generation the best possible legacy of all of the combined work and effort in every possible line. It has never been my privilege before to address an association devoted to this kind of work, but I hope it will be my privilege again provided you don't dislike to hear me, because I want to work in this line myself. I have had my perceptions made more acute, my interest has greatly increased since I have had charge of an institution which has an agricultural department to it. I think there is nothing more inspiring than coming directly in contact with nature, and you cannot do that in any of the other occupations in life as you can in farming in its various branches. To be sure a great deal of the wealth of this nation and of other nations has been made in what we call other lines, that is, manufactures, manufacturing products that have grown out of the soil or been dug from the soil, but after all, however much money may have been made in those lines, however great the development may have been in those lines and in the line of machinery, and so on, every one of us has to come back to the earth for our supply of food, and if we lose our interest in that and if we lose our skill in that, and if we do not try to make every bit of possible progress in that line, the world will come to naught in spite of all its advances in other lines. Let us do just what Dr. Twitchell has suggested, advocate the value of the State of Maine as an agricultural state. We know it is a state for lumber. Everybody knows that. It is put down in the geographies. My children came home the other day—one of the most remarkable things that they had discovered, that the Penobscot river was most noted for the lumber produced along its banks. They hadn't heard that before, but they read that in the geography. Let us put in the geography that it is an agricultural state, and let us put in every book and paper where we are advertising ourselves that this is an agricultural state, because we know it is. We haven't 500,000 square miles of land such as we have in Illinois; that don't make a particle of difference. Such as we have is good—it is good for results and the results are unsurpassed. Thank you.

Mr. GILBERT: An imaginary line separates us from our neighbors in the Granite State. We pass through a section of that state in almost all of our travels into other sections. It is but rare indeed that we have a representative from that state with us here in Maine and it is my pleasure at this time to introduce to you the secretary of the New Hampshire Horticultural Society. We have been working him some in the way of awarding prizes, but we do not want to send him away until we hear from him. Will Mr. Baker step to the platform?

Mr. BAKER: Brother Gilbert told me just a few minutes ago that he should want to hear just a word from me but that the time would be very brief. It reminded me of a little incident that happened to me a few years ago when I found myself over Sunday in one of our little New Hampshire towns. I went to meeting, as they call it, and stayed to the Sunday School after the service, and the superintendent, when he called the school to order, said: "We have with us a brother from one of the neighboring towns and I am going to call on him to offer prayer, and if he prays more than three minutes I shall strike the bell." I am not going to have Brother Gilbert strike the bell on me if I can help it.

A few days ago I received a letter from your honored president, a gentleman with whom I have had the honor to be acquainted for a good many years, especially in the dairy line, inviting me to come here and attend this horticultural meeting and meet the people of Maine. It was so that I could come and I very gladly accepted his invitation. On my way here I learned that the Commissioner of Agriculture was to hold a meeting at Saco that evening, and finding that I could make connections I stopped off there. There I met your commissioner, Mr. Gilman, and also President Fellows, and Mr. Gilman told me when he learned I was coming to Farmington, "Brother Baker, you will find there one of the finest exhibits you ever saw." I was partially prepared by that to see a fine exhibit, but I must say it far exceeds any anticipation I had and I want to congratulate the society most heartily upon the superior excellence of this exhibit, which I think I have examined as carefully as I ever did any exhibit in my life. In 1893 as a superintendent of the

New Hampshire exhibit at Chicago I had to attend to our fruit exhibit there, where Maine also had a most creditable exhibit,—one of the finest exhibits there, so the judges said. In that exhibit there were 75,000 plates of apples, but I see represented upon the tables here many varieties while the samples are superior to anything that was shown there at Chicago; and I want to congratulate you again upon this most meritorious display.

Now we have heard for a great many years of Maine Baldwins, in fact Maine Baldwins are known almost the world around. What has given them this reputation? I was in Boston two years ago and a prominent shipper said to me: "About one-half of all the apples I shall ship from the Boston market to European markets are grown in New Hampshire, but three-fourths of those that go are labelled 'Maine Baldwins.'" Now why is it? They must have been pretty good apples or they couldn't have come in the same class with yours. I will tell you why I think it is. You have had in your State for thirty years a live, active pomological society, composed of men who believed in their State and who were using every endeavor to show to the world that they were raising one of the best products possible in the world in the fruit line, and you have advertised your product by putting up nice goods and raising good goods until today a "Maine" Baldwin is a synonym for a good Baldwin. Now we hope at some time with our little horticultural society over there that is only nine years old, to get for our New Hampshire fruit something of your reputation, but I don't believe, after looking at this exhibit—I am not going to slander my own state, but I shall be honest enough to say that I don't believe that time is coming in the very near future.

Mr. GILBERT: Before Mr. Baker leaves us for his home, perhaps it may be well to call his attention to the fact that the law of Congress has recently been passed prohibiting counterfeit labels, and we give them a little warning in regard to selling New Hampshire apples for Maine Baldwins.

Mr. BAKER: Mr. Chairman, I can't allow Brother Gilbert to put me in a false light, the branding was not done in New Hampshire but by men who came up there and picked them and sent them for Maine Baldwins.

Mr. SAMPSON, Secretary of the Franklin County Agricultural Society:

Since coming into the hall this afternoon, the chairman of the trustees of our society came to me and wished me in some way to thank you all who have come here, especially the organization of the State Pomological Society, and I feel somewhat incompetent to put words together to express how the people must feel in regard to it. Last year, at our annual meeting, the society voted to extend an invitation to the State Pomological Society to meet for its next annual meeting in this place, and I had the pleasure of writing that invitation, and perhaps it is not altogether inappropriate that I say a few words now. Certainly it is a pleasure to me to say a few words along this line. I can assure you from the bottom of my heart that we do appreciate it. I can asure you that your presence, your countenances, your shake of hand have enlivened us and influenced us to feel that there is progress ahead in this line of work.

And this grand exhibit, why, as the last brother said, it is a surprise to me. I must say I couldn't possibly anticipate anything of the kind. I am going to say that this exhibit is going to be an impetus to send us as a county way ahead. We may not realize it at once, but it certainly will. At our next annual exhibit I expect to see our tables, provided it is a good year for fruit, I expect to see our tables look better. I expect we will have to enlarge the room to accommodate our exhibit in consequence of this exhibit. In behalf of our society I sincerely thank you.

Now as to the town, it is not necessary for me to say a word probably on this line, because I know you have all felt the appreciation that there is felt in this village towards you for coming here. I know, because I have heard it on the street since these sessions began; bankers, business men, lawyers, doctors, all express the same grand sentiment, "We are glad they came here." "It is a grand meeting." "It brings us up." "It is lifting agriculture." Agriculture is on the rise, thank the Lord for that, if I may use that expression. The agriculturists of Maine feel it and we are on the rise. In behalf of Farmington, I thank you. In behalf of the county I thank you.

Mr. GILBERT: It seems to devolve upon me at this time to say a few words in response to the remarks you have just listened to, and also to give some information in relation to our presence here and how we came to be here.

The invitation was received from the Franklin County Agricultural Society, one of the most successful agricultural societies that we have in the State, and in accordance with the name which it bears of an agricultural society one probably as closely helping the interests which it represents as any other county society in the State. We appreciated the importance of that invitation and what might result from it. In order to make an exhibition or an enterprise of this kind or a similar kind a success in any locality, the people at that point must be interested in it. Very much devolves upon them, however much we outsiders can do, very much devolves upon them to make the occasion a success, and without that aid we could not have made this exhibition and convention what it has been here at this time. The people of Franklin county have given us a cordial reception. They have fulfilled their every duty in connection with their invitation beyond what we have asked or expected of them. Nothing on their part has been neglected.

We were criticised somewhat severely for locating this convention here at this point. Still the faith was in us that it would be a success and that criticism would be wiped out on the occasion of holding the convention, and I am free to say that I have no doubt that that criticism has been silenced and forever. And further than that, our secretary, on whom very much of this work and this arrangement of a program, securing the speakers, etc., has devolved, is a resident of this town, and I want to give him the credit here and now. He has been interested in this meeting and he has done heroic work in the matter of local affairs connected with this institution in so far as our side of the work is considered. Every detail has been attended to, methodically and systematically. Every detail devolving upon the locality has been carefully canvassed and attended to. He and I were designated as a committee of the board of officers to complete this work and so I have known, been thoroughly informed as to every part of it as it has gone along; so not only your people, not only your agricultural society, but your citizen—our secretary, have done all that we could ask of them and could expect, and should receive the large measure of credit for the success which I hope you will all accord to this occasion. We thank you heartily for this attention on your part. We hope that your efforts will be in a measure rewarded. We trust they will, for wherever people do good work in a good cause they are sure to be rewarded. You in justice will receive a large measure.

Mr. POPE: I crave just a moment of your time. Some thirty years ago a few generous-hearted men met in the town of Winthrop and conceived the idea of organizing their effort in behalf of fruit growing in Maine. A few of you perhaps remember that time and may have been present. They there took measures which resulted in the organization of this State Pomological Society. Perhaps few of you know or are aware of the labor and of the time that was given by the officers, by the men at that time who had nothing as a precedent to work from, only their love and their desire to benefit their fellow fruit growers. They applied to the State. The appropriation which was allowed us was small. It was only through the efforts of a few public spirited men that this work was carried forward, and among them were such men as Gilbert, Sawyer, Varney, and those who without compensation, except from the satisfaction of doing good, carried on the work, frequently without money enough to pay the bills except as their hands went into their own pockets and helped out.

Now one of those charter members, who was then president, is at the present time our president, and a few of us life members, feeling that we wished something that should recall those days, have taken the pains to frame a certificate of membership and present it to this our worthy president, feeling that as it hangs upon the walls of his study it will recall to him the days and the hours and the weeks that he has spent with us—not for its intrinsic value but that the memories that it may call up will give pleasure to him. And perhaps I know better than any other man who was with him in the organization of the society and have been with him in every meeting since when he has been an officer, how much time and thought he has put into this, and know that the pleasure that he has received from the work that he has done far outweighs all of this, of that which can be received by those who simply attend these exhibitions for what little personal profit they may get from it.

In presenting this to our president we feel that he will appreciate it and recall the good feeling that the life members have for him and for the efforts that he has put forth to assist the fruit growers of Maine.

Mr. GILBERT: Brothers and sisters: This expression of your pleasure in connection with myself and the service I have done in the interests of fruit growing is a complete surprise to myself and I hardly feel prepared to say a word in response or express my thanks for this expression of yourselves in regard to that service. I can only assure you that it is a far higher compensation than any mere pay. I have often thought as I have put in days and weeks of work, especially in this direction and in other directions also in connection with agricultural affairs, I have inquired in my own mind whether I wanted to exchange those days' works with the compensation I have received while performing them for mere pay—money—and I never have found the time upon any occasion that I have wanted to sell that time or exchange it for money. I have been so far favored in life with compensation for my efforts on my own farm and in my own orchards that I have got a comfortable living. I could have secured, by putting my labors in other directions, more of money,—I don't know how much more. I never calculated things in that direction. But I have received compensation. I have no desire to exchange it for money; and this expression on your part is a great satisfaction to me, I assure you, that you appreciate those labors and have yourselves thought of the way and the manner in which those labors have been tendered for the cause which they have served. I thank your heartily, and from my heart I thank you for this expression.

SECRETARY'S PORTFOLIO.

HENRY A. ROBINSON, D. D. S.

Henry A. Robinson of Foxcroft was one of our earliest life members, and one who in a special sense had the interests of the society at heart. It was a pleasure to have him with us at our annual meeting in Dexter in November, 1901, but it was a cause of no little sorrow to observe his declining health. Several times he called attention to the great pleasure the meeting gave him, and it was the secretary's privilege to induce him to stop over to the evening meeting by sharing his room with him. A few weeks later we were shocked to learn of his death, while of his life there were only the sweetest of thoughts. To his wife and family the members of our society join in extending heartfelt sympathy in their sorrow, while they rejoice in the noble, helpful life he led.

Mrs. Robinson has kindly sent the secretary the following sketch of her husband, and it so beautifully tells the story of his noble life that it is a great pleasure to publish it for the perusal of our members:

Henry A. Robinson, D. D. S., was born at Foxcroft, Maine, March 6, 1840. He received his education in the common schools, and at Foxcroft Academy; and taught his first term of school at the age of sixteen, continuing to teach in winter for several years, while in summer he assisted his father on the farm. He studied dentistry in the office of Dr. Henry Leavitt at Foxcroft, and afterward graduated from the Philadelphia Dental College in the class of 1867. He then established an office in Foxcroft, where he followed his profession for thirty-five years, taking great pride in doing first-class work.

The doctor's chief interest, outside of his office, centered about fruit-growing, and he was a life member of the Maine Pomological Society, whose sessions he greatly enjoyed whenever he was able to attend. It addition to a large apple orchard, he had, besides the more common kinds, a number of varieties of Russian pear-trees, some of which were large enough to produce good preserving pears. He had also several varieties of plum trees, supplying fine large ones for the table and smaller kinds for preserves. For many years he raised strawberries in large quantities; also currants, of which his favorites were Fay's Prolific and the White Grape. Gooseberries, too, claimed his attention, and in recent years he cultivated successfully several new large varieties,—the Columbus, Triumph, etc. Grapevines, blackberries, red, yellow, and black raspberries, and many other fruits, were also to be found in his garden.

Each individual tree and bush received his careful attention, and he was never happier than when working among them. As his health failed, his interest in fruits seemed to increase. He was as eager to see and learn about a new variety as an astronomer to see a new star.

Flowers, both wild and cultivated, were his friends, and a small knot of them usually adorned his coat through the summer. Frequently when coming in from the field he would bring to the house some especially handsome specimen of clover or goldenrod, or the first wild rosebud of the season.

In 1860, Dr. Robinson married Miss Adriana M. Stacy of Foxcroft, who, with a son and a daughter, survives him.

For several years he suffered from a severe stomach trouble, which gradually reduced his strength, resulting in his death on January 24, 1902.

Dr. THOMAS HENRY HOSKINS.

Dr. Thomas Henry Hoskins was born in Gardiner, Me., May 14, 1828, and died in Newport, Vt., June 26, 1902, being a little more than seventy-four years old. He leaves a widow and one daughter, the wife of Rev. J. B. Spiers of Conticook, N. H.

Dr. Hoskins was widely known as a horticulturist and his writings were widely disseminated through such mediums as the Vermont Watchman, of which he was the agricultural editor for many years; the Rural New Yorker, the Maine Farmer, the New England Homestead, the New England Farmer, the Garden and Forest and others, he being one of the few in his day, who were paid for contributions of that nature. His father, Henry Box Hoskins, a paper manufacturer, was one of Gardiner's most highly respected citizens, repeatedly serving his city as treasurer, mayor and member of the legislature. Coming from a stock of sterling integrity and great mental ability on his father's side (his greatgrandfather was William Henry Hoskins, a merchant of Boston, and acting commissary in the Revolutionary War, whose remains now rest in the vaults of the historic Old South church of that city), his antecedents on his mother's side were no less worthy. She was Mary Green Jewett, and her father, Jesse Jewett, who owned a large farm in Windsor, Me., was for his day a scientific and progressive farmer, and was sheriff of his county to the day of his death at nearly 80 years of age.

It was on his grandfather's farm that Dr. Hoskins imbibed the love for the soil which he always retained. He early showed a fondness for newspaper work, owning, editing, and printing a little paper of his own at thirteen years of age. He received his academic education at the Gardiner lyceum. In 1849, at twenty-one years of age, he started for California in company with other young men of his city, but, not liking the manners of his companions, he left them and finally located in Louisville, Ky., where he remained nearly thirteen years. He engaged in the drug business, first as clerk, then as partner, and later studied medicine in the medical department of the University of Louisville, at the same time carrying on a market garden just outside the city.

Graduating at the head of a large class, he became assistant professor of anatomy, translated French and German works for the university, and practiced his profession until in 1861, just before the war, he removed to Boston. Here he remained several years, being surgeon to several institutions, one of the physicians of the Boston Dispensary for four years, also engaged as an editorial writer on the Boston Courier, and as a lecturer in Dio Lewis's school.

In the winter of 1865-66 he received a severe spinal injury by a fall on the icy pavement, which incapacitated him for the further practice of his profession, and for many months, for any work whatsoever. At the instigation of his friends, he went to Newport, Vt., to recuperate his health. He became enamored of the locality and decided to remain and experiment in hardy fruits for the cold regions. He began a nursery at West Derby, Vt., about 1868, experimenting very carefully with many varieties. It required not only money, but courage, patience and experience to solve, as he finally very largely did, the problem of tree fruits for northern New England and lower Canada. In the selection and introduction of ironclad Russian fruits, including apples, pears, plums and cherries, of various qualities and seasons, he was associated with Prof. J. L. Budd, professor of horticulture in Iowa university, and Charles Gibb of Montreal.

The latter made two trips to Russia in pursuit of new varieties, and shared his spoils with the doctor. He gave to the public the Yellow Transparent (Russian) and the Scott's Winter (native) varieties of apple, and in his seed business, which he conducted until 1899 as auxiliary to his nursery and market garden, he originated and propagated several varieties of vegetables.

In 1870 Dr. Hoskins started the Vermont Farmer at Newport, and after two years removed it to St. Johnsbury, where it was conducted for four years with himself as editor and Royal Cummings as publisher, reaching a circulation of 4,000. He then sold his interest to Mr. Cummings.

He was a popular member of the State Board of Agriculture, and for many years was in demand as a speaker at horticultural and agricultural meetings in Vermont, New Hampshire, Maine and Massachusetts. Always a public-spirited citizen wherever he resided, he was one of the founders of and first contributors to the Newport public library, and the first president of the library association. In politics he was a Jeffersonian Democrat; in religion, a believer in the doctrines of Swedenborg. Extremely versatile, he had poetic, artistic and histrionic talent, an extraordinary command of language and gift of expression, combined with a strong love of humanity. With all this he was possessed of great industry and a systematic and orderly disposition.

Few men have done more for the fruit grower and the fruit eater than Dr. Hoskins. He never forgot his native State, where he always found a most cordial welcome. He was present at the Norway meeting of our society held in the winter of 1890, and spoke upon the recent hardy fruits. He was in delicate health at that time, but we were all glad to meet him and to hear him speak. He is one of the immortals, for he lives in the valuable fruits and vegetables he introduced, some of which were almost his own creation. What better monument can be reared to a man's memory than these varieties of fruits and vegetables that will live on and on till time shall be no more?

Prof. E. S. GOFF.

Emett Stull Goff, professor of horticulture in the University of Wisconsin, died in Madison, Wis., June 6, 1902. He was born in 1852 on a farm near Elmira, N. Y. His early training was on the farm and in the common schools. In 1869 he graduated from the Elmira Academy; appointed horticulturist at the agricultural station, Geneva, N. Y., in 1882; appointed professor of horticulture in the University of Wisconsin and horticulturist of the Wisconsin Experiment Station in 1889, which position he held at the time of his death, with great credit to himself and the institution.

At the time of his appointment the department of horticulture was well nigh its beginning, consisting of a limited plantation of small fruit and office room in Agricultural Hall. There were less than a dozen students in the horticultural department at this time. During the past year over three hundred students received instruction from Professor Goff in a splendid building devoted to horticulture, with the added advantages of field work and observation in several acres of nursery and fruit plantations, containing thousands of specimens and hundreds of varieties. This growth in a large measure is due to the enthusiasm of Professor Goff and his popularity as an instructor in horticulture. "Principles of Plant Culture" and "Lessons in Pomology" were the outgrowth of his experience in the class-room, the study and the field. The preparation of these volumes came in the midst of his class and other duties, when there was need of rest and recreation especially for a man of so little reserve force as Professor Goff.

As an investigator in horticulture he won the highest ranks. His first important work was a study of the apple scab fungus, and in connection with Professor Gallaway he conducted the first successful series of experiments with fungicides for the control of this disease. He was a pioneer in spraying, and invented the kerosene attachment to spray pumps, the original model of which is now in the horticultural building.

His bulletins, sent out from the station, are among the most valuable agricultural literature issued by any of the numerous stations in the United States. His recent investigations in regard to the formation of flower buds have attracted world-wide attention. While ranking as a horticulturist, leading botanists recognized his ability and studied his experiments with care. He was a critical student, an accurate observer and a deep thinker, and all his great ability was given to the cause of horticulture that he loved so much. Maine fruit growers join with others in paying tribute to his memory.

APPLE BOXES.

The apple box has been under discussion in Maine for several years. Some years ago on the advice of buyers more or less fruit was sent abroad in boxes. There was an entire misapprehension on the part of the fruit growers, for they seem to have thought any fruit packed in a box would be jumped at by buyers at a fancy price. They were doomed to disappointment, but they learned that wrapping and packing did not make a number two apple a number one. Another thing that has been learned in more positive form is that the demand for boxed apples is only for the finest fruit for dessert, although the Ben Davis has sneaked in here, probably on account of its good looks. Like many other lessons in recent years, the west is teaching us how to pack fruit. In the winter of 1903 when apples in barrels found a very dull market and low prices, Spitzenburghs and Newtown Pippins from Oregon travelled across the continent, packed in bushel boxes, and sold at $3 to $6 a box. To show our people what this meant, a bushel box of Spitzenburghs were purchased in the New York market for $4 and sent to Cornish where a meeting was held. The sides of the box were one-fourth inch material and the ends three-fourths inch. Each apple was wrapped in white paper with thick blue paper between the layers and on the top and bottom. It was an excellent object lesson. This box for apples will be still further considered by the society.

Some correspondence grew out of this box of apples, in which Maine growers will be interested. Mr. H. W. Collingwood of the Rural New-Yorker wrote:

"So far as I have been able to learn most of the experiments in selling boxed fruits have been very successful. In some cases packers put a poor quality of fruit into the boxes and lost money by doing so. As a rule, however, when they use good judgment and pack only the best fruit I think they are well satisfied."

Mr. Wm. M. Higgins of the same paper, through whose co-operation the fruit mentioned, was obtained, wrote:

This is a typical box of Oregan Spitz. There were larger ones earlier in the season, and I have seen smaller ones that sold for nearly as much. I opened the box on the side and looked at a few, which appeared to be all right, but did not disturb many as I want your people to see them just as they were packed. The cost was $4. You will probably find the quality of these inferior to eastern grown fruit. I know that you can grow Spitz. larger and handsomer than many of these. The only reason that I can see for these high prices is the handy and attractive way in which they are put up. I am not yet ready to recommend the general use of boxes. Too many low grade eastern boxed apples have come here, so that dealers have become prejudiced and few will recommend the box. I have seen boxes made of old weatherbeaten timber, and wormy apples and culls mixed in. Such fruit will go better in barrels, as it falls flat by comparison with other boxed fruit. A man whom I worked for on the farm had a saying for people who jump at conclusions or sail in without investigation. It was "Go slow and study philosophy." That will apply to the boxed apple business. It is very well to experiment, but I would not advise anyone to sink much money in it until he sees how he is coming out, and what he has to compete with in the way of package packing and fruit. Your people can raise the apples and there is no reason why they should not have this high class trade, at least their share of it, if they feel their way along carefully. I have written this warning at some length to show that there are two sides to the matter and keep people from going astray. There are some western apples which we have not thus far been able to equal in appearance in the east. I have seen Newtown, Jonathan, Lawver and White Pearmians with most beautiful and delicate coloring. Such apples retail at almost any price, but there is no use in our bothering our heads about color shades in fruits that no one has been able to approach here in commercial quantities. A thing for us to consider is that we can raise apples as fine or finer than the rank and file of those that come from the Pacific coast, and that at least part of this trade belongs to us in the east.

I send by mail one quite large Spitz. I could not get a solid box of these and doubt whether the exhibit would have been worth the cost, probably $7 or more. These retail at fifteen cents each, or two for twenty-five cents. Of course the trade in them is limited. They being used largely for decorations. Earlier in the season I saw quite a good many of these overgrown western Spitz., some were considerably larger than this specimen.

Mr. John W. Clark of North Hadley, Mass., whom Maine people well remember for his excellent talks on orchard topics, wrote:

"Will say that I have never used the box for shipping apples, but think I shall try the box as I believe it is the coming package for choice fruit, although the commission men seem to discourage its use and want to hinder its general introduction. Still it is my opinion that they realize it has come to stay and will be used more and more."

SPECIAL CONDITIONS AFFECTING FRUIT OR FRUIT TREES.

Orrin McFadden, Cedar Grove, writes that scab has done much injury this year. Spraying does not seem to do any good. He sprayed three times for plum rot, black knot and scab on apples, which seem worse than ever before. Then he asks "What good is spraying?"

H. J. A. Simmons, Waldoboro, writes that several varieties are badly mildewed and spotted. The codling moth and railroad worm have very badly affected summer and fall varieties. A large portion of our orchards are fertilized by poultry."

C. S. Phiney, Standish, "Very few are giving their orchards any special attention. Where any cultivation is done fruit shows better quality and more of it."

Jennie E. Litchfield of Winthrop, "Trees are looking healthy. I think we should cultivate our orchards more, and keep the ground stirred lightly on the surface in order to raise good fruit."

V. P. DeCoster, Buckfield, says: "Fruit is good this year, and that orchards have received better culture this year."

A. C. Day, South Turner, "Orchards not receiving the attention they ought. The trypeta has done little damage this year. No caterpillars, and trees have made a fine growth."

W. P. Atherton, Hallowell, "Top dressing and mulching are the cultivation given our orchards. Scab and trypeta are worst enemies, and we cannot beat them. Ravages are extending rapidly. What can we do?"

H. L. Leland, East Sangerville, "Apples badly scabbed. Some improvement in culture," and adds "Better care, better cultivation or no profit.".

Another orchardist says, "There should be cultivation every season."

In Aroostook, John W. Dudley, Mapleton, writes: "Quality of fruit is poor, scabby and no color, except Dudley's Winter. Trees have grown fine. Orchards mostly seeded to grass. We have one of the best crops of Dudley's Winter we have ever raised, very large, smooth and well colored."

Will E. Leland, East Sangerville, "Quality of fruit poor. Scab. Orchards are receiving better care than for several years. Orchards in which a hoed crop has been grown for several seasons in succession are yielding a fair crop."

E. C. Hayford, Monmouth, "Some scab on the Fameuse. More plowing and dressing than ever before. I hear considerable talk of setting plum and peach trees next year."

R. Alden, Winthrop, "Quality of apples good. Ordinary culture. To make a success of orcharding trees should be cultivated or enriched by sheep or hogs and sprayed with the Bordeaux mixture."

A. S. Ricker, Turner, "Some apple scab and trypeta. Uses commercial fertilizers and hogs. No culture."

C. Fenderson, Wilton, "Trees have made a good growth this year. Orchards receive fair culture. More care will pay owners of orchards."

A. E. Andrews, Gardiner, "Some scab, but not bad in Bellflowers. Fertilize with mulching and dressing."

W. H. Phillips, "Some scabby, but good culture is given."

W. M. Munson, Orono, "Apple scab is unusually bad, also codling moth. As a rule no culture is given but some troubles are met in cultivated orchards. The present season was very wet and favorable to the growth of fungous diseases. All rubbish should be destroyed and trees thoroughly destroyed and trees sprayed next spring."

G. J. Wyman, South China, "Many orchards need pruning." Roscoe Vaughan, Wilton, "We have a great many wormy apples, both trypeta and codling. Mulching and top dressing are the most practical. One reason for much inferior fruit is the fact that the tree-tops are allowed to become thick and bushy."

B. C. Torsey, Readfield, "The fruit trees suffer from moths. No great culture is given orchards. In this vicinity only a very few orchards have any desirable yield. Some mulch, dress and care for, but many give but slight attention. Greater care is necessary."

A Cherryfield grower writes: "That orchards about him receive all kinds of culture. Fruit and apples are about half a crop, but apples are large, well colored, and free from worms or spots."

A. A. Eastman, Dexter, "Some orchards receive more or less culture, while others receive none."

E. A. Lapham, Pittston, "Some varieties are badly scabbed this year. Dress with barn manure, spread and mulch most every year. Fruit trees must have good care; must be sprayed to get good fruit. They ought to be sprayed two or three times. Some years once will do. This year I sprayed but once and it ought to have been two or three times."

Chas. S. Pope, Manchester, "Trees are looking better. Leaf rollers have done immense damage for three or four years. Many are plowing their orchards or preparing to do so. Orchardists do not consider that the season is late and are picking too early before the apples are grown or well colored."

N. Harding, New Sharon, "Part of fruit wormy. Orchards are not receiving the care they ought to have. I think orcharding the best part of farming and the crop should be more closely attended to."

Edward Tarr, Mapleton, "Some of the apples are scabby this year. Most orchards are in grass and receive top-dressing. Fruit growing is on the increase here. It is shipped by the carload yearly."

A Winthrop fruit grower, "The best fruit is where the trees are cultivated. One thing I am convinced of is that we must give more time to cultivating our orchards to insure better quality."

H. D. B. Ayer, Vassalboro, "Rust affects the trees some. Orchards are receiving fair culture."

C. W. Adams, East Wilton, "Leaf rollers have troubled some orchards. Apple scab is worse than usual this year. The orchards in most cases receive very little culture."

J. H. Barton, West Windsor, "Orchards are receiving little or no culture."

W. W. Rollins, East Dixfield, "Borers are working on the trees. No orchards are receiving attention. Less varieties would pay better."

Hallowell grower: "More or less fruit was damaged from freezing before it was gathered. Orchards are given no culture to speak of. Top dressing with ashes and manure and mulching. Good winter stock will be wanted abroad and in the west before spring, but those who expect or hold for extreme high prices will get left."

S. H. Dawes, Harrison, "More scab than usual. Orchards are not given much of any culture."

NOTICE TO TRANSPORTATION COMPANIES AND FRUIT GROWERS IN MAINE.

In recent years great damage has been wrought among the fruit growers of several states by the introduction of the San Jose Scale and other dangerous insects and contagious plant diseases. As a result of this devastation and injury to the trees, shrubs and vines producing fruit, a very large part of the fruit growing states have enacted laws to prevent the introduction of noxious insects and plant diseases so far as possible, as well as to destroy the same wherever they have been introduced. So far as known the State thus far has been exempt from the San Jose Scale and many other dangerous insects and plant diseases that in one way or another have found their way into orchards, nurseries and private grounds in other states, and it is the desire of all to keep them out of Maine and to get at them at once should they perchance make their appearance here.

This condition of fruit affairs led to the enactment of the present law, a copy of which forms a part of this notice. In extending this notice, the officers of the Maine State Pomological Society earnestly invite the co-operation of the officers and employees of all transportation companies and fruit growers generally in the State to join with them in aiding the commissioner of agriculture to impartially execute the law, and to that extent exclude and destroy these dangerous enemies to fruit culture in the State.

Special attention is called to section 3 of the law, which calls for notice wherever any of these insects or diseases make their appearance in the State in order that remedies may be at once applied for their destruction. This provision is of the utmost importance, and it is hoped it will be generally complied with by all.

All of which is most respectfully submitted to those whom it concerns.

D. H. KNOWLTON,

Secretary Maine State Pomological Society.

FARMINGTON, ME., March, 1903.

AN ACT to provide for the protection of trees and shrubs from injurious insects and disease.

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

Section 1. All nursery stock shipped into this state from any other state, country or province shall bear on each box or package a certificate that the contents of said box or package have been inspected by a duly authorized inspecting officer, and that said contents appear to be free from all dangerous insects or diseases. In case nursery stock is brought into the state without such a certificate the consignee shall return it to the consignor at the expense of the latter; provided, however, that any box or package bearing a certificate of fumigation, which shall be an affidavit made before a justice of the peace, that all stock sold by the consignor has been fumigated in a manner approved by the state nursery inspector of the state from which said nursery stock is shipped, the same may be accepted as though bearing a proper certificate of inspection.

Sect. 2. Any transportation company that shall bring into this state any nursery stock such as trees, shrubs, vines, cuttings or buds, and any transportation company, owner or owners of nursery stock, or persons selling nursery stock as thus defined, who shall transport such stock or cause it to be transported within the state, the same not having attached to each box or package an unexpired official certificate of inspection or an affidavit of fumigation, which shall meet the requirements specified in section one of this act, shall be guilty of a misdemeanor, and on conviction thereof be subject to a fine not exceeding one hundred dollars for each offense.

Sect. 3. Should any person in the State suspect the presence of San Jose Scale or other injurious insects or diseases preying upon trees, shrubs or vines in his possession or within his knowledge he shall forthwith notify the commissioner of agriculture to that effect; and it shall be the duty of said commissioner of agriculture to cause the said trees, shrubs or vines to be inspected by a competent entomologist, who shall forthwith make a report of the results of his inspection and file the same with the commissioner of agriculture at Augusta. If dangerous insects or injurious diseases are found by the entomologist the commissioner of agriculture shall publish the report of the same, and see that the best known treatment is applied to such trees, shrubs or vines for the destruction of the insects or diseases with which the same may be infested. And for the above purposes the commissioner of agriculture or his employes shall have authority to enter private or public grounds and treat any trees, shrubs or vines that may be infested with dangerous insects or injurious diseases.

Section 4. In case of violations of this act it shall be the duty of the commissioner of agriculture to enforce the penalties set down in section 2 of this act.

Sect 5. This act shall take effect when approved.

Approved March 18, 1903.

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