PUBLIC DOCUMENTS OF MAINE

1911

BEING THE

ANNUAL REPORTS

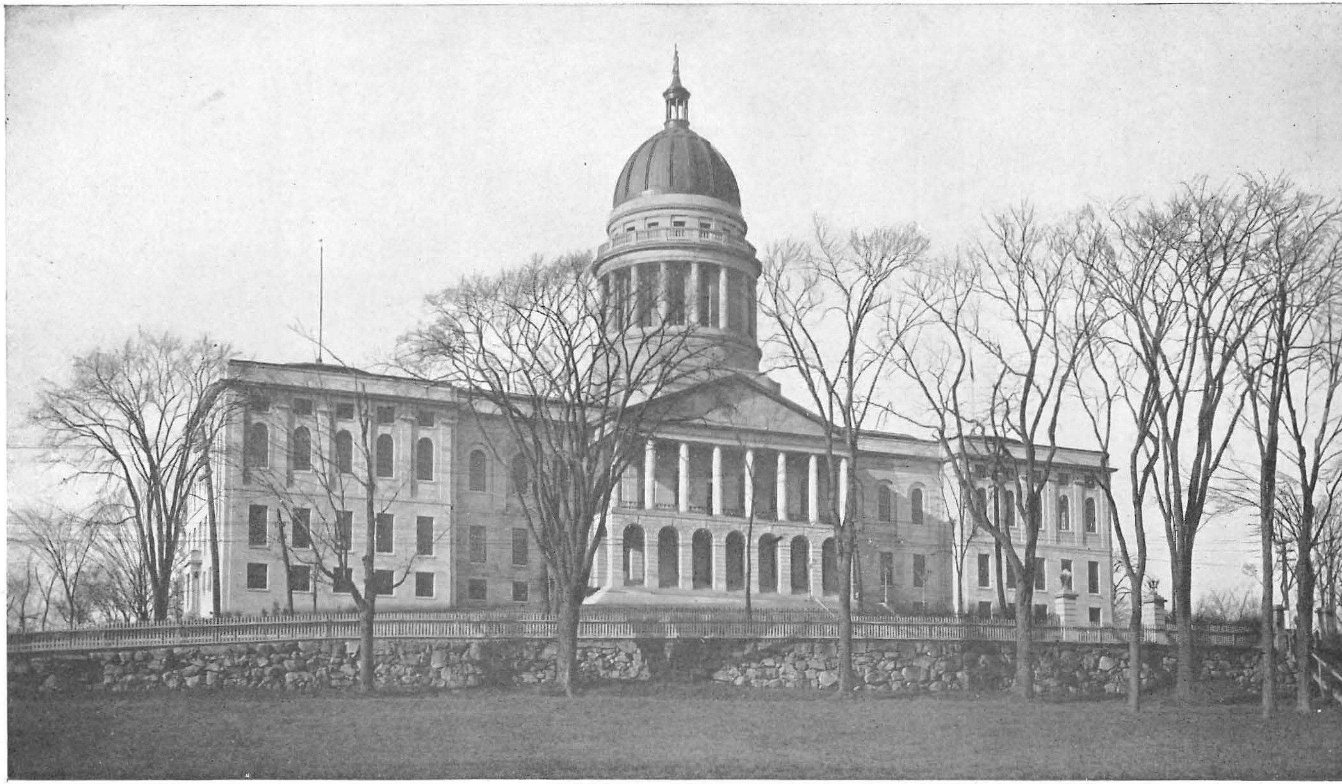
OF THE VARIOUS

DEPARTMENTS AND INSTITUTIONS

For the Year 1910.

VOLUME I.

AUGUSTA
KENNEBEC JOURNAL PRINT
1911



Enlarged and remodelled State House, Augusta, Maine.

AGRICULTURE OF MAINE

NINTH ANNUAL REPORT

OF THE

COMMISSIONER OF AGRICULTURE

OF THE

STATE OF MAINE

1910

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DEPARTMENT OF AGRICULTURE

To the Honorable Governor and Executive Council of Maine:

In compliance with Chapter 204 of the Public Laws of 1901, I hereby submit my ninth annual report as Commissioner of Agriculture of the State of Maine, for the year 1910.

A. W. GILMAN, *Commissioner.*

Augusta, December 31, 1910.

ANNUAL REPORT OF THE COMMISSIONER OF AGRICULTURE.

The year 1910 has brought a good degree of prosperity to the farmers of Maine. This is an indication of the general prosperity of the State, as "When the farmers prosper all other pursuits likewise prosper." The results of the steady progress and development in the science of agriculture, which have been greater during the last ten years than in the twenty years that preceded them, are seen in all the farming communities. The necessity of acquiring a knowledge of the principles which underlie their farm operations, and conducting their farming on a business basis, is well recognized by the majority of farmers. The idea of co-operation in their efforts is constantly gaining ground, and many co-operative associations have been organized during the past year. The principles of co-operation are as applicable to the farmer as to the members of any other pursuit or profession, and much benefit is sure to accrue from uniting their efforts.

With all the aid that the United States Government is giving to the agricultural population, directly and indirectly, and that received from the State, and the many organizations in the interest of agriculture, there is no reason why the farmers should not take courage and avail themselves more of their opportunities.

That there is an increasing interest in agriculture in this State is manifest from the numerous inquiries received by this Department from parties all over the country, for information in regard to procuring Maine farms, the best sections for different lines of farming, etc. It is evidently a widespread opinion that Maine is a good state in which to follow the pursuit of agriculture.

FARM CROPS.

The abundance of rain in the early part of the season assured to the farmers a bountiful hay crop. Owing to the severe drought of the two preceding seasons, it was thought that it would take several years for the grass fields to be restored to their natural vigor, so that they would produce as much as formerly, but the recovery from the drought was surprisingly rapid. Those fields of clover that seemed to be practically ruined were revived by the warm, wet season to an extent almost beyond belief. The farmers of the State have not received such a large hay crop for years. The lesson learned from previous short hay crops was heeded, and an unusually large acreage of forage crops for summer and winter feeding was planted, from which a good supply was harvested. Large crops of small grains were also raised; and the question now confronting the farmer is that of finding more stock to which these crops can be fed.

The acreage of potatoes was equal to that of last year, and the weather conditions in the great potato county of the State, Aroostook, were far superior to those of last season. An abundant crop of potatoes was raised and while in some sections of the State rot has been reported, as a whole the crop is in better condition than last year. Potatoes are bringing a fair price, and the indications are that they will be disposed of at a price above the average of the past few years.

A very much larger acreage of field corn was planted and the yield and quality are much in advance of former years. The acreage of sweet corn was also much larger than the average and as a whole the crop was better than any that we have raised for many years. The season has been favorable and this year's sweet corn has been a very profitable crop for the farmers. The price received at the factory for the corn produced on some of the best acres was more than $100, and very many acres brought from $85 to $90. There was also a great yield of fodder.

THE MAINE ORCHARDS.

The apple crop in some parts of the State was very light. There have been a few reports from the central and southern parts of the State of a fair crop of apples of good quality, but on the whole, throughout the State, not much more than fifty per cent of the usual crop was harvested. The small crop of this year, however, has not discouraged the orchardists. The Gregory gift and the prizes following this, and the special fruit institutes that were held in the fruit sections early in the year have aroused an interest and enthusiasm in the orchard industry such as we have never seen before, and farmers in all the fruit sections of the State are setting out new orchards and renovating their old ones. Nearly 200 acres have been entered for the Gregory prize, and many large orchards have been set in addition to these prize acre orchards. These orchards have been set with special care, and are looking well. Blanks have been sent by the Department to each contestant, asking for the name of the trees, the growth they have made, their general appearance, the kind of crop that was planted, the method of caring for it and the profit. There has been more interest manifested in this one farm industry this year than for several years, and much intelligent work has been done in caring for the fruit.

At the annual meeting of the State Pomological Society there was a great display of very fine fruit. The amount in boxes and barrels was exceptionally large, and the fruit came to the show in perfect condition. Great credit is due to the officers of the society for the attractive manner in which the display was arranged. This was the largest and finest exhibition of fruit ever held in the State. It is evident from this exhibition that some of the farmers of Maine are taking better care of their trees and know how to produce good fruit.

A report of the orchard work and other information in relation to our fruit interests will be found in the report of the State Entomologist, which is a part of this volume.

INSECT PESTS.

The nurseries are carefully inspected each year, and we believe that the suggestions offered by the State Entomologist and his assistant, in making these inspections, in the line of growing stock free from insects and diseases, have been of much assistance. Orchard inspection has been carried on as far as consistent with other work. Practically all of the orchards set for the Gregory prize have been inspected by a representative of the Department.

The work of exterminating the gypsy and brown-tail moths has been carried on in the same manner as during the previous year. Great credit is due to the gypsy moth force for their efficient work in checking the spread of this insect. While we have endeavored to do the best work possible with the funds at our disposal, the infestation of this pest is now a serious menace to our forest, fruit and shade trees, and a grave danger confronts us if means are not provided to actively prosecute the work.

Most of the cities and towns infested with the brown-tail moth have done good work in ridding their trees of this pest, and have manifested a desire to fully carry out the requirements of the law. In some of the southern and coast towns the repeated clipping of the trees to secure the nests is endangering the trees, and we would suggest that these towns supply themselves with sprayers and adopt the method of spraying to combat the pest. This has been done by some of the towns with good results. In the badly infested towns, it is our opinion that spraying at the proper time, soon after the caterpillars hatch from the eggs, with a proper sprayer, will be the most satisfactory way of exterminating this insect.

THE DAIRY WORK.

The results accomplished by the Dairy Division of the Department are very encouraging. The dairymen are very much in earnest in relation to improving the dairy breeds. The members of the several breeders' associations have manifested much interest in the work. A State Live Stock Breeders' Association has been organized, embracing breeders of stock from every section of the State. At the meeting of this association in Waterville in November a very interesting and instructive program was presented.

The members of the cow test associations have increased their interest in these associations. Monthly meetings have been held during the year, which have generally been attended by a representative of the Department. At these meetings questions in relation to the feeding and care of the cows and other matters which have offered difficulty to members of the association have been discussed. A detailed account of the work is given by the State Dairy Instructor, in his report, which follows.

The investigation of dairy products, under the Act of the Legislature of 1909, has been vigorously prosecuted during the year. Samples of milk have been taken in all sections of the State, and the Department has issued quarterly bulletins giving the results of the analyses of these samples. The publicity that is given to the work of the milk dealers in this way is doing and has done much towards advancing the standard of our market milk. The report of the agent in charge of this work, which is included in this volume, will be of much interest.

THE POULTRY INDUSTRY.

Interest in the poultry industry is steadily increasing. This is one of the industries that never fails because of hard times or low prices. Poultry has long been a side issue on the majority of farms, but it is now becoming in many instances one of the leading farm industries.

The value of co-operation in this industry has been urged by the Department and a circular on Co-operative Poultry Producers' Associations for Maine was issued in August. The September number of the Quarterly Bulletin was devoted to a branch of the industry which has not received the attention it should command—the marketing of poultry products—and the large number of requests for this bulletin indicate that the farmers all over the State appreciate the information it contains.

FARMERS' INSTITUTES.

A good interest has been shown in the farmers' institutes this season. Excellent speakers have been secured, and the interested, enthusiastic audiences show that the farmers are realizing more and more the value of these meetings.

The farmers' institute is one of the official agents for rural betterment. It is an avenue for the distribution of the scientific truth and knowledge of agriculture which are constantly being discovered. Some one has said that if the knowledge of agricultural operations now in the possession of mankind were distributed and intelligently applied by the farmers of the United States, the average of agricultural production in all crops would at once be doubled, with a steady and continued increase in the productive power of the soil.

The perpetuation of the farmers' institute system throughout the United States is a proof that it fills a want in the agricultural community and has a mission to perform. In order to be productive of the most good, these institutes should have the co-operation and hearty support of the local communities in which they are held. It is our purpose to carefully study the needs of the various localities and as far as possible bring to them speakers who will give instruction in the lines in which it is most needed.

Regular institutes have been held during the year as follows: Jan. 1, Walnut Hill, and New Gloucester; Jan. 3, Monmouth; Jan. 4, Readfield; February 9 and 10, Guilford; April 4 and 5, Portland; March 29, Ellsworth; Oct. 31, Lubec; Nov. 1, Machias; Nov. 2, Columbia Falls; Nov. 3, North Ellsworth; Nov. 4, North Penobscot; Nov. 5, East Dover; Nov. 7, Island Falls; Nov. 8, Blaine; Nov. 9, Mapleton; Nov. 10, Lincoln Center; Nov. 11, Stetson; Nov. 12, Dixmont Center; Nov. 14, Solon; Nov. 15, North New Portland; Nov. 16, New Vineyard; Nov. 17, Strong; Nov. 18, Phillips; Nov. 19, China; Nov. 21, Riverside; Nov. 22, Poland; Nov. 23, Turner Center; Nov. 25, Bryants Pond; Nov. 26, Norway; Nov. 28, Canton; Nov. 29, Parsonsfield; Nov. 30, Saco; Dec. 1, Harrison; Dec. 2, White Rock.

Special dairy institutes in connection with the Maine Dairymen's Association have also been held as follows: Oct. 24, Cornish; Oct. 25, South Waterford; Oct. 26, West Minot; Oct. 27, Bowdoin; Oct. 28, Hartland; Oct. 29, East Sangerville; Oct. 31, Brewer; Nov. 1, New Sweden; Nov. 2, Houlton; Nov. 3, Machias; Nov. 4, Monroe; Nov. 17, North Castine; Nov. 18, South Warren; Nov. 19, Portland; Nov. 21, Damariscotta; Nov. 23, Farmington.

In addition to the above, speakers have been furnished by the Department for several of the Pomona and subordinate granges when they have desired to have agricultural questions discussed.

The speakers from out of the State who have been upon the institute force are as follows: Lowell Roudebush, New Richmond, Ohio; Edward Van Alstyne, Kinderhook, N. Y.; Forest Henry, Dover, Minn.; Prof. J. W. Sanborn, Gilmanton, N. H.; S. C. Thompson, Dairy Division, U. S. Department of Agriculture, Washington, D. C.; and H. O. Daniels, Middletown, Conn.

AGRICULTURAL SOCIETIES.

The fairs of the State have had a favorable year. The weather was fine in most instances and the attendance above the average. The exhibit of dairy products at the state fairs was a credit to the various associations. There was a marked increase in the amount of milk, cream, butter and cheese exhibited, and these products were of superior quality. The exhibition of fruit was also far in advance of that of previous years. The care that was taken in selecting only the best—as the fruit shown scored much higher than in former years—shows that the apple growers of the State are much interested in these exhibitions. The vegetables and grains exhibited at some of the fairs were a great credit to the State. In fact, all the products of the farm and garden were far superior to those exhibited in former years. In the stock department, improvement was also noted. More full-blooded, registered stock was exhibited this year than usual.

We believe that the fair managers are generally trying to make their exhibitions more educational, as well as attractive. Fair days are holidays to the majority and they must have amusement, but let it be along educational lines. The officers of the fairs are reminded by this Department every year of the statute that governs the societies, in order for them to receive any of the state aid, and generally they are diligent in seeing that this statute is enforced. It is only occasionally that a violation occurs.

SEED IMPROVEMENT.

Realizing the importance of some systematic plan for improving the farm crops of Maine, the Legislature of 1909 made a small appropriation for work in this line, under the supervision of the Department of Agriculture. As a result the Maine Seed Improvement Association was organized on January 25th, 1910, at a meeting attended by a large number of enthusiastic farmers coming from nearly every section of the State. The work thus started is one of the most important lines of work that the State has ever undertaken to develop agriculture. The interest in it has been and is steadily increasing. At the present time this association has a membership of nearly 200 active, earnest, practical farmers.

The results accomplished in other agricultural states in the line of seed improvement have been very marked. Five-year tests with corn made by about 600 members of the Wisconsin Agricultural Experiment Association showed an average yield of 59.1 bushels per acre, while the average yield of the State was 36.5. Experiments in Indiana have shown that carefully selected seed corn of a type suited to the soil and climatic conditions where it is to be used will produce a much larger yield per acre than that which is commonly used, without selection.

Also, the farmers' co-operative demonstration work in the South gives a good illustration of the value of seed improvement work. In North Carolina last year the average yield of corn on the demonstration farms was 40 bushels, while the general average for the State was 16.8 bushels. The work in seed selection cannot be credited with all this gain, but it certainly played an important part.

We trust that the coming Legislature will see to it that this work is continued.

AGRICULTURAL STATISTICS.

The work of gathering agricultural statistics has been completed and the results have been published. This publication takes up the resources, agricultural production, etc., of the State by counties and cannot fail to be of great assistance in making known the advantages and agricultural possibilities of our State, and in guiding the many home seekers who are turning their attention to the East.

PUBLICATIONS.

The Quarterly Bulletins issued during the past year have been upon the following subjects: Better Fruit for Maine; The Home Garden; The Poultry Industry; The Silo and Stock Foods. Requests for these and for the annual report of the Department have been more numerous than ever before. Circulars and leaflets have been issued from time to time.

A Bulletin on Investigation of Dairy Products has been issued quarterly by the Dairy Division. In addition to the analyses of samples of milk, cream and butter taken during the quarter, and the results of prosecutions for violations of the law, these bulletins have contained practical suggestions upon the Care of Dairy Utensils, the Production of Market Milk, the Care of Milk in the Household, Better Sanitary Conditions of Stables, etc.

We wish to acknowledge the assistance rendered this Department by the University of Maine, the Agricultural Experiment Station and all the organizations in the State for the promotion of agriculture. Great harmony and co-operation have prevailed. Maine agriculture is steadily advancing. A continued, united effort on the part of all who have its interests at heart will place and keep our State in the foremost ranks among the agricultural states, where it rightfully belongs.

REPORT OF THE DAIRY DIVISION.

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

Having resigned from the position of State Dairy Instructor, I herewith present my report to and including September 30th, 1910, the date when my official relations with the Department of Agriculture closed.

The report will not include as heretofore, those made by others members of the Dairy Division, as it appears desirable for such reports to cover the entire year rather than to have two reports, each covering a section of the year.

Since my last report a considerable amount of constructive work has been accomplished along certain lines and as usual this will be discussed under its respective heads.

DAIRY TESTING ASSOCIATIONS.

The Dairy Testing, or as it is frequently called the Cow Testing, Association has already proven itself to be the most important factor in the making of dairy progress in our State within recent years.

The circle of its influence has not been confined to the membership alone, but it has spread until in some respects the whole State has received benefit from it. Let us examine briefly as to what extent these benefits have accrued to the membership and their relation to dairy progress in general.

The writer of this report will hereafter use the words Dairy Testing wherever applied to this particular form of organization, first, because it more nearly describes the actual work of the association, and second, because it avoids confusing the purpose of the association with that of testing cows for tuberculosis, for strange as it may appear, regardless of all that has been written in the newspapers of the State or spoken in public meetings, many people still understand that a Cow Test Association is an organization effected for the purpose of testing the cows owned by the membership for tuberculosis.

Dairy testing work is a plan for applying some of the simplest forms of bookkeeping to the business of dairying. It is primarily a system of dairy accounting. True it is that the plan is not carried far enough to include the whole business of dairying such as—

1. Inventory of stock and outfit.
2. Expenditures (investment, interest on investment, repairs, depreciation in value, mortality assessment, labor, etc.)
3. Receipts, sale of stock, calves, by-products of the dairy, etc.

I admit that a system of accounting complete in all its details is desirable and I have confidence that eventually the business of farming will be placed on a level that will recognize the need of such a system of accounting.

Perhaps some, if not all, the benefits which the member derives from dairy testing work may be summarized as follows.

BENEFITS TO MEMBER.

He learns:

1. That all cows are not equally productive or profitable and that some cows, too many in fact, are actually loss makers.
2. That sometimes the most productive cow is not the most profitable.
3. The actual daily, monthly, and yearly food cost to produce a pound of milk fat, or a quart of milk by each cow.
4. The actual profit or loss per cow over cost of food consumed for any period of time, or in other words, the dairy value of each cow.
5. The relative feeding values of different roughages and grains.
6. The value of an accounting system in conducting his dairy business.
7. The difference between guessing and knowing.
8. That he can effect a saving through co-operation with other members of the association in the purchasing of feed stuffs, grass seeds, and fertilizers, sufficient to pay more than his part of all the running expenses of the association.

The association work has awakened an interest in dairying in Maine as perhaps no other single move has ever done. It has forced home to the mind of the dairyman the importance of transferring the unit of measure from the herd to the individual animal and has thus made possible real and lasting improvement.

The application of bookkeeping to dairy work has at once elevated it in the minds of dairymen to a business of itself.

It has re-established cow values and also the value of the offspring. Today there is not a single member of a Dairy Testing Association who cannot sell a good cow from his herd at a far better price because of the record of her dairy value that goes with her. Farmers are willingly paying a premium for such cows. It has caused many farmers to begin to study, to weigh the milk daily from each cow, to weed out the poor, to breed from the best, to rear the heifer calves instead of selling them for veal. In fact, it has actually caused an uplift to the dairy business throughout the entire state. Primarily it has been the cause of the organization of local breeders' associations, and through them the organization of a State Breeders' Association.

During the past year two associations have been organized by Assistant Dairy Instructor Redman. The principal hindrance encountered in the organization of Dairy Testing Associations in Maine is the difficulty in securing as official testers young men who have had an Agricultural College training, for this is the prime requisite insisted upon by the members of our associations and speaks volumes concerning the attitude of our farmers toward the Agricultural College. It is exceedingly unfortunate that the supply of young men available for service as official testers is not greater.

CO-OPERATIVE BREEDERS' ASSOCIATIONS.

While I cannot report any extension of organization work among dairy cattle breeders' associations, it is with considerable satisfaction that I can report the organization of a state association of breeders under the name of Maine Live Stock Breeders' Association, with Hon. C. L. Jones of Corinna as its president and Mr. R. W. Redman, Assistant Dairy Instructor, as its secretary. Among the membership and officers of the association are to be found a large number of the most important breeders in the State. The association is well officered and is already exerting an influence upon our live stock interests.

While distinctly outside the Dairy Instructor's ordinary work, it was with great pleasure that I was able to assist in the organization of Maine's first local sheep breeders' association, which was effected at Madison under the name of Somerset and Franklin Sheep Breeders' Association. This association, while centered in Somerset and Franklin counties, accepts to membership men interested in the sheep industry in any part of the State.

A more detailed report of the Dairy Testing Associations and Breeders' Associations will be made by Mr. R. W. Redman, Assistant Dairy Instructor, who has had entire direction of the co-operative associations since he became identified with the Department. Mr. Redman has demonstrated marked ability in the handling of co-operative work. The Department was fortunate in securing his services.

INVESTIGATION OF DAIRY PRODUCTS.

The milk inspection work of the Department has been carried on more aggressively than during the preceding year. In 1909 the appropriation was not available until six months of the year had elapsed, and much time was needed to organize the work, so that the present year found the Department in a better position to actively engage in the enforcement of the dairy laws. Again, during the early part of the year the work was somewhat interfered with by the resignation of Mr. P. F. Skofield, agent in charge of investigation of dairy products. The Department was able, however, to secure at once the services of Mr. C. W. Barber, of Yarmouth, to fill the vacancy. Since then entire supervision of dairy inspection and enforcement of dairy laws have been in his charge. As Mr. Barber will later make a complete report of the work under his charge, the Dairy Instructor will content himself with saying that Mr. Barber's work has been at all times efficiently and satisfactorily performed.

STATISTICS AND SEED IMPROVEMENT WORK.

In accordance with the law directing the Commissioner to undertake the above work and complying with your instructions, Mr. A. S. Cook, of Presque Isle, was engaged to have immediate direction of the plans of the Department. Mr. Cook's services with the Department began in January and during the first few months he was occupied almost entirely in completing the gathering of statistics and preparation is now being made to publish the first report of this nature ever issued by the Department.

In making plans for improving the crops of the State it was thought best to co-operate with the Maine Seed Improvement Association, an association organized at Waterville, January 25th, 1910, for the purpose of improving the crops of the State through the selection, breeding, and distribution of superior strains of seed, but as to how long this co-operative arrangement should continue will of course depend entirely upon the results accomplished. The plan of co-operation arranged for included the furnishing of seed corn to such members of the association as desired it, for the purpose of carrying on co-operative tests. During the summer months the members were visited by Mr. Cook for the purpose of investigating methods and results, as well as to give advice wherever necessary and desirable.

Detailed reports of each visitation were made and are now on file in this office. In my opinion the work undertaken by the Maine Seed Improvement Association is of the greatest importance and should continue to receive as it has thus far, the closest co-operation from the Department of Agriculture, the Agricultural College, and Experiment Station; in fact, the work must receive the co-operative assistance and direction of men trained in the science of plant breeding if it is ever to be wholly successful, and herein lies the part the Agricultural College and Experiment Station must play in the successful prosecution of this great work.

The annual meeting of the association will be held in Augusta December 9 and 10 of the present year. At that time a competitive exhibit of corn, small grains, beans, and potatoes will be held and addresses on important plant breeding problems will be delivered. As plans for future work will at that time be made, this will constitute one of the most important agricultural meetings of the year. The details of the seed improvement field work will be discussed more fully in the report of Mr. Cook, agent in charge. In closing my report upon this particular section of departmental work coming under my official supervision, I desire to express my appreciation of the extremely valuable services rendered by Mr. Cook to the Department and to the farmers of the State during the short time that has elapsed since his official relations with the Department began.

MEETINGS.

Following the plan adopted for several years past the Dairy Division force have responded to as many calls for lectures upon agricultural subjects as possible. The ever increasing demand for lectures and demonstrations is the justification for continuing this line of work. In my report only such meetings as were attended by the Dairy Instructor personally or where speakers were furnished from outside the Dairy Division force will be tabulated. Those attended by the other representatives of the Division will be reported upon by them individually.

Meetings Tabulated.

Number.		Attendance.
13	Grange—Subordinates	1,193
6	Grange—Pomona	1,158
4	Grange—Field	1,550
8	Breeders'	469
11	Dairy Testing	528
3	Dairy Institutes	168
3	Regular Institutes	151
12	Miscellaneous	1,380
29	Miscellaneous meetings attended by speakers furnished by the Division	1,310
89		7,907

Thus it will be seen that eighty-nine meetings were held with a total attendance of seven thousand nine hundred and seven people.

GENERAL.

All lines of Dairy Division work have progressed during the past year with an exceptionally small amount of friction. Everywhere and by everybody have we been received with the greatest courtesy. The spirit of co-operation appears to be gaining ground and this is perhaps nowhere more marked than between the agricultural institutions and workers of the State. The Dairy Instructor desires to acknowledge the valuable assistance rendered the Dairy Division by the College of Agriculture. Without their co-operation the work would have suffered in many instances.

The press of the State, and especially the agricultural press, have treated the Dairy Division with unfailing courtesy. During the nearly four years of my official connection with the Department of Agriculture, I cannot recall a single instance where any newspaper of the State has indulged in any criticism of the dairy work of the Department. The Dairy Instructor is not egotistical enough to regard this as an indication that the dairy work has been above criticism, but rather as an emphatic indication of the desire of the press to generously overlook the mistakes which attend so much of life's work, and to vigorously support such measures and plans as appear important in the development of Maine agriculture. I am indeed grateful for the consideration and support the dairy work has received at their hands.

During the year the Dairy Instructor was twice honored by requests from without the State to deliver addresses upon important dairy matters. After consultation with you these invitations were accepted and I was given the privilege of attending the general round-up institute held in Providence, R. I., and speaking on "The Value of Dairy Inspection to the Farmer," and also to attend the Farmers' Week course of the Massachusetts Agricultural College. At this meeting I was requested to discuss "The Benefits of the Dairy Testing Association Work to Farmers," also "The Organization and Work of the Co-operative Breeders' Associations." The assignment of these three subjects is an indication of the estimate placed upon the dairy work in Maine by other New England states.

So far as future work for the Dairy Division is concerned I feel that as I am now leaving the services of the Department, it would not be wise for me to make recommendations. This is especially true because of the fact that those who remain in the Dairy Division of the Department are thoroughly conversant with all its plans and work, and it affords me pleasure at this time to assure my successor of my sincere wish for the successful prosecution of the dairy work, and of my willingness and desire to give whatever assistance it may be in my power to render to bring about that result.

As I am about to bring my report to its close and realize that it is my final report, I desire to express to you personally my sincere thanks for the consideration you have always shown me and for the many evidences of friendship and confidence you have constantly bestowed. My relations with all persons connected with the Department, both in field and office service, have been very pleasant and I shall always regard the nearly four years of official service with the Maine Department of Agriculture as among the best years of my life.

Respectfully submitted,

LEON S. MERRILL,

State Dairy Instructor.

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

I herewith submit my report for the year 1910, covering the work up to December 1st.

The first nine months, as Assistant Dairy Instructor, I had charge of the Dairy Testing and Co-operative Breeders' Associations; since then, as Dairy Instructor, I have had an oversight of the work of the Dairy Division. This work has been carried on on the same plans as outlined by former Dairy Instructor, Leon S. Merrill. The dairy work of the State has apparently met with the approval of the farmers, for this Department has received more calls to assist in the work than could be attended to.

DAIRY TESTING ASSOCIATIONS.

During the past year, only two testing associations have been organized, due to the lack of competent men for testers. In the summer months several men were available, but, as no association was ready for work at that time, they accepted other positions.

On May 2, 1910, the Somerset County Dairy Testing Association was organized at Harmony, with the following officers:

President, G. D. Magoon, Harmony.

Vice President, J. B. LaBree, Cambridge.

Vice President, C. S. Bean, Wellington.

Secretary and Treasurer, Alton L. Chadbourne, Harmony.

Directors: W. S. Bemis, Harmony; C. Sumner Ham, Cambridge; Uriah Whitehouse, Wellington.

Official Tester, H. D. Witherill of Cornish, N. H.

The members of this association live principally in the towns of Harmony, Cambridge and Wellington. Although they started with less than 300 cows, the work seems to be progressing very well.

Regular monthly meetings are held on Friday before the first Saturday.

On May 28th, the Waterville Dairy Improvement Association was organized at Waterville, with the following officers:

President, W. C. Stetson, Waterville, R. F. D. 47.

Vice President, R. O. Jones, Winslow.

Secretary, Samuel Daggett, Waterville, R. F. D. 36.

Directors: J. H. Reed, Waterville, R. F. D. 40; W. H. Nichols, North Vassalboro, R. F. D. 49; G. F. Terry, Waterville.

Official Tester, Paul R. Baird of Waitsfield, Vt.

Regular monthly meetings are held the fourth Saturday. This association also started with less than the desired number of cows, but Secretary Daggett writes, on November 5th, "We now have 230 or more cows pledged and are steadily growing."

The Kennebec Valley Dairy Testing Association has been temporarily suspended during the summer months on account of the lack of a suitable man for tester; however, the officers of the association expect to begin work again in December.

Officers of the other associations are as follows:

Waterford and Norway Dairy Testing Association:

President, L. E. McIntire, Waterford.

Secretary, W. K. Hamlin, South Waterford.

Official Tester, Harold S. Noble, South Waterford.

Oxford County Dairy Testing Association:

President, F. E. Adkins, Livermore Falls, R. F. D. 2.

Secretary, A. H. Adams, Canton Point.

Official Tester, E. A. Markham of Norridgewock.

West Penobscot Dairy Testing Association:

President, John Katen, Dexter, R. F. D.

Secretary, Geo. H. Knowles, Dexter, R. F. D.

Official Tester, Paul J. Fuller, Dexter.

Hebron, Minot and Mechanic Falls Dairy Testing Association:

President, Chas. R. Millett, West Minot.

Secretary, E. K. Holbrook, Mechanic Falls, R. F. D.

Official Tester, G. E. MacGown, West Minot.

Official Tester, Walter S. Whitney, West Minot.

It is the plan of each of these associations to hold monthly meetings on a regular day. At these meetings, the work of the association is discussed, herd records are talked over and a lecture by a representative of the Department is usually given. The discussions at these meetings are particularly vigorous and valuable. The association records furnish the members with an invaluable local dairy text book. One association—the Oxford County Association—has organized a class, using Lane's book "The Business of Dairying" as a text book, and lessons are reported on at each meeting. The majority of the members also answer the correspondence questions furnished by the Extension Department, University of Maine. The work of these associations in the local community can hardly be estimated. One prominent member says of the Minot Association after seven months' work, "The association has already raised the standard of dairying in this community." When attending meetings of associations that have been running more than a year, one frequently hears the voluntary statement from the members, "My cows are paying me more money than they did last year."

All of the associations have adopted some method of purchasing their feeds co-operatively and are thus saving considerably on them. Some of the associations have not only purchased feeds but grass seed, making a considerable saving, and by buying seeds from submitted samples which are tested for germination, they have been able to get an extra good quality at a reduced price. To fully understand the value of the work to the State, one needs to visit the associations and hear the members talk for themselves. A report of some of the associations follows. The other reports will be forwarded to this Department the first of January.

Canton Point, Me., Nov. 5, 1910.

R. W. Redman, State Dairy Instructor,
Augusta, Maine.

The Oxford County Dairy Testing Association has, all things considered, had a fairly successful year. The changing of official testers has not worked to our advantage. Most of the members are interested in the work, attend the meetings and take an active part in them. Many have Lane's book "The Business of Dairying." A class has been formed to study the work and discuss a certain portion of it at each meeting.

In the past we have done considerable in the way of co-operative buying of grain and there is talk of something of the kind for this winter. While we have not gone over the records sufficiently to be certain, we are hoping they will show a gain in average profit per cow.

A. H. ADAMS, Secretary.

Dexter, Me., Nov. 11, 1910.

Mr. R. W. Redman, Dairy Instructor, Augusta, Maine.

Dear Sir:—In regard to the Association, the work the past year has been in charge of P. J. Fuller, official tester, who has given satisfaction. The Association is not as large as some, but the work has been very satisfactory. We have at the present time about 250 cows with good prospects of enough to make 300 soon. The reason that we have not more cows is that the Association is composed of small herds.

A meeting has been held each month and these have proved of much interest.

The members have been co-operating in buying their feed, and have thus rar bought four carloads, making a good saving. They are planning on buying more the coming year. A set of veterinary tools has also been bought for the use of the tester which will be a great help in case of trouble in the herds.

GEORGE H. KNOWLES, Secretary.
West Penobscot Dairy Testing Association.

Mechanic Falls, Nov. 10, 1910.

Mr. R. W. Redman, Dairy Inspector, Augusta, Maine.

Dear Sir:—The Minot Dairy Testing Association has progressed finely during the past year. It having been the first year of existence, we have not endeavored to take up any particular line of work other than the weighing of the feed and milk and testing for the butter fat. We have accomplished much in the saving of feed, one of the members in particular having sold 20 tons of hay, whereas he had never before been able to sell any. Much has been the saving of the grain ration with no appreciable decrease in the production. One member estimates that he will receive a net income of $2,000, from his herd during the year. We have enthusiastic meetings which bring out many new and helpful ideas. We still have over six hundred cows and employ two testers. We have lists in the hands of the testers soliciting members for another year. We hope to be able to take up the work of co-operative buying of grain, grass seed and fertilizers the coming season.

ERNEST K. HOLBROOK, Secretary.

Harmony, Maine, Nov. 8, 1910.

R. W. Redman, State Dairy Instructor, Augusta, Maine.

My dear Sir:—Below you will find a brief report of the Somerset County Dairy Testing Association:

At present we have thirty-four members, owning 234 cows, the maximum price per cow per year being $1.50. We have had six meetings, with an average attendance of twenty-five. At each of these meetings, except one, there has been a representative sent by the Department or some one from the University of Maine.

We have tried to purchase our feeding stuffs co-operatively and have been able to secure some discount but expect to save more in the near future. I think the Department is trying to help the farmers all it can.

The officers of the Association are: G. D. Magoon, Harmony, president; J. B. LaBree, Cambridge, vice-president; C. S. Bean, Wellington, vice-president; Alton L. Chadbourne, Harmony, secretary and treasurer; H. D. Witherill, Harmony, official tester.

Yours very truly,

A. L. CHADBOURNE.

Waterville, Maine, Nov. 5, 1910.

R. W. Redman, State Dairy Instructor, Augusta, Maine.

Dear Sir:—The Waterville Dairy Improvement Association is getting well under way. We started in very slowly. We got 155 cows pledged and it seemed to stop right there for several weeks. At last we decided to secure a tester; we did so in the the person of Paul R. Baird, who is proving himself to be a good worker. We now have 230 or more cows pledged and we are steadily growing.

We are buying our grains as an Association, at reduced rates. We have some very interesting discussions at the meetings. The members are getting interested and I think it is a move in the right direction and is coming to be appreciated by those who are interested in dairying.

Very truly,

SAMUEL DAGGETT, Secretary.

Waterville Dairy Improvement Association.

CO-OPERATIVE BREEDERS' ASSOCIATIONS.

The members of the various local dairy cattle breeders' associations, realizing the advantages to be gained from a state-wide organization, met at Orono during Farmers' Week, in March, at the invitation of Prof. P. A. Campbell of the University of Maine, and there discussed the plans for a State Live Stock Breeders' Association. It was voted to hold a meeting for the purpose of considering the organization of a live stock association on April 14, 1910, at the City Council Chambers, Waterville. At this meeting it was decided that it would be to the advantage of live stock interests to organize the Maine Live Stock Breeders' Association which should take in men who were breeding all kinds of live stock. This association was organized, with 77 charter members, and the various committees since appointed have been doing active work to promote live stock interests.

On November 15th and 16th, the first annual meeting was held at Waterville, with a program of much interest. Officers were elected as follows:

President, L. E. McIntire, East Waterford.

Secretary, R. W. Redman, Augusta.

Treasurer, A. H. Ellis, Fairfield.

Executive Committee: L. E. McIntire, East Waterford; R. W. Redman, Augusta; A. H. Ellis, Fairfield; Prof. P. A. Campbell, Orono; Dr. B. A. Bailey, Wiscasset; Dr. H. M. Moulton, Cumberland Center; Fred Hilton, Anson.

A vice president was also appointed for each county in the State.

There is a prospect of the immediate organization of one Dairy Cattle Breeders' Association, while others are under consideration. The officers of the five local Cattle Breeders' Associations are as follows:

Sebasticook Valley Holstein Breeders' Association:

President, C. L. Jones, Corinna.

Secretary, G. G. Grinnell, Exeter.

Oxford County Holstein Breeders' Association:

President, Benj. Tucker, Norway.

Secretary, Clayton S. McIntire, East Waterford.

Androscoggin Valley Jersey Breeders' Association:

President, A. J. Foster, Canton Point.
Secretary, A. H. Adams, Canton Point.

Oxford and Cumberland Jersey Breeders' Association:
President, H. W. Evans, North Bridgton.
Secretary, C. S. Hamlin, Harrison, R. F. D.

Androscoggin County Holstein-Friesian Breeders' Association:
President, P. M. Austin, Danville Junction.
Secretary, Geo. B. Carvelle, Lewiston.

These associations plan to hold quarterly meetings, at which time live stock problems are discussed. When the weather will allow, animals are scored, the work being led usually by Prof. Campbell or myself.

One of the local breeders' associations has already taken steps to secure extra good animals for use in the association. I believe there are many sections of the State where a Community Bull Association, organized on a plan similar to the one used in Michigan, could be adopted to the great advantage of live stock work. During my vacation, I personally visited several of these associations in Michigan, and I am satisfied that a similar plan could be adapted to Maine conditions. In these bull associations, men owning 120 to 180 cows organize, select a breed of sires to be used, divide themselves into three blocks and purchase the best animals which they can buy for the money raised by subscription among themselves. Each animal thus has a group of 40 to 60 cows to serve during the year; he is used in this block two years, and then changed to another block, thus the purchasing of three animals gives six years' service. I think there are a number of communities where the adoption of such a plan would be the most practicable method for rapidly improving dairy stock.

The work in both the testing and breeders' associations means a great deal to the dairy industry of the State. The people are taking hold of the plans rapidly and there is more call for associations than can be filled, especially with the present shortage of desirable men for testers, two of the men in the work at the present time coming from out of the State.

I have planned to attend each meeting of these associations myself, but occasionally some other representative has been sent. I think it desirable for each tester to be visited in the field at least once during the month so that he may be kept well informed of the progress made in the other associations and also that he may be assisted in the many difficulties which are continually arising in the work. Reports from the officers of some of these associations will be found following this; reports from the other associations will be forwarded to the Department the first of January.

Corinna, Maine, Nov. 6, 1910.

R. W. Redman, State Dairy Instructor, Augusta, Maine.

My dear Sir:—I wish to say that the Sebasticook Valley Holstein Breeders' Association has, in my opinion, done very much to create a favorable sentiment toward this breed of cattle. Since its organization we have held quarterly meetings, usually at the home of some member, which have in the majority of instances been very well attended, not only by those who are interested in this breed, but in all other breeds. The discussions at these meetings have shown the merits of this particular breed to those in attendance as no other method could. As an illustration of the advantages of the association, we made an exhibition of Holstein cattle at the West Penobscot Fair where one half of the whole exhibition was made up of the Holstein breed.

The association has under consideration the advisability of purchasing a royally bred bull for the use of its members, and I have no doubt this will be accomplished, as there is now nearly money enough raised for the purpose. In short the value of an association of this kind for the purpose of keeping the merits of its particular breed, as well as the better methods of breeding and caring for our live stock interests, before the people cannot be overestimated.

Very truly,

C. L. JONES, President.

Canton Point, Maine, Nov. 7, 1910.

R. W. Redman, State Dairy Instructor, Augusta, Maine.

The Androscoggin Jersey Breeders' Association is fairly launched on its second year's work. While we have not accomplished all that we should have liked, we should be pleased with our success.

We have meetings every three months at which addresses have been made by members of the Department, questions of interest to all breeders of live stock have been discussed and several classes instructed in stock judging by the score card.

We have had an advertisement in the Maine Farmer for quite a part of the year, and several sales have been made in this way. We expect to do more advertising in the future.

It has been the aim of the Association to induce its members to keep only pure bred bulls of the Jersey breed.

A. H. ADAMS, Secretary.

South Waterford, Me., November 15, 1910.

R. W. Redman, Dairy Instructor.

We think that the Oxford and Cumberland Counties Jersey Breeders' Association is doing a good work among the members and those who are not members, in showing the advantages of breeding pure bred animals. I think the work that we have done will be of lasting benefit, and we, as members of the Breeders' Association and the Cow Test Association, think the appropriation for that purpose has been of great benefit to the farmers of Maine, and we hope for an increased appropriation so that the work can go on with renewed vigor.

Yours truly,
C. S. HAMLIN, Secretary.
Harrison, R. D. 2.

SPECIAL DAIRY INSTITUTES.

The Dairy Division, in co-operation with the Dairymen's Association, has held special dairy institutes in fifteen counties during October and November. Kennebec county did not have a dairy institute, as the annual dairy conference will be held in this county. Aroostook county had two dairy institutes. Credit is due the Granges, the United States Department of Agriculture and the University of Maine for assistance in these special institutes; also to the Bangor & Aroostook and Maine Central Railroads for passes for such speakers as could legally use them. These meetings were held in response to a demand for short dairy schools in each county. At each institute lectures on subjects directly related to dairying were presented and dairy products scored. The attendance and interest shown indicate that the efforts were appreciated.

MEETINGS.

As a representative of this Department I have attended eighty-two meetings, sixty-one of them being all-day sessions. They are grouped as follows:

Meetings.	No.	Attendance.
Dairy Testing Association	35	1,241
Breeders' Association	13	607
Special Dairy Institutes (2 sessions for 14)	15	1,654
Grange	12	785
Miscellaneous	7	465
	82	4,752

I desire to express my most sincere appreciation of the cordial assistance given me in the work by the members of the Department, the press and the people of the State, all of whom, both officially and as private citizens, have used their opportunities to help the work along.

I thank you for your ever cordial support and hope that I may have the pleasure of co-operating with the Department for the advancement of Maine agriculture.

Respectfully submitted,

R. W. REDMAN,

State Dairy Instructor.

REPORT ON THE INVESTIGATION OF DAIRY PRODUCTS.

January 1, 1911.

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

I respectfully submit herewith my report as agent in charge of the investigation of dairy products from March 15th, 1910, to date.

During the year 1910 the work of milk inspection has been carried on far more aggressively than in years past. The laws of 1909 having instituted a good basis on which to prosecute, have led to increased activities on the part of local milk inspectors. Boards of health have taken greater interest in the production and care of milk; people are learning the true character of milk and demand that something shall be done to improve its quality and cleanliness. Many inquiries have been received in this office regarding the cleanliness and purity of the milk supply in our towns and cities. More especially is the demand for pure milk arising in the larger cities. Consumers are no longer satisfied with milk diluted with water, colored artificially, preserved with poisons used so extensively in years past, flavored with odors of the barn-yard and laden with dirt. People realize more than ever that milk has been and is today in many communities one of the most carelessly handled articles of food. Milk is a necessity in the welfare of children, in the nutrition of invalids, and yet we find people and hospital overseers buying milk from dairies in which no attention is paid to sanitation, cleanliness of the barn, and health and cleanliness of the cow and the attendants. Milk which contains dirt is suggestive of danger just as water containing dirt is considered unfit for drinking purposes. As a medium for carrying disease germs, milk is probably second to none. Physicians could do no better service than to aid in educating the people to realize the great importance of clean milk and its role in nutrition.

This increased interest among consumers has caused many dairymen to take greater care in the production and sale of this most important output of the dairy. How to produce clean milk has been a much repeated question. Through bulletins issued quarterly by the Department of Agriculture, an effort has been made to instill into the minds of all who handle milk the absolute necessity of cleanliness in the barn, of clean cows and careful attendants, and the importance of removing the milk from the stable immediately and cooling to 50° F. or lower. Clean milk kept at a temperature below 50° will remain sweet for days.

SAMPLES OF DAIRY PRODUCTS.

Since January 1, 1910, 643 samples of milk, 66 of cream, 16 of skimmed milk and 14 of butter have been purchased by your agent in seventy different towns, representative of conditions in every county excepting Aroostook. Of the samples of milk 378 or 58.8% contained sediment, 40 or 6.2% contained added water, 3 samples were skimmed, 2 contained preservatives and 2 were artificially colored. Such a high percentage of samples pronounced as dirty or slightly dirty is indicative of extreme carelessness on the part of those who handle this article of food. The sediment found in most of these samples was made up almost entirely of dust particles, and this tends to show that the presence of dirt is due more to carelessness than to any other cause. However, it is a noticeable fact that the milk from cows that are rarely groomed, and kept in barns having open ceilings thereby admitting dust particles from the hay mow overhead, contains sediment in nearly every case. Dairymen have reached a similar conclusion and in many instances have eliminated one source of dirt by sheathing the ceiling, and also are using more care in handling the herd, for they realize that the comfortable, well groomed cow gives greater returns than the poorly cared for animal. It is plainly evident that in certain localities there has been a marked improvement during the past year in the quality of market milk. Dilution with water is the most common form of adulteration; the use of preservatives has been eliminated to a marked extent, daiymen having at last realized the harmfulness of such and the need only of cleanliness and cold storage.

The law justly holds the retailer responsible for the purity and quality of the product which he offers for sale. In all cases of the sale of adulterated milk the offender has been brought before the court. Only a few cases have been fought, most of the defendants having pleaded guilty or nolo contendere. The exposure of the nefarious methods practised by certain dealers to the searching light of publicity has been productive of good results.

BULLETINS.

The analyses of all samples of milk, cream and butter have been published in bulletins issued quarterly by this department under the heading "Investigation of Dairy Products." Comment is also made as to the presence or absence of dirt, and while this has many times been a point of criticism, it has been productive of the best results in the end, for dairymen take more care to market a clean article of food.

In addition to publishing the analyses, short articles have been prepared with a view of aiding the dairyman in his labors. These articles included the following subjects: "Cleansing Dairy Utensils," "Production of Market Milk," "Market Milk of Uniform Quality," "Consumer's Responsibility," and "Whitewash." From time to time it has been found advisable to publish extracts from the statutes governing the sale of dairy products. Newspapers have rendered valuable assistance through the publicity given this work.

It is hoped that the scope of these bulletins will be extended to comprise such subjects as ventilation, reconstruction of barns, herd management, feeds and principles of feeding, etc. For the betterment of dairy practices it is absolutely essential that we have the personal assistance of every dairyman in Maine. We must examine minutely the daily problems of the dairyman, the difficulties which constantly arise, especially as regards the health of the herd, management, etc., for it is only through a comprehensive study of this subject from all view points as experienced under Maine conditions that progress can be insured. Having already advanced a great deal, we must bend our energies to gain a higher state of development.

INSPECTION OF BARNS.

Besides securing samples of dairy products your agent has inspected one hundred twenty-five barns, representing average conditions in the various parts of the State. In the dairy barn we do not look for ideal conditions to be found only in costly equipment. We do look for that simple, practical, economical construction that will insure the health and comfort of the animals, and permit of the highest efficiency of labor in maintaining the cleanly conditions necessary for the welfare of the herd and essential in the production of pure milk. The chief things lacking in the construction of our dairy barns—points that can be remedied easily and cheaply—are windows and a system of ventilation. The importance of sunlight and fresh air to the well-being of the herd has received too little attention from dairymen. However, when called to their attention most dairymen agree that such is the case, and in many instances changes have been made whereby these deficiencies have been remedied. To light our average barn properly there should be allowed at least two square feet of glass—and it would be better to have four square feet of glass—per cow. These subjects will be more fully treated in bulletins to be issued later. More attention is also being given to the construction of stalls with as little surface as possible so as to facilitate cleansing. The ceiling over the cows has in many instances been sheathed to keep out the dirt from the hay mows. In the barn we need the simplest construction—the least surface to keep clean—in order to care for the cows and produce milk most economically and of the best quality as regards cleanliness. Dairymen are exerting more care in grooming the cows. The comfort of the animals is of the greatest importance.

In all this work dairymen have responded willingly and with a spirit of co-operation which is the surest means of bettering dairy conditions.

LAWS.

The laws at present governing the production and sale of dairy products are not broad enough in their scope to afford sufficient protection to consumers and dairymen. During this past year numerous technicalities have arisen in the prosecution of certain cases and many conditions dangerous to the public health have been encountered which cannot be remedied until more stringent laws are enacted. One of the most important requirements for the betterment of the milk supply is a standard for milk of good quality. A law requiring the cleansing of milk cans before being returned to the producer should be enacted. Improved sanitary conditions in dairies and milk depots can be secured with certain dealers only through the enforcement of stringent laws. Although publicity has been the greatest power in establishing better methods and more healthful conditions in the production and sale of milk, strong laws are needed in many instances to insure improvement.

MEETINGS.

Since the first of April, 1910, I have attended the following meetings:

Maine Creamerymen's Association, one day.	
Portland Institute, two days. Attendance	54
Central Maine Fair, one week, in charge of exhibit of dairy products.	
Maine State Fair, one week, in charge of exhibit of dairy products.	
Dairy Institute, South Waterford, one day. Attendance	119
Dairy Institute, West Minot, one day. Attendance	118
Grange meeting, Pownal Center, one day. Attendance	90
Maine Live Stock Breeders' Association, Waterville, two days. Attendance	270
Maine Dairymen's Association, one week.	
Total	651

Respectfully submitted,

C. W. BARBER, *Agent.*

REPORT OF SEED IMPROVEMENT WORK.

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

I herewith respectfully submit a report of my work from January 24th, 1910, to January 1st, 1911.

During this time the work has been divided as follows:

Field work of the Maine Seed Improvement Association.

Assisting in gathering and preparing report of agricultural statistics.

Dairy Testing Association work and meetings.

The greater part of the time has been devoted to the field work of the Seed Improvement Association, and while doing this, considerable time has been devoted to gathering agricultural statistics; Dairy Testing Association meetings have also been attended when it has been convenient.

MAINE SEED IMPROVEMENT ASSOCIATION.

In accordance with the law passed by the Legislature of 1908, appropriating a sum of money for this work, the Maine Seed Improvement Association was organized at Waterville, January 25th, 1910. This meeting was attended by about 60 Maine farmers coming from all parts of the State. All offices in the association are held by farmers of the State except that of Secretary, held by Leon S. Merrill, Director of Extension Work, University of Maine, Orono, and the field work, which is in charge of a representative of the Department of Agriculture; in this way the association is assured of the hearty co-operation of both institutions.

List of Officers.

President, W. G. Hunton, Readfield.
Vice-President, John Pease, Cornish.
Secretary, Leon S. Merrill, Orono.
Treasurer, Charles M. White, Bowdoinham.

Executive Committee, A. P. Howes, Palmyra; George W. Moore, Presque Isle; E. E. Additon, Leeds; Frank Lowell, Farmingdale; C. S. McIntire, East Waterford.

In charge of Field Work, A. S. Cook, Augusta.

FIELD WORK.

The purposes of this field work are to establish a closer relation of members and institutions co-operating with the association; to obtain definite information regarding the work done by each member; to have each member visited by a representative of the Department; to see that the work is carried out in detail and that all reports are properly kept in order that the agriculture of Maine may receive the benefit of this work. The success of the association depends largely upon the thoroughness and carefulness exercised in doing the field work, and the benefits to the State—financially and educationally—will be measured by the character of this work. A thorough understanding of all plans will give the members more interest and, consequently, more efficient work will be done. The Department of Agriculture should be in close touch with all work of the association, and this can only be done through efficient field work.

The plan that was adopted by the association for the year 1910 was the result of a careful investigation of similar work that is being done in other states and countries, and has the approval of expert agriculturists of Maine. Undoubtedly these plans will be made more comprehensive each year as the work progresses and develops. Detailed plans for the work with corn and potatoes have been adopted by the association and blanks, reporting all details regarding weather conditions, seed used, soil, planting, cultivation, yields, etc., of each crop raised, are filled out by the members and forwarded to the secretary of the association at the end of the season. Superior strains and varieties of these crops will be isolated, propagated and distributed.

After considering the matter of obtaining seed to start in the first year's work with corn, it was decided that the Department of Agriculture should send out ten-ear lots to members desiring to experiment. In order to insure as far as possible that the corn sent out would mature, the State was divided into four zones. These zones were numbered and all members living in zone No. 1 received corn that was raised in the same zone. This corn was secured from men who had been practicing selection for a number of years. The germination test of this corn was conducted at the Department and only those ears testing 100% were sent to the members.

Corn. It will be unnecessary to comment upon the plan of work with corn, as the following copy of the blank that is sent to each member will give this information:

DETAILED PLAN FOR SEED BREEDING WORK. CORN.

Purpose. The primary purpose of the work is to breed strains of flint corn that shall be both early and high yielding.

Plan of Work for 1910. In carrying on the work for 1910 the following rules should be observed:

Seed. The Department of Agriculture will, through the Association, furnish to each member 10 ears of Maine grown flint corn for conducting an experimental plot during the present year. If however, any member already has a superior variety of flint corn, then he should carefully select from his bulk seed 10 ears of such size, shape and characteristics as shall most nearly resemble the type he has in mind.

Planting. The plan to be followed in planting is what is known as the ear-to-the-row method, each ear being planted in a separate row. The rows should be three feet apart and the hills three feet apart in the row. Only about half of the ear, rejecting both tip and butt kernels, need be planted, 40 hills in each row being sufficient for the test, thus obviating the necessity for long rows. The testing plot for carrying on this experiment will therefore need to be large enough for 10 rows with 40 hills to the row. The corn should be planted 4 kernels to the hill, and when the plants are well above the ground thin to three to each hill. The number of stalks pulled from each row should be recorded on the blank provided for that purpose, and the total number of stalks in each row should be counted after the surplus stalks have been pulled, and a record made of same, as this will show the field germination test of the seed.

Harvesting. When the corn is harvested, each row should be kept by itself, carefully weighed on the cob and tagged for identification.

Selection of Seed. In selecting the row which shall be used for seed purposes in 1911, the following factors should be taken into consideration and in the order in which they are mentioned:—

1st. Earliness.

2nd. Yield of Seed Ears.

3rd. General Conformation of Ears.

While earliness is of fundamental importance, and it is quite likely that there will be some difference in earliness between the different rows, yet the selection should be made only from the highest yielding rows which are capable of maturing in the average season of the locality. It is felt that the selection for yield should be made on the basis of the largest amount of corn fit for seed purposes, it being desirable to eliminate in so far as possible ill shaped and poorly matured corn. After the row from which the seed is to be taken the following year has been selected, the corn should be carefully cured and stored. In selecting from the best row the seed for the experimental plot for 1911, it would be best to select twenty to twenty-five of the best ears as to shape, size, tips, butts, etc., and apply to each ear the germination test, and then from the ears tested select the ten ears having the highest test. The balance of the corn raised from the best row should be used as seed for the main crop for 1911.

General. A report blank for corn will be furnished each member of the Association. It should be carefully read and its requirements understood. At the close of the season after the corn is harvested this report should be filled out and forwarded to Leon S. Merrill, Secretary, Orono, Maine.

The experimental plot should be planted if possible at least 40 rods distant from any other corn, and would advise that it be located near the road so that it may attract attention to the work being carried on by the Association. If comparisons are to be made between the results obtained on this experimental plot and your main crop, then the preparation of the soil, cultivation and fertilization should be the same, as it is not desirable that the lots of corn sent out for experimental purposes should be grown under abnormal conditions.

When members of the association are obliged to purchase corn for seed purposes they should insist that it be delivered to them on the ear, and when any is sold by them it should always be delivered to their customers on the ear.

Potatoes. The plan for improving potatoes is similar to that of corn except that the unit of selection is a hill instead of ears. The following copy of report blank explains itself:

DETAILED PLANS FOR SEED BREEDING WORK.
POTATOES.

Primary purpose of work: Breeding strains of each of the commercially important varieties of potatoes which shall be high yielding.

Work in 1910: Obtain the best and purest seed of the variety you select which you can find. Go over the seed very carefully and reject all badly shaped, abnormal, undersized and diseased tubers. Disinfect the seed with formaldehyde (see Maine Eperiment Station circulars, 309 and 375).

Plant a plat of this seed, not too large to be given personal attention, and not so large but that you personally can dig the potatoes by hand. We would recommend that the size of this plat be about 400 hills.

Give the plat the same treatment as to (a) soil conditions, (b) fertilizing, (c) cultivation and (d) spraying, which is given to the main crop.

If you desire to select for earliness go through the field several times during the season and tag the plants furthest along at those times. Keep record of date of blooming of selected plants.

In digging the potatoes save as seed only hills possessing strong upright tops and having 6 or more merchantable tubers, of fairly uniform size and shape typical for the variety, and containing no small, misshapen or diseased tubers. Ten hills so selceted will give sufficient seed for plat work in 1911.

Keep the tubers from each of the selected seed hills separate, and give each lot of seed from one hill a number.

Weigh the tubers from each selected hill and divide by the total number of tubers, thus getting the average weight. Keep a record of the work according to the following scheme:

1910 POTATO SELECTION.

Selected hill number.	Number of tubers.	Weight of tubers.	Average weight of single tuber.	Planted in 1911 in		Notes.
				Plat	Row.	
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Keep full notes as to size of plat and character of soil, date of planting, fertilizing, date of blooming, date dug, yield of whole plat, and any other items in which you may be interested. Keep record of yield of general crop for 1910 for comparison.

Work for 1911: Plant the 1910 selected seed in such a way that the progeny of each original hill will be kept together.

Repeat selections as in 1910 work.

In digging it will doubtless be found that the progeny of certain original hills is not as good as that of others. Reject the lines which do not measure up to standard.

Oats. The plan for improving the oat crop is a rigid system of fanning and grading, and through selection the isolating of superior strains of seed. Report blanks are filled out, giving a detailed record of the raising of this crop as in the case of corn and potatoes. There are members working with oats in nearly every county in the State and the detailed information received from them regarding the growth and yield per acre will be of immense value in securing superior strains.

Beans. Owing to the fact that so many members were interested, and desired to practice selection of the bean crop, a report blank has been made similar to those for the other crops.

Other grains and garden crops. At the present time, there is no report blank for these crops, but as the interest in them is increasing, the Association will undoubtedly take steps along this line in the near future.

VISITS TO MEMBERS.

During the summer months I have visited nearly all of the members. The number doing work, with the different crops, is as follows:

	Number of Members.
Ear-to-the-row method plots of corn......	45
Mass selection of corn..................	84
Potatoes	51
Oats	24
Beans	7
Wheat	5
Barley	3
Garden crops	3

At all times when visiting the members I have endeavored to make a special study of conditions and to help in the solution of the various problems which arise. A discussion of the purposes and aims of the Association has been held in order that there might be a better realization of what the work will mean to the agriculture of the State.

The results of the first year's work have been very satisfactory. Much interest is expressed by the members and the report blanks have been well kept. Some very interesting and instructive facts have been brought to the attention of the farmers. The following data give a partial record of one of the experimental plots conducted during the past season in the way it is recorded on the report blank:

Number of Row	Date corn first appeared above ground	Even or uneven	Strong or weak	No. stalks pulled	No. stalks remaining	No. barren stalks	Date of tasseling	Time of maturing	Time of harvesting	Total yield per acre in bu.	Yield of corn fit for seed purposes per acre in bu.	Lbs. of fodder and corn per acre at time of harvesting
1	June 17	even	strong	32	120	3	Aug. 5	Sept. 25	Sept. 29	87 bu.	55 bu.	24768
2	"	"	"	23	116	–	July 31	" 23	"	81	65	17952
3	"	uneven	"	37	120	–	Aug. 5	" 24	"	75	48	18528
4	"	even	"	14	116	4	"	" 27	"	60	28	14976
5	"	"	"	33	120	1	" 1	" 26	"	75	54	18240
6	"	"	"	39	120	–	" 2	" 22	"	82	60	20256
7	"	"	"	11	108	2	" 5	" 25	"	71	45	18720
8	"	"	"	31	120	2	"	" 27	"	72	54	18624
9	"	"	"	7	100	7	"	" 27	"	62	39	16896
10	"	"	"	31	119	–	" 2	" 24	"	75	51	18624

It will be seen that the date the corn first appeared above ground was the same in each of the ten rows. This may be partially accounted for by the fact that all the ears used in planting the plot germinated 100%. Only one row was uneven and all of the plants appeared strong. The variation in time of maturing was five days between row No. 6 and row No. 8. At the time this experimental plot was visited, one of the most striking features of the plot was the uniformity of the different plants in each row. This was during the latter part of the season and at that time all of the plants in row No. 8 appeared much more immature than those in row No. 6. The row yielding the most corn fit for seed purposes was row No. 2, which yielded at the rate of 65 bu. per acre. The yield of row No. 4 was only 28 bu. per acre or 37 bu. less than the yield of row No. 2. Considerable variation is found in the yield of corn fodder per acre in the different rows. Row No. 2, which yielded the most corn fit for seed purposes, did not yield the largest amount of fodder. The variation in pounds of fodder in row

No. 4 and row No. 1 was 12,792 lbs., or a little over six tons per acre. The results given in these data are much more uniform than those found in the records of the majority of experimental plots.

Following is a summary of the results of another experimental plot, showing greater variation in yields per acre.

Number of Row	1	2	3	4	5	6	7	8	9	10
Germinated 100% in hours	96	144	120	96	120	144	192	144	144	192
Total yield per acre in bushels	127	110	137	120	158	144	98	111	117	127
Yield of corn fit for seed purposes per acre in bushels	82	46	27	0	48	51	12	48	5	7

In these data a record is given of the germination test of the ten mother ears used in planting the experimental plot. Although each of the ears germinated 100%, it will be seen that some of them germinated quicker than others. Row No. 1 germinated 100% in 96 hours, while row No. 7 and row No. 10 required 192 hours. One of the interesting things noticeable in this record is the relation of the total yield of corn to that of seed corn. There was not as much variation in the total yield of corn per acre as in the yield of seed corn. In row No. 1, with a total yield of 127 bu. per acre, 82 bu. were fit for seed; in row No. 10, with a total yield the same as No. 1, only 7 bu. were fit for seed purposes. As each row was planted with an individual ear of corn and the ten ears used in planting the plot were carefully selected for uniformity, the difference in the ability of individual ears to reproduce is made very evident by the above data.

EXHIBIT AT THE NEW ENGLAND CORN EXPOSITION.

In accordance with an invitation extended by the New England Corn Exposition, the Maine Seed Improvement Association made an exhibit at the Exposition in Worcester, Mass. Upon a request made to the members, 220 exhibits of corn, grain and potatoes were received at Augusta and transported to Worcester and exhibited by the Maine Department of Agriculture. The Maine Agricultural Experiment Station contributed an exhibit of 31 varieties of oats with which they are doing experimental work for the benefit of the Maine Seed Improvement Association. Credit is also due the University of Maine for their co-operation. This exhibit attracted a great deal of attention, as it was the only co-operative organization of farmers represented at the Exposition. During the Exposition at least 200 men expressed their desire to purchase seed from the Association; this impresses upon one the possibilities that are open to seed raisers in the State and also the care that must be taken in selling seed through the Association.

The interest of the members is shown by the fact that the exhibit at the New England Corn Exposition was of an educational nature and no premiums were awarded. This exhibit was moved to Augusta and shown at the Annual Dairymen's Conference and Seed Improvement Meeting, and, upon the invitation of the State Grange, was left in the hall during their meeting. The Seed Improvement Association will be represented in Maine's exhibit at the National Corn Exposition in Columbus, Ohio. The best exhibits will be selected and some of the members desire to compete for premiums at that time.

AGRICULTURAL STATISTICS.

Considerable of my time in February, March, April and May was spent in gathering statistics. I visited every town in Piscataquis County and twenty-two towns in Somerset County. Data were obtained from the assessors' books in each town, and at least two communities in every town were visited. In the summer months, while doing field work of the Seed Improvement Association, I interviewed several agriculturists in each county to gain information for the statistical report. The compiling and comparing of these statistics has occupied much of the time during November and December. Complete statistics concerning the different farm crops, farm help, opportunities for special farming, available markets, etc., have been collected and tabulated and furnish very valuable information to those interested in the agricultural prospects of the state.

MEETINGS.

While doing other work, I have planned to attend as many meetings as could be arranged for, and as a representative of the Department of Agriculture I have been present at twenty-four meetings, having a total attendance of 1,813, as follows:

Meetings.	No.	Attendance.
Dairy Testing Associations	10	440
Granges	6	914
Breeders' Associations	2	89
Farmers' Institutes	2	287
Seed Improvement Association ...	3	51
Poultry Association	1	32
	24	1813

Seventeen of these meetings have been held in two sessions. I have devoted considerable time to chart and demonstration work in the lectures which I have presented and have endeavored to make them as informal as possible. In addition to the above meetings, three weeks of my time were devoted to the demonstration work on the "Modern Farming Special" which made a tour of the State in June, and another week was spent at the New England Corn Exposition at Worcester, Mass., in November.

GENERAL.

In addition to the card system of reporting daily work, I have kept a detailed record of visits to members; these records give such information as interest taken, character of experiments, and crop experimenting work. A card filing system is also employed for keeping an alphabetical list of members, according to counties, and a record is kept on the cards of the work done by each.

In meeting and conversing with the farmers of the State, I have tried to emphasize the importance of seed selection in all crops and have discussed its relation to yields per acre.

During the months of March and April, 1910, germination tests were conducted with corn, small grains and grasses for any farmer of the State who desired this information regarding the seed he was to plant. This is, indeed, an important phase of work and is worthy of more attention from the Department. Although there is a law at the present time, requiring a purity test of seed, it seems that the germination percentage is of sufficient importance to receive some attention from the coming Legislature.

Great credit is due the members of the Seed Improvement

Association for the interest taken in the work and also for the way in which they have contributed to the association exhibits, knowing them to be purely educational, and to the Maine Agricultural Experiment Station and University of Maine for their hearty co-operation.

In closing, I desire through this report to express my appreciation to you, and to former Dairy Instructor Leon S. Merrill, for the many kindnesses shown me in all problems of my work, to all members of the Department and to all agricultural workers for the favors they have granted at all times.

Respectfully submitted,

A. S. COOK,

In Charge of Seed and Plant Improvement.

REPORT OF STATE ENTOMOLOGIST.

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

I take pleasure in presenting my sixth annual report from the Bureau of Entomology for the year nineteen hundred and ten.

The season as regards insect pests and fungous diseases has been rather unique. Insects that for the past few years have been very serious pests almost disappeared from the list of the collector, and with the exception of the fall web worm, but very few complaints came to the office regarding insect injury as a whole. The weather conditions during the month of June were very favorable to insect destruction; while on the other hand they were equally as favorable to the propagation and spread of several of our noted fungous diseases. The disease affecting the brown-tail caterpillar, that was disseminated so thoroughly through the southern part of the State two years ago, again showed itself to a very marked degree. The same disease was found attacking many other species of caterpillars, the gypsy excepted. This last species seems to be immune from the attack of our native parasites and fungous diseases.

Many pupae of the different species of moths perished during the cold wet weather; at the same time the same conditions were very injurious to the fruit blossoms of our orchards and the small fruits as well, and as a result there was a shortage all along the line. Strawberries were scarce and raspberries were hardly seen in the market. Those who were fortunate in having a fair crop were well repaid in the extra price received. No insects were reported attacking the strawberry plant except the flea beetle and the "June-bug." These did considerable damage in a few localities. More reports than usual came in regarding the raspberry cane borer, in fact it was more abundant this year than for many years. Investigations were made and in some sections almost every cane was found to be infested.

It is Nature's way of pruning but it does not always work to the best advantage. Whenever this injury is noted the canes should be cut off just below the row of punctures made by the insect and destroyed by burning.

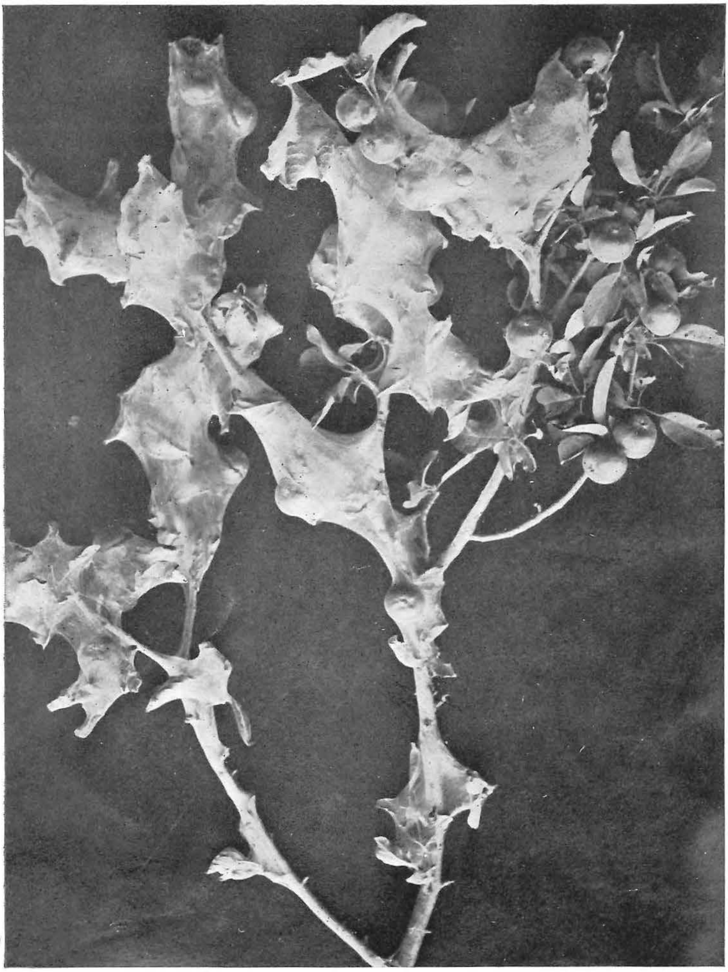
The Saddled Prominent, *Heterocampa guttivitta,* so abundant for the past three years, doing extensive damage to orchard, shade and fruit trees, has practically disappeared owing to the presence of the predaceous beetles, parasites and fungous diseases. This was predicted last year, when the presence of these many enemies was recognized.

The maple worm, *Anisota rubicunda,* also dropped out and not a single maple was reported defoliated by this caterpillar.

The bud moths and leaf rollers were common in orchards that were not sprayed; so also were the codling moths. In neglected orchards the railroad worm ran express, local and accommodation trains without let or hindrance. Leaf-feeding caterpillars like the tent caterpillar, yellow-neck, red-hump, etc., were rarely found, but the fall web worm was never so abundant and destructive, especially to young orchards. The following food plants of this insect were recorded: apple, pear, plum, cherry, all wild cherries, maple, oak, ash, mountain ash, elm, poplar, willow, beech, thorn, dogwood, hornbeam, mulberry, corn, raspberry, etc.

They were reported from all over the State in great numbers. The first egg cluster sent in was on June 26th; the first caterpillar, June 28th, and from that date until into September, the complaints poured in from all classes of people—orchardists, lumbermen, village, city and cemetery care-takers, farmers and summer visitors. The first moths appeared about the middle of June and the last ones noticed were flying as late as the middle of August. This extended period of the adult stage is quite unusual and can only be accounted for by the weather conditions from March to June. In fact, many of our insect and fungous troubles must of necessity be laid at the door of this usual "Month of Roses."

The early spring season was unprecedented in recent years. March came in warm and hastened the development of many species of insect life, especially the pupae of the moths that produce the leaf-feeding caterpillars. This was true, in a marked degree, of the fall web worm, and I have no doubt that



Nest of fall web worm.

many of the pupae of other species were advanced to such a degree that the cold wet weather of June destroyed them in great numbers. The fact that nests of the fall web worm in their young stage kept appearing on orchard trees after they had been repeatedly cleared is explained only on the ground that the moths were delayed in their time of hatching by the weather and soil conditions.

It will be remembered that caterpillars of this species, like most other leaf-feeding kinds, go into the ground in the fall to pupate and remain over winter. In the spring the development of these depends to a great degree on soil, moisture and temperature. If they happen to be in low or wet places, they will not emerge so quickly as they would from light and dry soil. The conditions last spring were such as to make just this unusually wide variation in soil conditions. Thus the great variation in the emergence of the moths to lay their eggs, and thus it was, when an orchardist had gone into his orchard and removed all of the nests, that in a few days he might return and find as many more, and so on as long as any belated moths emerged and laid their eggs. In fact they were delayed so long that many young colonies were found as late as September and were mistaken for brown-tail nests by some. Many were much concerned about their appearance, and not a few could hardly be assured that they were not the brown-tail caterpillar, and some even persisted that they must be another form of either the gypsy or brown-tail. The concern was so widespread that I was requested by an editor of one of our papers to send in an article explaining the different characteristics of these species. Much damage was caused by their ravages, especially in our young orchards, where they were a great menace not only to the foliage but to the fruit as well. Several reports have been received stating losses to fruit. In one instance a statement was made by a reliable orchardist, that the loss to one orchard alone amounted to hundreds of dollars. It is to be hoped that this pest has reached the climax of its cycle and its sudden disappearance will be expected after another season of depredation, at least. We do not anticipate such an infestation another year but cannot tell for a certainty, as but few parasites were seen and no indication of a fungous disease. The caterpillars of this species are by nature very active and being so protected by long hairs they are not so susceptible to attack by some species of parasites, especially the Tachnid flies, as are the smooth-skinned species like the Saddled Prominent. Birds are not so fond of hairy caterpillars, so they have a double protection. Yet they may disappear as abruptly as did the Prominent last year, although we do not feel as safe in predicting it.

This orchard pest could have been easily controlled by spraying the trees thoroughly about the first of July with lead arsenate, three pounds to fifty gallons of water, directing the spray upwards from underneath so as to coat the under side of the leaves with the poison, as the eggs are always laid in a cluster on the under surface.

Other leaf-eating caterpillars, such as the red-hump, yellow-neck, Saddled Prominent, the tussocks and brown-tail moth can be controlled in the same way, as the moths of all of these different species except the tussocks lay their eggs on the under side of the leaves. If the eggs are not laid at the time of the spraying the poison will remain, if properly applied, until long after the last of them have hatched, so that as soon as the tiny caterpillars begin to feed there is enough poison left to quickly destroy them.

SAN JOSE SCALE.

The only known orchard infestation of this insect is at Limerick in York county. A thorough treatment was given with lime-sulphur by the owner in the spring, followed four weeks later with scalecide on the trunks and branches, with the result that no live specimens were seen crawling, although several inspections were made during the season. A careful watch will be kept and another thorough spraying with lime and sulphur will be made next spring.

Three other infestations have been found during the season, one at Northeast Harbor, discovered by Dr. H. T. Fernald of Amherst, Mass., while on his vacation. It was found on some purple plum trees but a careful inspection revealed only dead scales. It will be inspected another season.

While inspecting an orchard in Gardiner a single tree was found infested with scales. The tree was dead and every indication pointed to the fact that the scale must have been destroyed by fumigation before it was set. The tree had made but slight growth, was badly infested by borers, probably killed by them, and all of the old scale had not been shed.

While inspecting orchards set for the Gregory contest, Mr. Yeaton found a single tree infested with the San Jose scale. All others were carefully looked over but no scale could be found. The tree was removed and sent to the office. We are thus getting evidence that this much dreaded scale is with us and that a most careful inspection of all young trees must be made. We have enough pests now to contend with, and where but comparatively few of our orchardists spray, we are surely up against a very serious proposition in regard to this insect.

A positive evidence that it can stand our climate is found in the orchard above mentioned, for the trees were set at least nine or ten years ago. As near as can be judged only one or two trees were then infested. That was before the severe winter of 1906 and '07. In 1909 live scale insects were found crawling on about a dozen trees; some trees were completely alive with them, from the ground to the outermost twigs. A full life history of this insect was given in our annual report for 1906. All who set trees should become sufficiently familiar with the appearance of the scale to guard against a further spread of the disease.

WOOLLY APHIS OF APPLE.

This pest was found on a few trees in many of the orchards set this year, but only above ground, generally on the small branches or where scars were left from the removal of limbs. These were controlled by spraying as for the green aphis.

A lot of nursery stock was sent into the State badly infested with this pest, but it was condemned. See description under "Infested Nursery Stock."

This insect occurs on the roots under ground as well as on the trunk and branches. On the root it often causes an enlarged growth, forming a gall. This underground infestation is most difficult to handle and is generally neglected entirely. From what observations we have been able to make, and they are many, we are of the opinion that this insect does more damage in Maine than in almost any other state. We have found it infesting trees direct from the nursery and from that age up to quite mature trees. One special example was noted of a tree about 30 years old that was completely alive with the snowy covered aphis—roots, branches and small twigs. No attempt had been made to control the insect and it had secured complete mastery of the situation. The tree died that season. The air was full of the mature winged females so that, in all probability, the pest was spread to many other trees in the immediate vicinity. We have been asked many times if the woolly aphis, found so abundantly on the alder, was the same species. It is an entirely distinct species and cannot live on the apple.

When this apple aphis occurs above ground, on the twigs and branches alone, it can be easily controlled by the same treatment that is given to the green aphis, viz., kerosene emulsion. In fact, it is less difficult to handle, as it does not attack the leaves but is exposed on the trunk or branches. Often it is found in the scars left where limbs have been removed and sometimes in seams in the bark. In these cases care should be taken to thoroughly spray with sufficient power to force the material into these cavities and thus touch each specimen.

GREEN APPLE APHIS.

(*Aphis pomi.*)

The small green louse of the apple was one of the worst pests to the young trees set this year; this was especially true of the Gregory orchards.

The first brood hatched from the eggs that were already on the trees when they were set. These began their work in June and kept it up until late fall.

This pest is one of the most difficult to handle on account of the protection they have from the curled-up leaves in which they are at work. The eggs are laid in the fall and are so minute that they usually pass unnoticed. As the trees leave out they appear free from any insect pests, so the orchardists, in attending to other duties, pass them by without much inspection. About that time, though, the little green fellows have begun their work and are busily sucking the sap from the under sides of the tender leaves; this causes the leaves to curl up to such an extent that the edges often touch, completely protecting the little fellows from injury. As they are sucking insects the only spray that can harm them is a contact spray, one that reaches the body of the insect.

The usual remedy is kerosene emulsion, whale oil soap or a similar solution.

If they are not discovered before the leaves protect them by curling it is a very difficult matter to control them. The only safe way is to keep a sharp watch and as soon as the first ones appear they should be destroyed at once. It will be necessary to keep a close watch and spray again, possibly a third time. The eggs do not generally all hatch at the same time. If the first brood can be destroyed the trees are generally secure from attack for that season. Practically all of the Gregory orchards were slightly infested with this pest.

BROWN-TAIL MOTH WORK.

In most sections this pest is being handled in a more satisfactory manner by the town authorities. In its early history there was so much prejudice to overcome that but little effective work could be accomplished, but with the continued infestations the public in general has come to realize that the problem must be met and the sooner this is done the better. We hardly think there has been any further spread northward as no reports have come to the office from new territory. No damage of any extent has been reported outside of York and Cumberland counties. It is very gratifying indeed to note, as intimated in the beginning of this report, that the fungous disease planted out in 1907 again made its appearance during the favorable weather in June, and destroyed millions of the feeding caterpillars. As a result of this much fewer moths were seen during their annual flight, although many came across the border from New Hampshire. It would seem to be a wise move on the part of our neighboring State if she would plant out this disease on her own territory, and thus rid her towns of a large number of these pests. This insect can be controlled in our orchards by one spraying in July, and the time is not far distant when all owners of fruit trees will realize this fact and put it into practice.

GYPSY MOTH WORK.

We most sincerely hope that those who are looking to the conservation of our forests will not overlook this, the most important enemy of our Pine Tree State. If once this pest should get away from the fetters that now keep it under control our fair State would suffer beyond measure.

From an economic standpoint we can ill afford to let this menace go unrestrained. It is a most subtle power of destruction that lurks in our midst and unless a more aggressive policy is inaugurated and a combined movement set on foot in Maine as well as New Hampshire this pest will get the upper hands of us. The experience of Massachusetts is a lesson that should not go unheeded. A careful study of the report of our special field agent should be made in order to realize the importance of this work.

INFESTED NURSERY STOCK.

There has been such a volume of complaint regarding the nursery stock purchased last spring that we feel the time has come for more drastic measures in dealing with this phase of the movement for better fruit in Maine.

We were anxious to secure the passage of the bill requiring all persons who wished to take orders for nursery stock, for parties outside of the State, to obtain a license from this department for so doing. The experience of the past season has shown the wisdom of this act. One nursery has been forced out of business, as far as this State is concerned, and should be shut out from doing business in any state. The agent acting for that company has been refused a license on the ground of obtaining orders under false pretences.

One or two other nurserymen have been cautioned about the stock they have been selling in this State, with the result that these parties will either mend their ways in the future or will be obliged to drop out of business as far as Maine goes. We have organized a movement for better fruit and we must insist that better nursery stock is sent in the future. Several of the Gregory orchards had to be ruled out on account of inferior stock. In some cases hardly a tree started to leaf out in the orchard set. The trees had hardly any root system, and the

Spraying Demonstration in orchard at Bethel, Maine, July 1, 1910.

tops dried out so the branches rattled like dead twigs. We would caution all purchasers to examine the stock when delivered and see if it is satisfactory before paying for the same. In this way much unpleasantness might be avoided and better stock would be the result.

Movement for Better Fruit.

ORCHARD RENOVATION.

Soon after the Gregory movement was started it was thought advisable to introduce a system of tree renovation with the old orchards that were rapidly going to decay for want of proper care and attention. With this object in view we consulted with several of the manufacturers of pumps, spraying material, fertilizers, etc., with the result that many premiums were secured for fruit exhibited at the different fairs, from renovated orchards.

SPRAYING DEMONSTRATIONS.

The movement for orchard improvement also extended to the direct care of the trees, in the line of pruning, thinning, treatment of canker and other diseased portions, followed by spraying to control insect and fungous troubles. The following companies were only too glad to aid in the good work: Frost Insecticide Co., Arlington, Mass., using the Arlington Outfit B B pump, manufactured by the Douglas Pump Co. of Middletown, Conn.; Smith & Thayer Co., Boston, Mass., using the 1100 Gould Pomona pump; Charles J. Jager Co., Boston, Mass., with the Deming pump, manufactured by the Deming Pump Co., Salem, Ohio; a dealer in the Hardie pump, made by the Hardie Manufacturing Co., of Hudson, Mich.

Other concerns wished to lend a hand but could not on account of engagements previously made. The Maine Central and Grand Trunk Railroads kindly furnished free transportation for the pumps and material used, which was greatly appreciated by the State.

These spraying demonstrations were begun on May 2nd at Belfast and continued until the 21st. They were then put off for a month on account of the Farming Special train that was run by the Maine Central road, but were again resumed on the 20th of June and continued to July 2nd.

Arrangements were made with granges in the different towns to open their halls and have an all-day meeting on the dates assigned. When convenient two demonstrations were given in near-by orchards. Generally a lecture would precede or follow these demonstrations, to best suit the audience. In all cases these meetings were open to the general public and many interested parties, not members of the grange, availed themselves of the opportunity to be present. In most cases the meetings were well attended, and much interest was manifest. Often a pruning demonstration preceded the spraying and in some cases illustrations in treating diseased trees were given, especially cankered trees. At most of the sessions the different methods of grafting were demonstrated, the scions being cut and set in the proper manner. Sometimes an evening lecture was given. During the five weeks fully 70 lectures and short talks were given, covering the whole ground of orchard management from the preparation of the ground to the selling of the fruit, but most of the work was on the care of old orchards, such as cultivation, fertilization, pruning, spraying, etc. At each meeting insect pests and fungous diseases were discussed, with measures for their control.

Each pump company, in conjunction with a manufacturer of spraying material, furnished its own supplies and paid the expense of its men for the entire trip.

Although these meetings would have been much more profitable could they have been held earlier in the season, yet we feel that much good was accomplished, and would strongly recommend that a series of orchard schools be conducted during the coming season, these schools to be held for at least a week at each session and include one for each county in the State, and be divided into two sessions, one of eight weeks in the spring for one-half of the State, and the other to come in the fall.

Instead of confining these schools to the one topic of orchard work, they might include all lines of farm management, and be conducted under the head of "Better Agriculture for Maine."

Under the head of "Better Fruit for Maine" there could be two sessions each day, from 10 to 12 A. M., and from 2 to 4 P. M. Each orchardist should come provided with a note book and pencil and lots of questions, for a half hour of general discussion at the close of each session. The whole subject of Fruit Growing and Management could be divided up so as to have a new topic for each session covering a week's work. The following outline is suggestive only.

A WEEK OF INSTRUCTION IN FRUIT CULTURE.

Monday	A. M.	Soil preparation. Nursery stock.
	P. M.	Preparation and setting of tree. Small fruits (strawberry and raspberry).
Tuesday	A. M.	Care of young trees. Small fruits (currant and gooseberry).
	P. M.	Growing of pears, plums and cherries. Small fruits (blackberry).
Wednesday	A. M.	Orchard renovation (soil treatment). Trimming old trees.
	P. M.	Treatment of diseased portions, canker, etc. Cementing cavities, etc.
Thursday	A. M.	Spray-pumps, nozzles, spraying material, etc. Fungus troubles (canker, scab, etc).
	P. M.	Spraying demonstration, orchard work. Insect control in small fruits.
Friday	A. M.	Insects classified (beneficial). " " (injurious).
	P. M.	Insect control (sucking and leaf-eating). " " (affecting fruit, also root and wood injury).
Saturday	A. M.	Thinning fruit—picking fruit. Demonstration in sorting fruit.
	P. M.	Packing fruit (directions for all packages, including small fruits). Packing fruit (demonstration in box and bbl.).

This outline could be modified to suit the season; for instance, the outline for Saturday would have to come in the fall; but if the week of instruction came in the spring the day could be devoted to other topics that are not included in the above.

FRUIT INSTITUTES.

In addition to the spraying demonstrations several fruit institutes have been held during the year. These were well attended and much interest shown. In each case topics relating to insect and fungous control were freely discussed and when we take into account the quality of the fruit shown at our several fairs in the State, as well as the magnificent exhibit of apples of high quality shown at the State Pomological meeting in Auburn, we can safely say that much good came from the holding of these institutes and orchard demonstrations. This movement for better fruit has just begun; let us all join forces until Maine shall take her place as one of the foremost states in the Union for fruit production.

EXHIBIT AT THE STATE FAIRS.

Exhibits were made at the three state fairs. Great pains was taken to make as much of an educational exhibit as possible. The insect display was along the line of economic entomology where the life histories of our leading fruit pests were shown, together with their work of destruction. Associated with these was a new feature, a collection of our most troublesome weeds, also an exhibit of alfalfa, the clovers, and some of the grains and grasses. This last addition attracted a great deal of attention and many inquiries were made as to the manner of getting rid of the different weed pests.

The exhibit is attracting more notice each year and we would strongly recommend the preparing of enough separate exhibits to be able to accommodate the several county fairs. We would also recommend the preparation of leaflets of instruction on the different phases of economic entomology to be distributed at each fair.

ORCHARD AND NURSERY INSPECTION.

The work of inspection is growing rapidly each year. This work is of the utmost importance to the State, and should be encouraged. Hardly an inspection is made that does not bring out some question of vital importance to the owner of the orchard or nursery. Several requests for inspection during the year have had to be turned down on account of lack of time or previous engagement.

Several new nurseries have been added to the list of last year. The following list is complete to date, as far as we know. Kindly notify the department if any are omitted.

LIST OF NURSERIES IN MAINE.

ANDROSCOGGIN COUNTY.

Chapput, Joseph T., Auburn,	Small fruit.
Lombard, T. M., Auburn,	" "
Merrill, A. S., Auburn,	" "
Merrill, Chas. A., Auburn,	" "
Roak, Geo. M., Auburn,	Regular stock.
Saunders, Ernest, Lewiston,	" "
Woodman, H. M., Auburn,	Small fruit.

CUMBERLAND COUNTY.

Barbari, Charles., Woodfords,	Small fruit.
Burnell, Dexter, Cumberland,	" "
Goddard, L. C., Woodfords,	Regular stock.
Gould, C. E., Woodfords,	Small fruit.
Holm, Hans H., Woodfords,	" "
Jackson, H. A., Westbrook,	Regular stock.
Leighton, Gardiner, No. Yarmouth,	Small fruit.
Loring, E. D., Walnut Hill,	" "
Macomber, E. R., Woodfords,	Regular stock.
Minot Co., J. W., So. Portland,	" "
Prince, Albert F., Walnut Hill,	Small fruit.
Smith, C. W., Woodfords,	" "

FRANKLIN COUNTY.

Childs, John, New Sharon,	Regular stock.

HANCOCK COUNTY.

Ball, Henry A., Hancock,	Small fruit.
Ball, H. D. & Son, Hancock,	" "
Crabtree, W. A., Hancock,	" "
Hancock Nursery Co., Surry,	Regular stock.
Hodgkins, Howard, Hancock,	Small fruit.
Keif, Thomas, Hancock,	" "
Moon, Geo. M., Hancock,	" "
Mt. Desert Nursery Co., Bar Harbor,	Regular stock.
Penny, C. A., Hancock,	Small fruit.
Phillips, Willard H., Hancock,	" "
Wooster, E. W., Hancock,	" "

KENNEBEC COUNTY.

Elm Brook Farm Co., Farmingdale.	Regular stock.
Erskine, John N., Chelsea,	Small fruit.
Gabree, James, Chelsea,	" "
Glidden, Mrs. C. M., Gardiner,	" "
Jones, Willis E., So. China,	" "
Jones, W. H., China,	" "
Lawrence, H. C., Chelsea,	" "
Merrill, F. R., Augusta,	" "
Metcalf, Frank, Albion,	" "
Patterson, Frank, China,	" "
Perkins, Chas. S., Vassalboro,	" "
Perley, C. A., Winthrop,	Regular stock.
Perley, Clarence, Winthrop,	Small fruit.
Perley, Fred W., Vassalboro,	" "
Pike, Geo. A., Winthrop,	" "
Stevens, E. W., Augusta,	" "
Ward, Edwin, China,	" "
Ward, Freeman, China,	" "
Ward, O. U. G., China,	" "
Wiles, Z. D., Gardiner,	Regular stock.

KNOX COUNTY.

Ayer, Wallace A., Union,	Small fruit.
Glaentzel, Geo. H., Camden,	Regular stock.
Lufkin, W. C., Rockland,	Small fruit.
Simmons, R. B., Appleton,	" "
Thurston, Philo, Union,	" "

OXFORD COUNTY.

Bryant, James J., Buckfield,	Small fruit.
Conant, A. A., Hebron,	" "

PENOBSCOT COUNTY.

Carter, J. Lewis, Bangor,	Small fruit.
Eastman, A. A., Dexter,	" "
Edminister, David, Hermon,	" "
Fogg, A. B., Bangor,	" "
Gould, W. S., Brewer,	" "
McCabe Bros., Bangor,	Regular stock.
Osbourne, Wm. E., Brewer,	Small fruit.
Overlock, Fred, Bangor,	" "
Phillips, James M., Bangor,	" "
Phillips, John C., Levant,	" "
Phillips, W. W., Bangor,	" "
Pomroy, L. H. & I. L., Glenburn,	" "

Richardson, Chas., Levant,	Small fruit.
Smith, A. C., Hermon,	" "
Smith, D. B., Bangor,	" "
Smith, H. A., Hermon,	" "
Smith, J. E., Newport,	" "
Smith, P. J., Bangor,	" "
Wing, Forest, Levant,	" "

PISCATAQUIS COUNTY.

Cleaves, F. W., Sangerville,	Small fruit.
Howard, S. D., Sangerville,	" "
Knowlton, Sanger, Sangerville,	" "

SAGADAHOC COUNTY.

Dunnell, A. H., West Bath,	Small fruit.

WALDO COUNTY.

Stantial, A. R., Belfast,	Small fruit.
Vose, Chas. C., Belfast,	" "

YORK COUNTY.

Fernald, W. Linwood, Eliot,	Regular stock.
Hazelton, F. H., Old Orchard,	Small fruit.
Mahoney, Geo. L., Saco,	Regular stock.
Moulton, Milton S., West Scarboro,	Small fruit.
Murch, G. A., Old Orchard,	" "
Smith, T. W. A., Biddeford,	Regular stock.
Strout's, Biddeford,	" "
Whitman, B. M., Old Orchard,	Small fruit.

An important step has been taken in the right direction, as a result of the movement for better fruit. It is the starting of an apple nursery of 50,000 trees in the State. These were set last spring and budded this summer. At the time of writing they are in good condition. The stock is of France seedlings. They have been budded to standard Maine apples, such as Baldwins, Spys, McIntosh Red, etc. If nothing goes wrong these trees will be ready for the market in 1912 or '13. We feel that this is a movement in the right direction and would like to see some native stock from Tolman or Spy seeds raised on a large scale for nursery purposes. This may come in the near future.

As indicated in my last report, the movement for better fruit received an impetus when the late James J. H. Gregory made his offer for Maine orchards. Hardly had the papers announced his magnificent gift before others joined in the movement. The following is a list of premiums offered.

GREGORY PREMIUMS.

Better Fruit for Maine.

The following premiums are offered for the best acre of apple trees set in the spring of 1910 and judged in 5 years:

1st,	James J. H. Gregory prize.........	$200
2nd,	Premium by a friend..............	150
3rd,	Bowker Co.	100
4th,	B. G. Pratt Co....................	100
5th,	Douglas Pump Co.	100
6th,	Deming Pump Co., Salem, Ohio....	50
7th,	Chas. J. Jager Co., Boston, Mass....	50
8th,	Portland Farmers' Club	50

Registration blanks were sent out and have been returned to the office to be kept on file.

Owing to a scarcity of nursery stock many who contemplated entering the contest were unable to do so.

GREGORY INSPECTION.

As soon as the annual nursery inspection was begun it was thought best to make an inspection of the registered orchards, so the two were combined, requiring but one trip for the complete record.

My other duties have been so urgent that this work has mostly fallen to my assistant. Much extra time has been spent, as it often required many hours of evening work in order to get around in time for the next day's trip. Much credit is due Mr. Yeaton for his faithful work along this line. If he wasn't an enthusiast along orchard lines much valuable data would be lacking.

In the inspection much of interest has been gathered, of which we note the following:

Insect Injury.—Most of the insect injury is with the green apple aphis, which was noticed in almost every orchard. In one orchard the Saddled Prominent (*Heterocampa guttivitta*) had stripped several trees (this is the only record of the kind that has come to our notice this year). Climbing cut worms stripped two trees in one orchard. Red-humped caterpillars were found in five orchards; yellow-neck caterpillars in one; San Jose scale on one tree in one orchard; woolly aphis on quite a number, but these were destroyed by spraying with kerosene oil emulsion. Mice injury was reported in two orchards and injury from deer in two others. Cattle injured every tree in one orchard and another orchard was practically destroyed by using too much fertilizer. The following is a list of the owners of the orchards entered for prize, as recorded to date:

LIST OF CONTESTANTS FOR THE GREGORY PRIZE.

Abbot, Horace P. .... Eliot
Adams, Fred L. .... Jay
Allen, Harold .... Hope
Bailey, L. Adelbert .... Dresden
Bailey, Roscoe G. .... Wiscasset
Bean & Son, C. S. .... Wellington
Bearce, H. W. .... Hebron
Benner, D. M. .... Monmouth
Berry, H. P. .... Livermore
Bickford, Anson M. .... Oakland
Bishop, Dr. Heber .... Industry
Blake, J. A. .... Farmington
Blaisdell, A. L. .... Winterport
Bragger, Bessie Wentworth .... Exeter
Bragger, Wm. B. .... Exeter
Bridges, Charles .... Guilford
Bryant, C. A. .... Livermore
Bryant, J. B. .... Buckfield
Bryant, J. I. .... Buckfield
Burdick, John A. .... Auburn
Burns, E. L. .... Oxford
Burns, S. L. .... Eden
Calderwood, Jesse F. .... Union
Campbell, Earl W .... Clifton
Carter, John Wm. .... Mt. Desert
Chapman, D. A. .... Newburg
Chase, Isaac .... Turner
Chipman, Chester E. .... Poland
Cobb, S. E. .... Oxford
Conant, E. E. .... Buckfield
Cummings, R. L. .... Woodstock
Currier, Frank .... Morrill
Daggett, Sumner T. .... Foxcroft
Davis, E. E. .... Burnham
Davis, Owen R. .... Woodstock
Dean, J. L. .... Winslow
Dingley, F. A. .... Casco
Dixon, E. S. & Son............ Wales
Dole, L. J. .... Limington
Dolloff, E. W. .... Standish
Douglass, Rothens A..... Bowdoinham
Dow, O. B. .... Monroe
Dresser, H. F. .... Turner
Dunham, Harry E. .... Madrid
Dunton, C. A. .... Hope
Eaton, Harvey D. .... Cornville
Edgecomb, E. S. .... Bowdoinham
Edgecomb, Percy S. .... Belfast
Emery, H. G. .... Eliot
Emery, Osmond .... Hancock
Everett, Persian V. & Son.... Hebron
Farmer, W. L. .... Charleston
Fay, W. L. & B. L. Call ...... Dexter
Fifield, M. S. .... Manchester
Fisher, Sumner .... Winterport
Flint, Arthur E. .... Bridgton
Ford, W. C. .... Whitefield
Ford, L. H. .... Whitefield
French, C. A. .... Temple
French, E. O. & W. A......... Norway
Frost, Augustus C. & Son.... Wales
Gage, Irving O. .... Winthrop
Gay, Charles T. .... Farmington
Gilman, A. W. .... Foxcroft
Gleason, George .... Union
Goodrich, W. W. .... Berwick
Graves, William .... Topsham
Greenleaf, Ausbury C. .... Farmington
Griffin, John C .... Madison
Grinnell, H. L. .... Union
Hall, A. B. .... Addison
Hamilton, John E. .... Garland
Hardy, Arthur J. .... Wilton
Harriman, Charles D. .... Belfast
Hathaway, Gilbert T. .... Auburn
Herrick, A. A. .... Norway
Hescock, Charles H. .... Foxcroft
Hills, Rufus P. .... Belfast
Hitchings, E. F. .... Waterville
Hobbs, Miller B. .... Hope
Hussey & Genthner .... Parkman
Irish, F. S. .... Turner
Jillson, Elmer D. .... Greene
Johnson, Everett E. .... Hebron
Johnson, Wm. P. ...... No Yarmouth
Jones, C. L. .... Corinna
Keene, Alton A. .... Hebron
Keene, Frank Henry .... Belfast
King, J. H. .... Bowdoinham
Lachance, Louis .... Lisbon
Lane, A. W. & Sons ...... Vassalboro
Lane, Francis E. .... Litchfield
Lannigan, H. H. .... Mt. Vernon
Lash, Jesse D. .... Waldoboro
Law, J. Wesley .... Union
Leavitt, Arch D. .... Turner
Lee, Lyman K. .... Foxcroft
Leighton, Dr. Ralph P. .. Harrington
Leland, Will E. .... Sangerville
Leland, W. E. & Son .... Minot
Loring, Fred H. .... Parkman
Macomber, A. C. .... Wilton
Macomber, E. W. .... Winthrop
Maine Sanatorium Farm ...... Hebron

Marcotte, Leon T. .... Poland
Matson, Joseph .... Solon
McFadden, Orrin .... Dresden
McNaughton, A. J. .... Foxcroft
Meade, Charlie K. .... Greene
Merrill, Chauncey Dean ...... Auburn
Moon, Curtis .... West Sullivan
Morang, Carrie E. .... Ellsworth
Morang, C. L. .... Ellsworth
Morrill, Willard A. .... Belmont
Morse, Wilson M. .... Waterford
Nason, Charles E. .... Wiscasset
Nason, Harry J. .... Saco
Nealley, Bertha E. .... Monroe
Newman, Herbert L. ...... Mariaville
Nichols, H. A., & L. A. Jack.... Lisbon
Oakes & Sons, A. A. ...... Chesterville
Osgood, Charles F. .... Garland
Packard, James R. .... Monmouth
Page, Ernest E. .... East Corinth
Page, E. D. .... Hermon
Patten, Mrs. Lois W. ...... Skowhegan
Patten, Ralph J. .... Topsham
Patten, Roland T. .... Skowhegan
Paul, Delbert .... Morrill
Pettingill, George W. .. East Livermore
Phillips, Willard H. .... Hancock
Plummer, S. Lyman .... Lovell
Potter, Warren J. .... Monmouth
Ralph, W. B. .... Waldoboro
Reaves, A. F. .... Bowdoinham
Ricker, F. A. & Sons .... Turner
Ricker, George B. .... Cherryfield
Ricker, W. J. .... Turner
Rose & Sons, Stephen W. .... Greene
Saunders, I. F. .... Hebron
Saunders, I. F. & Son .... Hebron
Sawyer, A. A. .... Winthrop
Savage, Mark N. .... Lewiston
Scott, E. W. .... Harrington
Shute, Herbert C. .... Hancock
Small, George R. .... North Yarmouth
Small, R. H. .... Harrington
Smith, Anna M. .... Gorham
Smith, M. B. .... Belfast
Soper, F. M. .... Winthrop
Spaulding, Leslie C. .... Mechanic Falls
Sprague, C. E. .... Skowhegan
Sprague, Mrs. P. C. ...... Skowhegan
Strout, George E. .... Milbridge
Sturtevant, Ernest W. .... Peru
Swain, John P. .... Farmington
Thurston, Raymond E. .... Union
Towns, Frank L. .... Madison
Tucker, Herbert M. ...... Livermore
Tukey, Daniel P. .... Auburn
Twitchell, Dr. Geo. M. ...... Auburn
Vaughan, Wm. Jr. .... Belfast
Verrill, H. M. .... Portland
Vickery, J. F. .... Morrill
Walker, Geo. W. .... Alna
Watson, W. L. .... Monroe
Webber, Fred A. .... Jay
Weeks, Wm. A. .... Wilton
Wentworth, Frances Towle .... Exeter
Werth, Jacob .... Temple
Williams, Henry L. .... Fairfield
Worcester, W. H. .... Columbia
Wyman, F. D. .... Lincoln
Yeaton, J. A. .... Chelsea
York & Sons, C. A. .... Bangor
Young, H. G. .... Brunswick

LICENSED NURSERY AGENTS.

During the past season there were 347 persons licensed to sell nursery stock in the State. With such a number in the field it would not seem strange if some were doing a crooked business. A noted instance of this kind came to light in the case of the large amount of infested stock sold in Hancock and Washington counties. This license has been revoked. Several complaints were made in other sections, but as a rule we think these parties are trying to do a legitimate business.

There are, however, several who are liable to be removed if statements made last season do not clear up. We must depend upon the patrons who receive stock, to notify us at once, on receipt of stock, if it is not entirely satisfactory. We would also greatly appreciate the favor if parties who are approached by these agents and are not satisfied with their methods of taking orders, would report to us. A word in time might save a great deal of trouble later, and help the department to keep this line of work upon a satisfactory basis.

The following is a list of those who have been licensed in 1910:

LIST OF NURSERY AGENTS LICENSED BY THE STATE ENTOMOLOGIST FOR THE YEAR 1910.

Abbott, Hiram F. ......Rumford Pt.
Allen, Perley C. ....Montville
Ames, J. F. ....Kenduskeag
Anderson, Arthur A. ....Jemtland
Andrews, C. L. ....Portland
Archer, Elmer ....Chester
Arthur, C. E. ....Farmingdale
Atkins, A. W. ....West Peru
Attwood, E. P. ....Mechanic Falls
Austin, Andrew H. ....Shapleigh
Ayer, George S. ....Saco
Banks, Henry G. ....Richmond
Barlow, L. A. ....East Boothbay
Bartlett, Andrew ....Orient
Bartlett, Fred ....Houlton
Bartlett, Thos. H. ......Island Falls
Barton, Edwin A. ....Casco
Barton, R. S. ....Waterville
Baston, Harry S. ....Moro
Bean, Charles E. ....Sanford
Beane, Oral T. ....Caratunk
Beedy, Bernard S. ....Bingham
Bell, Wm. P. ....Westfield
Bicknell, L. H. ....Albion
Billington, H. C. ....Surry
Blethen, Geo. P...........Thorndike
Bolton, F. J. ....Portland
Booker, John F. ....Somerville
Bootuby, Asa ....Westbrook
Bradford, Albert T. ....Turner
Briggs, J. Franklin ......Kennebunk
Briggs, Walter S. ....Littleton
Brown, I. L. ....Bucksport
Brown, Nelson W. ....Milo
Brown, W. W. ....Old Town
Bunker, Francis W. ..Cranberry Isles
Burges, P. A. ....Andover
Burleigh, Arthur A. ......Biddeford
Burns, S. L. ....West Eden
Burrill, Stacy L. ....Monroe
Butler, William ....Foxcroft
Butterfield, Harold C. ....Brownfield
Campbell, John C. ....Steuben
Cannon, S .T. ....Augusta
Carter, Ruel S. ....Bradley
Carver, Augustus ......Pulpit Harbor
Carver, W. H. ....Bucksport
Cassidy, M. L. ....Calais
Chadbourne, Chas. L. ..North Bridgton
Chadwick, Hiram W. ......Port Clyde
Chamberlain, Francis A. ......Castine
Chapman, Curtis ....Kezar Falls
Chapman, Mrs. H. B. ....Auburn
Cheney, H. E. ....Bowdoinham
Cleaves, Howard F. ......Old Orchard
Cobb, Willard ....Paris
Cole, Joseph E. ....Union
Colson, W. A. ....Searsport
Coneter, Ancil ....Vanceboro
Combs, Arthur W. ..Northeast Harbor
Cowing, John F. ....Dedham
Cox, Rev. A. M..............Morrill
Crawford, Willis P. ....Hudson
Crocker, Hiram D. ......East Machias
Cummings, Lincoln ....Bethel
Cunningham, W. J. ....Oakland
Cushman, Edward H. ....Portland
Dailey, E. L. ....Canton
Daggett, Lee ....Strong
Dakin, E. J. ....Wilton
Danforth, D. W. ....Fairfield
Danforth, John R. ....Washington
Davis, A. C. ....South Paris
Davis, Edmund ....Turner
Davis, E. B. ....Rumford
Davis, George ....Searsmont
DeBeck, Earl ....Clinton
DeMarey, Henry N. ....Lincoln
Dennison, L. H. ....Mercer
Doak, J. L. ....Rangeley
Dobbs, Charles ....North Anson
Dole, Leslie J. ....Holden
Domansky, R. C. ......North Castine
Douglass, Burton ....Belfast
Douglass, B. B. ....Bowdoinham
Dow, Sewall ....Old Town
Dowie, F. G. ....Mexico
Dudley, Frank H. ....Auburn
Dudley, O. P. ......West Farmington
Dunning, Herbert A. ....Bangor
Dunphy, A. J. ....Highland
Duran, Jas. F. ....Charleston
Dyer, Alden ....Eastbrook
Dyer, Geo. G. ....North Gorham
Eaton, James R. ....Calais
Eaton, Samuel H. ....Oxford
Eaton, Winfield W ..South Thomaston
Eaton, Z. B. ....Phippsburg
Ellingwood, A. P. ....Monroe
Elliott, L. D. ....North Rumford
Emery, W. S. ....North Berwick
Emmons, Benjamin C., West Kennebunk
Erskine, Joseph F..........Wiscasset
Fadden, Edgar F. ......West Newfield
Fairbanks, A. E. ....Monmouth
Fall, G. W. ....Garland
Farnham, Mark ....Wells
Faught, Herman A. ....Belgrade
Fenderson, W. P. ....Dennysville
Fernald, C. G. ....Old Town
Fernald, Fred H. ....Newport
Fernald, Miss P. Estelle ....Dixmont
Fickett, Miss Minnie ....Saco
Finney, J. O. ....Locke's Mills
Flagg, James H. ....Augusta
Fox, A. N. ....South Berwick
French, DeLeon A. ....Norway
French, Randall B. ......Lincolnville
Frizzell, J. N. ....Mercer
Frost, Stephen D. ....Baring
Gardiner, W. E. ......Fort Fairfield
Gardner, Richard C. ......Stonington
Garney, A. Frank ......No. Shapleigh
Gaudet, Albert L. ....Rockwood
Gerow, Wallace R. ....Houlton
Gerrish, Gerald L. ....Sanford
Gillchrest, Walter A. ......Thomaston
Gilman, H. W. ....South Berwick
Gordon, Wilson M. ....Winn
Gott, J. M. ....Wayne
Gould, R. D. ....South Paris
Gove, G. W. ....North Searsmont
Gray, E. W. ....Columbia Falls
Gray, Frank L. ....Centre Lincolnville
Gray, George H. ....West Kennebunk
Gray, William D. ....Bowdoinham
Greene, Henry ....Linneus
Greene, M. M. ....East Bowdoin
Gregory, George E. ....Hartford
Grover, John P. ....Brewer

Gushee, A. C. ....Appleton
Hale, Herbert H. ......North Brooklin
Hall, F. A. ....Sebec
Hamlin, Geo. A. ....Gardiner
Hammond, Nathan P. ......Danforth
Haney, C. F. ....Camden
Hart, Rodney E. ....Ellsworth
Haynes, G. H. ....Lincoln
Helme, A. G. J. ....Dexter
Herrin, Forrest ....Cornville
Hersey, G. L. ....East Corinth
Hichborn, F. O. ....Portland
Higgins, Ernest D. ....Morrill
Hight, Elmer V. ....Harmony
Hinckley, A. E. ....Portland
Hiscock, Augustus ..West Farmington
Hocking, Alfred C.........St. George
Hodgdon, D. W. ....Boothbay Harbor
Holland, Fred ....Buckfield
Holmes, Amos E. ....Oakland
Hopkins, John ....West Peru
Howard, J. F. ....Fort Kent
Howard, Justin W. ......Lexington
Hubbard, Melvin ....Canaan
Huntress, Geo. I. ....Porter
Huntress, Sarah L. ......So. Berwick
Hussey, J. C. ....Oakland
Jenkins, John Henry ....Presque Isle
Johnston, Orla G. ......Washington
Jones, S. L. ....West Kennebunk
Jordan, J. A. ....Bingham
Judkins, John E. ....Stonington
Judkins, N. F. ....Madison
Kiah, Paul J. ....Jackman
Kimball, G. E. ....Pittsfield
Knight, Edwin W. ....Sweden
Knight, Philip E. ....Pownal
Knowlton, Chester D. ....Monroe
Labbi, V. J. ....Eagle Lake
Lamb, James ....Robbinston
Lamson, Hanson S. ....Liberty
Lane, C. A. ....Waterville
Larrabee, Chas. ....Charlotte
Laurence, Warren H. ......Palmyra
Leach, Maxwell Everett ......Castine
Leavitt, H. W. ....Newport
Lee, Harold Lester ....Jay
Leeman, E. T. ....Millinocket
Leighton, C. H. ....Augusta
Lewis, Harry ....Shawmut
Libby, Arthur W. ....Portland
Libby, J. S. ....Harmony
Linscott, Isaac L. ....Brunswick
Linscott, Oscar A. ....Lamoine
Linscott, Arthur F. ....Troy
Littlefield, S. L. ....Poland
Lombard, I. C. ....Steep Falls
Loring, E. D. ....No. Yarmouth
Mace, W. L. ....E. Winthrop
Macomber, E. R. ....Portland
Margridge, James ....Dexter
Matson, Joseph ....Solon
McAlister, F. A. ......Livermore Falls
McCabe, E. T. ....Palmyra
McCabe, John C. ....Bangor
McCabe, George L. ....Bangor
McCabe, Robert F. ....Bangor
McClure, Fred R. ....Cornville
McCormick, Chas ....Kingman
McElroy, Harry ....Marion
McKechnie, George B. ......Danforth
McLaughlin, Angus ....Lincoln
McQuarrie, Wm. S. ....Ashland
Merrick, W. S. ....Unity
Merrill, A. J. ....Bangor
Merrill, James ....Augusta
Mitchell, Alton Ray ....Troy
Mitchell, H. R. ....Waterville
Monroe, George H. ....Milo
Moore, E. A. ....Skowhegan
Moore, Howard W. ....Pembroke
Morse, C. M. ....Gray
Morrill, Herbert O. ....Gorham
Morris, George R. ....Oxford
Moulton, Jeremiah ......Cape Neddick
Nash, A. D. ....Damariscotta
Newcomb, D. L. ....Portland
Newcomb, F. H. ....Winterport
Nichols, Peter ....Gloucester
Norris, Edmund B. ....Gardiner
Norton, A. D. ....Farmington
Norton, Mary E. ....Farmington
Noyes, Colby J. ....Jonesboro
Noyes, Reno P. ....Wilton
Nutter, John W. ....Montville
O'Brien, Horace ....Portland
O'Roak, T. K. ....Kingman
Packard, G. H. ....Bridgton
Partridge, G. H. ....Gorham
Patten, L. P. ....Herman
Payson, H. H. ....Hope
Pendleton, G. S. ....Warren
Perham, John F. ....Farmington
Perkins, F. B. ....Penobscot
Perry, Chas. C. ....Sullivan
Peters, Andrew J. W. ....Bangor
Phillips, Milton ....Madison
Phillips, W. H. ....Hancock Pt.
Phinoon, Walter ....Livermore
Pitcher, A. I. H. ....Lincolnville
Poland, A. L. ....Hartford
Powers, Chas. E. ....Sunset
Prescott, Emery ....Etna
Preston, Andrew J. ......Dennysville
Pulsi er, Geo. E. ......West Sumner
Purinton, W. S. ....Augusta
Raymond, J. O. ....Winthrop
Reynolds, Geo. L. ......Graniteville
Rich, G. W. ....South Newburg
Richardson, W. H. ....Lovell
Ritchie, Elijah ....Belfast
Rivers, Harold ......Tenant's Harbor
Roberts, James A. ....Waterboro
Robinson, Delmore ....Bridgton
Robinson, Frank ....Robinson
Rollins, E. P. ....Warren
Ross, T. F. ....Saco
Rowe, Harry L. ....Berwick
Ryan, Roy G. ....Calais
Sabin, John H. ....Danforth
Salley, Harry A. ....Atkinson
Sanborn, D. S. ....Norway
Sands, Robie H. ....Bingham
Sargeant, A. E. ....Lamoine
Sargent, Solomon ......So. Gouldsboro
Savage, J. A. ....Skowhegan
Savage, J. Frank ....Woolwich
Savoie, Joe ....Eagle Lake Mills
Seavey, Jedediah ....Bucksport
Simmons, Gilbert ....North Jay
Simmons, S. N. ....Appleton
Simpson, F. A. ....Winterport
Sinclair, George L. ....Columbia Falls
Sinkinson, Edward P. B. ..Woodfords
Small, R. H. ....Harrington
Smart, J. E. Jr. ....Seboeis
Smith, Alfred J. ....Gardiner
Snow, H. O. ....Frankfort
Sodergren, John J. ....Stockholm
Spear, Charles T. ....Rockland
Stanchfield, Frank W ....Veazie
Staples, Charles C. ....Shapleigh
Staples, Charles E. ....Haven
Staples, Nicholas ......W. Kennebunk
Stevens, Fred W. ....Garland
Steves, D. G. ....Hallowell
Stitham, A. ....Bridgewater
Stilphen, H. A. ....Alna

Strout, George E. ....Milbridge
Tash, George W. ......New Vineyard
Tash, James A. ....Salem
Tebbetts, Isaac ....Readfield
Templeton, Orrin ....Greenville
Thomas, H. C. ....Sumner
Thomas, J. H. ....Roxbury
Thompson, W. A. ....Livermore
Thurston, Elmer E. ....China
Thornton, F. C. ....Brookton
Tracy, Jason L. .... Gouldsboro
Tucker, J. R. ....West Paris
Twombly, F. S. .... Buxton
Underwood, James A. .... Lisbon Falls
Viles, Blaine S. .... Augusta
Wadsworth, W. D. ...... South Hiram
Ward, Lowell E. .... Embden
Ward, W. B. Jr. ....Limestone
Walker, Fred I. ....Swanville
Warren, Joseph H. .... Dexter
Wasson, Loring S. .... Bucksport
Webb, Frank .... North Paris
Webber, Samuel H. ....Hallowell
Weeks, Will S. .... Parsonsfield
Wentworth, C. C. .... Gardiner
Wentworth, E. J. .... Sanford
Wentworth, Leslie .... Searsmont
Wheeler, C. W. .... Houlton
White, Albert K. .... Portland
White, J. W. .... Ludlow
Whiting, Charles H. ...... Gouldsboro
Whiting, Ethel .... Belfast
Whiting, Frank O. .... Belfast
Whitney, Geo. M. ....West Falmouth
Wiggin, C. S. .... Waterford
Wiley, James .... Milo
Wilson, Thomas E. .... Kittery
Wincapan, Mrs. Alma M. ... Monhegan
Winslow, A. T. .... Otisfield
Winslow, Caleb .... Poland
Wood, E. L. .... Troy
Woodbury, David B. ..... South Paris
Woodman, F. D. .... Winterport
Wright, Charles E. ....Hartland
Wright, Frederick T. .... Old Orchard
Wright, F. W. .... Wilton
York, Lemont C. .... Mechanic Falls
Young, Charles E. .... Shirley
Young, Esther M. .... Garland

LECTURE WORK.

There is a growing demand for lecture work but owing to the greater call for demonstration work in the field we have been obliged to refuse many calls in this popular line.

The following is a list of the most important:

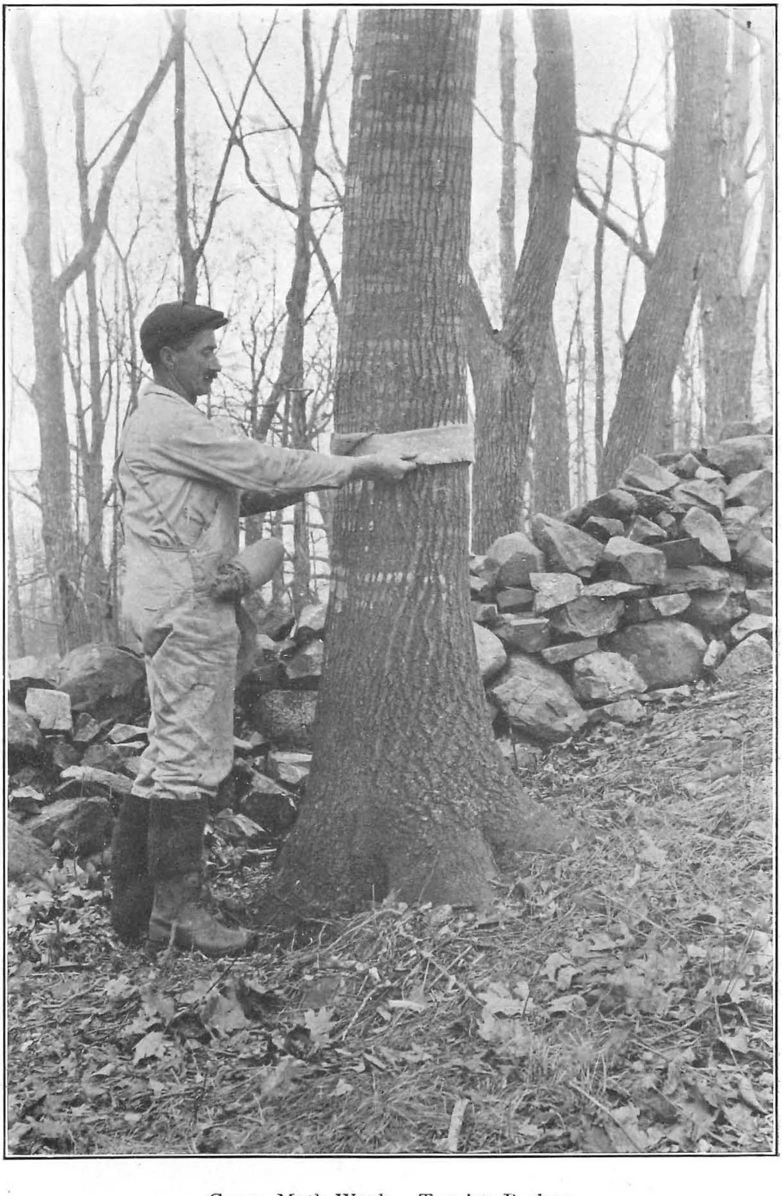
Lectures at Farmers' Institute.............	3
Lectures at Fruit Institute	9
Lectures out of State	3
Lectures at Orchard Demonstration meetings	27
Lectures at Pomological meeting	2
Lectures at Pomona and subordinate Granges	33
Lectures at School and Academies	12
	89
Total attendance	7,702

At the present time there are about 100 nurseries in the State, counting those who sell plants of the small fruits. There are about 200 Gregory orchards. Besides the inspection of these, many requests are made for inspection of orchards, city shade trees and parks. This work added to other labors of the Bureau made it necessary to appoint an assistant to aid in the work. Mr. G. A. Yeaton, of Augusta, was chosen for this position, and a more faithful and efficient person could not have been selected for this purpose. He has put his whole time and energy into the work of the Bureau, thus accomplishing what could not have been done but for his faithful work. Frequently he has been called upon to take charge of orchard demonstration meetings and was placed as one of the speakers to demonstrate methods of orchard management.

Respectfully submitted,

E. F. HITCHINGS,

State Entomologist.



Gypsy Moth Work. Turning Burlaps.

REPORT OF SPECIAL FIELD AGENT.

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

I herewith submit my fourth annual report as Special Field Agent in charge of gypsy moth work.

It may be well at the outset to state that the actual limits of the district infested by the gypsy moth in the State of Maine are not yet known, and will not be determined until such time as funds for a more thorough examination of the outlying towns by the trained scouts are available.

To correctly ascertain the extent of the infested section and to properly handle the same, a force of at least 75 trained men might well be employed for the greater part of an entire year. Such operations, however, have been impossible in view of the great need of suppressing the moths in the badly infested woodlands of the towns in the southwestern part of the State.

It has not seemed wise to spend too much of our limited appropriation in scouting new territory, while in the badly infested towns there has been an opportunity to destroy egg clusters and caterpillars by the hundreds of thousands, and thus relieve the people of such towns from caterpillar annoyance and damage to woodlands and orchards. The only course for the new Legislature is to make such appropriation as shall, together with those made by Congress, enable those in charge of the work of suppression to prevent the further spread of this pest and gradually reduce the infested area. The appropriation must necessarily be larger than the last one made so that every infested place, however small, can be attended to, even in the forests. If this forest work is neglected by insufficient appropriations, the moths in slightly infested places, like those in Acton, Newfield, Shapleigh, Gorham, Lebanon, Alfred and many other towns in the northern part of York County, will spread rapidly, and in consequence all of the valuable timber will be absolutely destroyed by the feeding of the caterpillars.

The owners of timber lands and orchards in the eastern and central part of Maine—the part not yet infested with the gypsy moth—have such a fear of this pest and desire so strongly to be protected from it, that, as far as I am able to learn, they are more than ready and willing to pay their part of such appropriations as may be necessary to prevent the insect from spreading beyond its present limits and eventually invading their lands. Should the gypsy moth be allowed to increase and spread, such a course would end in enormous loss of wealth to the State of Maine.

Massachusetts has expended about $6,000,000 in the moth work. This is a large amount of money. Massachusetts is a rich state and is able to expend such a sum of money for such a purpose, but for Maine, the prospect would be ruinous. Hope must be placed in the Legislature of 1911-12 to make such appropriation as may be necessary to stop the spread of the moth to new territory, the purchase of more high power spraying machines as well as the introduction of parasites and other natural enemies of the gypsy moth.

The appropriations made by previous Legislatures have not been large enough to properly carry on the work throughout the entire year and a system of co-operation has existed between the Government Field Agent and this office, so the work could be continued uninterruptedly.

By such an arrangement it has been possible to keep most of the force employed during the entire year. This is an important factor in our work, as by this method we are able to train and keep the men of the force up to a high degree of efficiency.

The work in Maine has been carefully and thoroughly handled by the force and the men have shown much interest and enthusiasm in meeting this difficult problem.

All of the known colonies have been given most thorough attention, and their conditions have improved each year. Many new infestations have been discovered in the already infested towns and cities and several new towns have been added to those already known to be infested. The scouting is still being carried on by the government, and without any doubt, many more towns will be found infested.

During the year 1910 the work against the gypsy moth has been carried on practically along the same lines as in the three preceding years, and with the same gratifying results.

The scouting operations which were begun in the fall of 1909 were carried on until May, 1910, 75 trained men being employed for this work. During May and June spraying operations were carried on with excellent results. Ten and one-half tons of arsenate of lead were used in this work and millions of caterpillars were destroyed.

Owing to the bad poisoning received from the brown-tail moth under the burlaps last year, I waited until the brown-tail moth had pupated before allowing the men to begin putting on burlaps this year, which was July 1st. Eighty-five thousand trees were burlapped and carefully attended during the months of July and August. One hundred eighty-five thousand eighty-six caterpillars were taken from the burlaps and destroyed. Nine and one-half bales of burlap were used in this work. Thousands of caterpillars were destroyed by fire in the burning operations on the ground and in stone walls. Six barrels of crude oil were used in the work. Considerable cutting, cleaning, thinning tree tops, pruning, tin patching and scraping of trees in orchards and woodlands was done during the months of January, February, and March.

Owing to the shortage of funds we were obliged to stop work the latter part of August. In October the work of scouting was again taken up and is now being carried on by the government. During the scouting operations, 53,894 egg clusters were found and creosoted. If these egg clusters had been allowed to hatch they would, without any doubt, have brought forth 20,000,000 caterpillars.

The following new towns have been scouted and found to be quite badly infested, viz: Parsonsfield, Lyman, Standish, Portland, Westbrook, Buxton, Cape Elizabeth, Old Orchard and South Portland.

The following list shows the towns now infested with the gypsy moth in York and Cumberland Counties, total 30: Kittery, York, Eliot, Wells, Kennebunk, Kennebunkport, Portland, Westbrook, Buxton, Cape Elizabeth, Old Orchard, Biddeford, Saco, Scarboro, South Portland, Gorham, Standish, Dayton, South Berwick, North Berwick, Acton, Parsonsfield, Waterboro, Shapleigh, Berwick, Lebanon, Newfield, Sanford, Lyman, Alfred.

LUMBER INSPECTION.

The inspection feature of this work is of greatest importance and must be well organized and enforced to obtain results. At the present time the work is being done entirely by the government, and is not being looked after as sharply as it demands. Cars have been shipped from Maine to other states during the year without the necessary permit, but this fact was not discovered until the cars had been away from the State for some time. The Boston & Maine R. R. again sent into the State cars loaded with shim wood which was distributed along the tracks from Wells to Portland. Capt. Spinney and his crew found this shim wood badly infested with egg clusters at Pine Point, Old Orchard, Scarboro Beach and Rigby Stations.

This work demands great attention to prevent new infestations from being established at distant points as well as to prevent new colonies or infestations in our own State.

FIELD DAY.

The third annual field day of the force was held at the Lyman Hastings Hotel at York Beach on August 31st, and was a great success. A shore dinner was served at noon after which speeches were made by Hon. A. W. Gilman, Commissioner of Agriculture, Mr L. H. Worthley of Massachusetts Department for Suppression of Gypsy Moth, Col. T. H. Dearborn of the New Hampshire Department, Hon. Horace Mitchell of Kittery, Mr. Spinney of North Berwick, Prof. E. F. Hitchings, State Entomologist, and others. It was a very enjoyable time, many visitors from Massachusetts, New Hampshire and Maine being present.

LECTURES, CORRESPONDENCE AND EXHIBITS.

During the year 1910, fifteen lectures have been given before different societies, all of which were illustrated with lantern slides. One thousand fourteen letters relative to the gypsy moth have been received and answered. One exhibit was made at the Food Fair in Portland.

I now have over 100 lantern slides illustrating the gypsy moth work in Maine, showing the forces at work scouting, burning, turning burlap, cleaning and cutting woodlands, scraping, pruning and tin patching the orchard trees, as well as the life history and hiding places of the moth.

ACKNOWLEDGMENTS.

I am glad at this time to acknowledge the help received from others interested in the work; the advice and assistance received from the Government Field Agent, D. M. Rogers, which has been freely sought and as freely given. To the inspectors, foremen and members of the field force I am glad to acknowledge my obligations for loyalty to the department, and their efficiency, to which in no small measure is due the success obtained.

PARASITES.

A considerable number of parasites and natural enemies of the gypsy moth have been received at the laboratory in Melrose, Mass. These have been liberated and conditions at the present time seem to warrant the hope that eventually much good will result from this work. It should be borne in mind, however, by those who are over enthusiastic as to the possibility of controlling the gypsy moth by means of parasites, that there are but few cases on record where work of this kind has been entirely effectual. Until it has been demonstrated that natural enemies can control the situation it is folly to curtail the amount of work which is being employed for the destruction of this pest.

The following is a list of the infested towns and the condition of same as far as it is possible to learn at this time.

KITTERY.

The work here has been done faithfully and intelligently by the crew located in the town, but for all that the infestations have increased to quite an extent. During the fall scout in October over 150 new colonies were found on trees along the highway, which indicates that the same had been brought from New Hampshire on automobiles or other conveyances. The old infestations have been carefully attended, with excellent results. The scouting has been carried on with the same care as heretofore, with the result of finding and destroying 3749 egg clusters.

During the summer months the trees were burlapped and attended each day, which resulted in finding 17,432 caterpillars.

Spraying was done on a much larger scale than ever before and thousands of caterpillars were killed by the poison.

The scouting of the balance of town will be finished by the government after the first of January, 1911. Many of the old orchards have been attended to, which will make the work here much easier to handle and will give the men a better chance to get into the woodlands.

Owing to the new infestations found along the highways a great deal of work will be required in this town next year.

YORK VILLAGE.

I am again glad to report the excellent condition of this village relative to gypsy and brown-tail moths.

A larger amount of spraying has been done than ever before, with the same gratifying results. Millions of both gypsy and brown-tail moth caterpillars have been killed by the poison used.

The excellent condition of both the orchard and shade trees in this village is a striking illustration of the wisdom of spraying.

The usual campaign of scouting, spraying and burlapping was carried on in a most satisfactory manner and with good results.

During the scouting season 1584 egg clusters were found and creosoted. After July 1st the trees were burlapped and carefully attended, with the result of finding 6104 caterpillars under same.

The excellent public spirit shown by the officials and citizens of this town is worthy of the highest commendation.

Much credit is due the foreman and crew located here for the good work which has been done.

YORK (BRIXHAM AND AGAMENTICUS DISTRICTS.)

Agamenticus—This is the very worst infested part of the whole State and it will require much work and money to properly handle same. There are 9600 acres in this colony, of which three-fourths is heavily wooded. Extending from Mt. Agamenticus to the center of south Berwick on the north and to the town of Wells on the east, it is a menace to all of the surrounding country, and unless cleaned out and attended to, the infestation will continue to spread until it will become impossible to handle it. A great deal of work has been done here during the year and the conditions are much improved over last year. Large tracts of woodlands have been cleared of underbrush, the deadwood taken from the trees and spraying and burlapping done, with excellent results.

Many acres of ground have been burned over and millions of caterpillars destroyed by the fire. During the scouting operations carried on in the early part of the year 29,054 egg clusters were found and treated.

During the burlap season over 30,000 trees were burlapped and attended, with the result of finding 104,693 caterpillars, which were destroyed. Millions of caterpillars were killed by the arsenate of lead used in the spraying work.

No scouting has been done here this fall so it is impossible to state the exact conditions at the present time. The government crews will scout this territory after the first of the year.

Brixham.—The conditions in this district are nearly as bad as those existing in Agamenticus district. There are many bad woodland colonies which are in bad shape and it will require much work to properly handle them. The usual methods were employed during the year for the suppression of these infestations. Scouting, cleaning, burning over the ground, spraying and burlapping were carried on with good results. During the scouting in the early part of the year 2597 egg clusters were found and destroyed.

A large amount of spraying was done both in woodland and orchard with excellent results. 2595 trees were burlapped and carefully attended, which resulted in finding and killing 12,682 caterpillars.

In addition to the above figures many thousands of caterpillars were killed by fire and spray.

No scouting has been done here this fall. The government crew will scout this section after Jan. 1st, 1911.

ELIOT.

Scouting operations were not taken up in this town until April 1st owing to lack of funds. This left but six weeks to scout before the spraying season began, therefore the town is but partly scouted at the close of the year. The government forces will scout here after the first of January. A great deal of spraying has been done both by the citizens and the men of the gypsy moth force.

During the time the work has been carried on in this town it has met with the hearty approval and co-operation of the citizens. They have become interested in the spraying work and have done a great deal of same. This year nearly 2½ tons of arsenate of lead were used by the people of Eliot.

Twenty-five thousand trees were burlapped and carefully attended during the season and 15,362 caterpillars were taken from same and destroyed. The number of egg clusters found in the early part of the year and while finishing up the summer work was 1218. Owing to the bad condition of this town a great deal of work will be necessary.

WELLS.

A general scout in the early part of the year showed the town to be quite badly infested. One thousand eight hundred sixty-seven egg clusters were found and destroyed. No scouting has been done here this fall and it is impossible to tell just what the conditions are. At the present time the condition is much better than at the same time in 1909.

The work has been looked after very carefully by the crew located in this town.

In the season the trees were burlapped and carefully attended, with the result of finding 8963 caterpillars, which were destroyed.

Spraying has been carried on with the most gratifying results, thousands of caterpillars being killed by the poison. About 800 lbs. of lead were used.

This town will be scouted after Jan. 1st, 1911, by the government forces.

KENNEBUNK.

The situation in this town remains about the same as last year. During the summer months quite a few roadside trees were found to be infested with single caterpillars which, no doubt, were brought in on automobiles coming through New Hampshire.

The trees were burlapped and carefully attended during the season; 265 caterpillars were taken and destroyed.

The town was thoroughly scouted in the early part of the year and 117 egg clusters found and destroyed. No fall scouting has been done yet. The town will be scouted by the government crew later.

KENNEBUNKPORT.

The work in this town has been attended to with care but, in spite of this, the infestations have increased this year, many new infestations along the highway being found this fall while scouting. This indicates that caterpillars are being brought from some other towns or possibly from New Hampshire on automobiles. The Post road through New Hampshire, over which most of the machines come, is very badly infested and without any doubt caterpillars are brought on same to the towns along the coast between Kittery and Portland, and possibly farther east.

The scouting operations resulted in finding 172 egg clusters, which were destroyed.

The trees in town were burlapped and carefully attended during the summer months. 124 caterpillars were taken and destroyed.

BIDDEFORD.

Previous to the year 1910 only one egg cluster was found in this town, but, while attending this infestation during the summer, five more infestations were found. They are situated in different parts of the city and it will require considerable work to properly handle same.

The trees were burlapped and attended during the summer, which resulted in finding 72 caterpillars.

The government crew is now scouting the city and without doubt will find other infestations.

SACO.

This city has not shown much during the summer months. The four infestations have been looked after carefully, but only 3 caterpillars were found. I fear that there are more infestations in the upper part of the city and without any doubt the government crew will find them when they scout this winter. The conditions of the city warrant a hard fight to stay the spread of the moth and to exterminate the infestation already found.

SCARBORO.

Last year in scouting but one infestation was found in this town. This was carefully attended during the summer months. While doing this work 6 more infestations were found which were attended, and from all 35 caterpillars taken. The government crew is now scouting the town. This is a large town and contains a great deal of woodland which will require a great deal of work and money to handle. The railroad infestations found here during the winter have not developed any caterpillars and it is safe to say that they are exterminated.

SOUTH PORTLAND.

While scouting the town in the early part of the year two infestations were found near the golf grounds and while attending to these during the summer months two more were found close by. The trees were burlapped and attended carefully, which resulted in finding 235 of the caterpillars. Scouting developed 31 egg clusters.

These infestations are all on the Post road on Main Street and are liable to be carried some distance as the owner of the worst infestation is a truck gardener and drives to the city of Portland each day with his goods. I certainly look for new infestations to develop from this one by these means.

GORHAM.

The scouting of last fall revealed for the first time in this town, one egg cluster. During the summer months this infestation was visited and 1 caterpillar was found. During the scouting this fall 65 egg clusters were found and destroyed. These new infestations are located in every part of the town and much work will be required to properly handle same. The fall scouting was done by the government crew.

STANDISH.

For the first time during the work in this State we were able to get into this town and scout same. The scouting revealed 30 egg clusters. These were located in different parts of the town and undoubtedly many more are to be found in the woodlands.

The situation here is indeed serious and a great deal of work will be required to handle it properly.

The scouting was done by the government crew.

LYMAN.

This is a new town and was found to be quite badly infested during the scouting operations this fall. Fifty-two egg clusters were found and destroyed. The scouting was done by the government crew.

DAYTON.

During the scouting operations of last fall (1909) one egg cluster was found in the town. Nothing was done during the summer. In this fall scout 40 egg clusters were found and destroyed. The scouting was done by the government crew.

SHAPLEIGH.

This town was scouted during the early part of the year and one infestation was found containing 55 egg clusters.

This infestation was visited frequently during the summer and 1 caterpillar was found. No scouting has been done here this fall.

NEWFIELD.

The one infestation in this town was visited many times during the summer and 1 caterpillar was found and destroyed.

No scouting has been done here this fall, but some will be done in the early part of the year 1911.

ALFRED.

The one infestation has been visited many times during the summer, but nothing in shape of caterpillars developed.

The town has not yet been scouted this year, so I cannot give the exact conditions existing. Scouting will be done later, in year 1911.

ACTON.

The infestations in this town were carefully attended during the summer months and 35 caterpillars taken and destroyed. No scouting has been done here this year. This town is so near the New Hampshire line that it is more than possible that many new infestations will develop during the next scout.

WATERBORO.

Nothing has been done in this town this year owing to lack of funds. The government will scout the town during the early part of 1911.

PARSONSFIELD.

During the scouting this fall several infestations were found by the scouts and 160 egg clusters were taken and destroyed. The scouting is now going on and will probably reveal more egg clusters. The government crew is doing the scouting.

SANFORD.

A great deal of good work has been done in this town. The usual methods were employed in the work, such as spraying, cleaning, scouting and the use of burlap. The scouting operations during the year yielded 131 egg clusters, and the burlaps on the trees 370 caterpillars. The spraying operations killed thousands of caterpillars, not only the gypsy moth caterpillars but many other kinds.

LEBANON.

The work in this town has been carried on with the greatest of care and the foreman and crew located here deserve much praise for the manner in which they have handled the work. During the scouting in the early part of the year 534 egg clusters were taken and destroyed; 1203 trees were burlapped and carefully attended during the summer and 341 caterpillars were taken and killed. The town will be scouted by the government early in the year 1911.

BERWICK.

The work of scouting this town was finished about May 1st, and 394 egg clusters were found and creosoted; 4259 trees were burlapped and the same carefully attended during the summer season, which resulted in finding and killing 2904 caterpillars. A great deal of spraying was done and many thousands of caterpillars were killed by the poison. The scouting showed the orchards and woodlands to be generally infested. The work in this town has been carefully looked after and with funds to carry on the work it is safe to say the situation can be easily handled. The citizens are interested and have helped to make the work pleasant for the crew located here. The government will scout the town after January 1st, 1911.

NORTH BERWICK.

No scouting was done here in the early part of the year owing to the lack of funds. During the summer months the trees were burlapped and the same carefully attended to; 5501 caterpillars were taken and destroyed. During the fall scout made by the government crew 275 egg clusters have been found to date and the work is still going on. This town is in bad shape and needs much work next year to hold the insect in check. Considerable spraying was done during the season with good results, many thousand caterpillars being killed by the poison.

SOUTH BERWICK.

Owing to the lack of funds no work was done in this town until May 1st. During the months of May and June spraying was carried on with good results, mostly in infested orchards. Some cleaning, pruning and trimming were done in these same orchards.

The trees were burlapped and attended during the season and 18,749 caterpillars were taken from under the burlap bands and killed. Many thousands more were killed by the arsenate of lead used in the spraying operations.

The town has been partly scouted this fall and 841 egg clusters found and creosoted. More scouting will be done soon after the new year. The town is in bad shape and much money and many men will be required to handle the same.

BUXTON.

While scouting Standish egg clusters were found by Sadler and Spinney. The government will scout this town after the first of the year. As the government crews only scout the roadsides for 100 feet from center of road, it will be necessary to scout all of the towns which they go over to get the egg clusters which are usually found in orchards and woodlands.

OLD ORCHARD.

In scouting this town this fall 7 egg clusters were found and destroyed. These are the first found here. The town has been scouted three times previous.

WESTBROOK.

The state crew scouted this city and found 17 egg clusters. These are the first to be found here. The city has been scouted four times before. The egg clusters found were situated in different parts of the city and it will require much work and money to properly handle same.

CAPE ELIZABETH.

Up to this time the government crew scouting this town have found 19 egg clusters. These are the first found here and it will require prompt attention to keep same in check.

PORTLAND.

A four-days scout by the state crew resulted in the finding of 9 egg clusters in the western part of the city. A more thorough scout must be made at once to properly handle the situation here. The trees of the city are old and will not withstand the ravages of the moth for more than one season and it is necessary to take care of the city trees and make sure that no nests are left to hatch the coming spring. Portland has been scouted four times previously and nothing found.

TOGUS.

The trees were burlapped in and about the Home and very carefully attended during the season. No caterpillars were found and it is safe to report this infestation as being entirely exterminated. This is very important, for if this infestation were allowed to increase and spread it would be but a short time before the moths would migrate to the great woods of the State and do untold damage. This infestation should be watched very carefully for a few years yet.

CONCLUSION.

You will see by this report that we have gained 9 new towns as infested. This is due to the fact of a short appropriation and it was impossible to get into these towns to scout same with the money at hand. The government has done most of the scouting this fall and it will be very necessary to go over the towns again this winter and spring to look over woodlands and orchards which were passed by the government crews. Unless the coming Legislature makes a suitable appropriation for the work it will go beyond our power and the State will have the same condition confronting it as now exists in Massachusetts and New Hampshire.

E. E. PHILBROOK,

Special Field Agent.

INSTITUTE PAPERS.

BREEDING THE DAIRY COW.

By EDWARD VAN ALSTYNE, Kinderhook, N. Y.

In speaking of the breeding of the dairy cow I do not want to be misunderstood. I want to talk a little in the beginning about the pure-bred animal, and I want to say that there is no man that holds a pure-bred animal in higher esteem than I do; and I do not want you to construe anything that I say later on about breeding grades to mean that I do not value pure breeding.

I want to talk to you about the pure-bred animal. When we are going to build up a dairy herd the first thing is to get some type in mind. If the first thing is to be the production, then I think it is established beyond doubt that what we want to breed for that purpose are the Channel Island cattle. Why? Because they have been bred for two centuries just for the purpose of producing butter. They are rather small animals, have adapted themselves to their environment in the Channel Islands, with their rather bleak climate in some parts of the year, and rather scant forage—animals that have been bred along one line, cows that can produce a pound of butter-fat cheaper than any other cows in the world. Not only that, but from animals of that line of breeding can more readily be made a fine line of butter products, more easily churned, at a higher temperature, of superior grain and higher color.

On the other hand, if our idea is to produce milk, without much regard to its fat, then I think it admits of no doubt that we can produce a quart of milk most economically from a type of animal of the Holstein breed—that for more than 2,000 years have been bred for that purpose. While the Jersey and the Guernsey cows have been bred in these little islands, with the food rather scanty, the Holstein has been bred in the fertile pastures of Holland, where she can get all she wants of food with the least possible exertion. Her food has been of a bulky nature, and it has developed an animal just the counterpart of the Channel Island cattle. If our environment is of that nature, and we want that kind of a product, then I believe that is the kind of a cow to which we should turn our attention.

If our pasture land is more abundant and rougher, and the cattle must spend more time and more effort in gaining the food, if we want the milk that is very well balanced in fats and solids, then I think the farmer would do better to take up a cow of the Ayrshire type.

All these high attainments have come through line breeding, not through cross-breeding; the Holstein cow having been bred with her kind for all these years, and the Channel Island cattle having been bred with their kind, just as these elegant beef cattle have been bred with their kind. One of the greatest fallacies of today is this notion of cross-breeding. I am asked this question more than any other: "What do you think of this cross?" or "What do you think of that cross?" or "What animal shall I put with my cows to bring me better results?" For instance, a man comes to me and he says, "What shall I use to cross on my Jersey cow to give me more milk," or "to cross on my Holstein to give me more butter?"

It is a very common thing to think that we can take a Holstein that is so pre-eminently a milk-producer, and a Jersey which is so pre-eminently a butter-producer, and can combine those two strong bloods, and then will get an animal that has some of the good qualities of the Jersey and some of the good qualities of the Holstein, and is about medium as between the two in size. How does it work out in practice? Once in a while we will get a superior animal from a cross of this kind, and nineteen out of twenty times we get an animal that is neither Holstein nor Jersey, nor much of anything else.

I have made a statement of this kind, and I have had men say, "I have made a cross of this kind and I had a splendid cow." I do not doubt that, but those are the rare exceptions, and I leave it to your good judgment; if you will carefully go over in your mind the crosses of that kind that have been made in all the history of breeding, and if you can show me where there has been any great attainment, I would like to see it. The attainment in breeding has been along pure-bred lines only. A man asked me a while ago what bull he should put on an Ayrshire cow to give her larger teats and more milk. And I said, "An Ayrshire." He thought I had misspoken myself and he asked me again, and I repeated the answer, "An Ayrshire." Then he said, "I have Ayrshires." I said, "I know you have, stick right to them." If you want to put larger teats on your Ayrshire cows, and want more butter-fat, then get an Ayrshire bull that comes from a family of rich milkers; from a family that have large teats, and the bull itself has large and well-placed rudimentaries; then you will attain what you want a good deal faster and a good deal surer than by attempting to get it by a cross of some kind. And if you ask me to what place I would go to find poor dairy cattle, I would take you every time to the community where they had started out on this line: A man says he wants more milk, and so he uses for a period of years the Holstein bull, and then he says, "I am not getting rich enough milk," so he gets a Jersey bull. But that does not satisfy because he hears someone talk about the beef cattle, and he says, "I would like to have a little of this strain in mine," so he buys a Shorthorn bull, and when he is through with that combination he has about the most worthless lot of cattle on earth.

What has been attained by years of careful line-breeding we expect to better by crossing in nine months. There are always two tendencies in our domestic animals, the one is to perpetuate themselves, their characteristics, the other to revert to the original stock. I believe the tendency of reversion is stronger when we take in all this blood that I have mentioned, than when we take animals of no particular breed and combine them.

Let me give you a concrete illustration. When Darwin wrote his "Origin of Species," in the course of his investigations he became satisfied that all the varieties of pigeons had originated from the Blue Rock pigeon of the Mediterranean Sea. Any one of you who has been to a poultry show, as you pass by the coops will notice varieties as different as can be. There is a pouter pigeon, with its immense crop, and there is a pigeon with its great fan-tail, dissimilar in plumage and make-up and everything else. And yet Darwin contended that they came from the same source. What did he do? He crossed the pouter pigeon and the fan-tail. Neither of them had a blue feather in their plumage and had not had for generations. The first young developed a blue feather and when they were crossed again they went right back to the original condition. That is the danger when we do this cross-breeding.

I was speaking on this subject not long ago when a gentleman came to me and said, "What do you think of the Jersey and Guernsey cross?" I said, "I don't think anything of it. What are you going to gain?" You say those are not so dissimilar as the breeds you have been speaking of, the Holstein and the Jersey. No, that is true; their line of breeding has been quite similar, yet I think if you will trace up the origin of those two breeds, you will find that they are quite dissimilar. There is quite a difference in the blood that enters into the Guernsey from that of her cousin, the Jersey. I tried that kind of breeding to my sorrow; that is why I speak of it with so much emphasis.

Seven or eight years ago I got the idea in my mind that if I took my Jersey cows, that were not quite as large as I wanted them, and crossed them with a Guernsey bull, I would get an animal that was larger than the Jersey, that had more constitution and that would give more milk. So I bought just as good a Guernsey bull as I could find and went to crossing, and I lost two years of breeding. I got a beautiful animal, and now and then one that was very fair, but four out of every five were inferior to their dams. I would have done infinitely better had I bought a Jersey bull from a family of larger animals and good milkers and used him on those Jersey cows, and so have built up the size a little and have gotten a little more milk. And I would have had just as good a constitution. So I say, my friends, don't be led away by any such foolishness.

If you want an illustration of the value of line-breeding, I do not know where you will find one that is equal to that of the Jew. Here is a race of people, not only the result of line-breeding, but also of in-breeding, and wherever the Jew goes on the face of the earth, I do not care to what climate or nation, his characteristics stand right out, and they are usually such that he makes himself a formidable competitor wherever he is, whether in commerce, music, politics, finance or agriculture. He is the result of line-breeding, and where will you find a race of men anywhere that are cutting the figure that the Jews are?

You want to study a little scripture: take your Bibles and go back to the book of Exodus, and read the pedigree of Moses. He was an inbred man.

Let me say, in the next place, to that farmer who wants to build up a herd for production (and I suppose all farmers want that here in Maine), I do not believe it necessary or wise for you to think that you had better put in a herd of pure-bred animals. I yield to no man in respect for pure breeding. I repeat again that all the permanent advantage that we have, has come from pure breeding, and I say then that the man who is going to do that must do it by itself. That is not the business of the dairyman who makes production his main aim. Now, why? Because, simply that an animal has a registry, simply that an animal is pure-blooded, does not prove that the animal is all right. I believe in breeding in man and beast. I believe in pedigree, but you know, gentlemen, that there are families in every community whose very name is synonymous with honesty, uprightness and integrity. You know there are other families whose name is synonymous with everything that is the reverse. A young man that comes out of the first family will go into life with a wonderful advantage over the other. I will take his chance of success because he has a line of breeding of the right kind behind him, and the other goes out handicapped; but, in spite of that, I leave it to you if there is not in these families of admirable characteristics, every now and then, one of whom it is charity to say that it would have been better for him and for his friends if he had never been born. And if that is true of the human race, how much more must it be true in the brute creation?

How are we working a dairy cow? We ask her to become a mother at two years of age, and then we ask her to produce a total weight of solids that is equal, at least, to two-thirds, and more, of the weight of her body, and at the same time to give us a calf at the end of the year that is healthy and strong. Is there any other domestic animal that we are taxing to that extent? To my mind, it means that unless we select and care for her very carefully, we must have, even in the animals of the best strain, those that are inferior, no matter how excellent their breeding may be.

So I say that the man who is going to breed pure-bred animals wants to make that a business. He wants to make it a business to breed them for show, for the perpetuation of their kind, and for the work of producing. I would not give a cent for the pure-bred animal that is not a producer.

Let me go a little further on that line before I leave it. I have no sympathy or patience with this breeding of pure-bred animals simply for the artificial points, the black muzzle and the black switch in the Jersey, and the reverse in the Guernsey, and a whole lot more that has nothing to do with dairy production. Here in an illustration: I have a couple of photographs lying on my table, of two cows that were in the dairy test at Buffalo, two Guernseys, and they will illustrate this point and another one that I want to bring out a little later on. Here was a cow, handsome to look at, that was selected to go into the dairy test because she had a light muzzle and because she conformed, in some superficial points of color, a little nearer to the Guernsey type than another cow that was there equally accessible, but had a black muzzle, and did not have these artificial or exterior points that are so desirable, or thought to be, in the Guernsey. What was the result? That black-nosed cow was sent home and this creature was put in the dairy. The only point that she had of excellence was her udder. She had a most beautiful udder when she was fresh.

There is a picture of Mary Marshall, the cow that stood highest in the dairy for butter production; a cow that in six months made a net profit of nearly $60.00. "Look on this picture and then on that." It was very readily seen that unless that cow was very carefully handled she would eat her head off, and she would go dry. She was fed with the greatest care, and it didn't make any difference, she gave less milk every day, and when the test was closed that cow was giving ten pounds of milk a day, and in the six months that follow that test, wherever she may be, she will be eating up the profit she made in the test.

There is a living illustration of superficial, artificial points, and not those that indicate dairy production. That cow was registered, she had a pedigree, yet a man that buys her simply because she is registered, simply because she is pedigreed,—What is he doing? Why, he is breeding down instead of up.

The ordinary farmer who is building up a dairy herd cannot afford to do that. What shall he do? I want to give you something that is practical, something that is going to be of value. The bulk of it is based on my experience along that line. Take the good cows that we have and mate them with a pure-bred sire. Then we will have a herd, the foundation stock of which, with the exception of the sire, is going to cost very little. Breed them into a herd that in the course of ten years is going to be as valuable as most herds of pure-bred animals, but remember that we must have a type in mind. I do not care whether it is Channel Island or Holstein cattle, or whether it is something else, get the ideal in your mind and work toward that, and do not bring in half a dozen different kinds.

Let me say in this connection that the man who starts out to make butter with the beef cow is going to make a great mistake. He will be like the calf that the boy was driving. He was driving a cow with a calf, and as he went along he met a herd of steers going to market. The calf left the cow and started off after the steers. The old cow mooed and bellowed, and the boy called: "Co, Bossey," but it did not heed, so the boy tied the cow to a tree and ran after the calf. By and by he got to the top of the hill. He saw the steers, and the calf following. The boy was out of breath, and he expressed himself as some of us perhaps would. He said: "You fool calf, you darn fool calf, you will be sorry when supper time comes."

So I say that the man who starts to get milk and butter from the beef cow will be sorry when supper time comes.

The man who takes grade animals, or native cows, such as he can get, and breeds them into a herd of producers, by the aid of a pure-bred sire, that I will speak of, is entitled to more honor and credit than the man who goes down into his pocket and gets there that which never cost him any effort, and buys a pure-bred herd, the result of some other man's brains.

Now, let us see what type a dairy cow is. All these different breeds have their scale of points, that vary a little with one breed and the other. Yet if you look at them carefully you will find that they all point to such a type of animal, a type of cow that we find in Mary Marshal, and we find her in Belle of Scituate and Pauline Paul, a little more pronounced than in this cow perhaps. You find a cow that is wedge-shaped. First of all we want in that cow constitution. We do not care what else she has or has not, if she has no constitution, she is of very little worth. We want a cow that is well developed about the heart and lungs. That cow is doing a great deal of work, and must have plenty of blood, and plenty of lung-power to purify that blood. Then we want the long slim neck, the wide face, the bright eye, the rather slim horns, the pointed horns and the wide barrel, just the reverse of the beef cow, because she has got to have a reservoir to take care of her food.

What about this dairy cow that we have today? She is an artificial animal; she has been brought about by artificial means. In the early days when the cow roamed about among the wild animals she had to fight for her living, and she wanted the heavy and the long, wide horns, the heavy neck, the heavy shoulders, so that she could fight for her life, and she wanted a body of the shape that she could run easily through the underbrush and escape, where one of the present dairy type would be at a disadvantage. And that wild cow had to have her body protected from the wild beasts, so she needed a coat of mail around her, and she had her ribs very close together, and zoölogists tell us that the ribs extended from the shoulder way back to the hip.

Today the cow has to do none of those things. If she is to do her best, she has to have her food provided in abundance and without much effort on her part. She has to make no fight for her existence, so the horns are not needed. That short bull neck we do not want, nor those close ribs, for all the ribs have to do today is to assist in breathing: so in the process of time we have eliminated the ribs, and I ask you if it is not a fact that the space between the hip-bone and the first, or floating rib, in your best cows is very great. What does that mean? It means that we have been raising the cow for a different purpose from that for which she was originally intended. We have eliminated the extra ribs. The ribs are wide apart and fewer in number, because there is a tendency in nature to do away with the unnecessary. If you will note in some of your best cows, you will not only find that space very wide, but you will find that floating rib very short, and in some cases it is gone.

Take a good cow of the dairy type that I am describing, and breed her to a bull of superior dairy excellence, and nine times out of ten that short floating rib is gone.

We want a big chest, the reverse from the steer, and the mellow skin and the long tail, that is an elongation of the spinal column and for that reason an advantage. We want a large, tortuous milk vein, with a large orifice at the end, and then we want a good udder.

I admire the udder on a dairy cow, but an udder alone without these other points, is of very little worth. I speak of this because it so readily fills our eye when we come to purchase the dairy cow that we overlook her other points.

Take the best that we have in our herd, if they are bred along one line so much the better; if not, let us select the best that conform to that type, then let us breed them to the dairy sire, always the pure-bred. I hope that if you gentlemen have anything to do with making out the premium lists of any exhibition you will cut off premiums for grade males, however excellent they may be. You never know whether they will perpetuate their good qualities or not. How shall we select that sire? We have a breed now in mind, whatever it may be, and we will purchase a sire of that breed, and there is the time and the one time that we have got to go into our pockets. And the poorer we are the better animal we need to have: we can not afford to fool away any time.

I want to speak strongly of this because we are so apt when we are selecting a male, to say I want a pure-bred animal, and we buy the first one that is available: or worse yet, we buy the one that we can get for the least money. He may have a pedigree behind him, but I would not buy one to breed from unless he had in his pedigree cows of superior excellence; and his sire came from a family of the same kind, animals that are of superior excellence as producers.

You cannot buy a gold dollar for fifty cents, and you cannot buy a bull of superior excellence, both as to breeding and production, for a small sum. I would rather buy one a little mature, a bull that has passed six months, than to buy a calf, because you cannot tell how he is going to develop. I have come to the point, I am sorry to say, that I would not buy a bull to head my herd unless I went into the dairy and picked him out myself, or had some one in whom I had equal confidence do so. I do not mean to say that breeders are dishonest, but I do say that they want to make money, and want to sell stock and there are very few breeders who are willing to sacrifice an animal that is registered. I would not buy him unless he had the points of excellence. You may not agree with me, I do not suppose you will, that the bull should be of a feminine type. The great value of a bull is his ability to reproduce himself. What do you want him to produce? Why, dairy cows that are going to be producers. Then it seems to me that he should be prominent along the feminine lines. He does not need to be a fighter any more, so you want rather the light horns than the heavy ones. We want rather the slim neck, and the shoulders the same as in the dairy cow. I like to see a good crest as an evidence that he has power to reproduce himself. I think this is quite important in the bull, also that his eye is bright and clear. Then the ribs should be wide apart, and the general contour of his hind parts as you would like to see them in the good cow.

We want to find underneath his abdomen, on either side, well defined milk-veins, not quite as marked as in the dairy cow, but they should be there, and at their end one orifice, at least; and well placed, in front of the scrotum, there should be four teats. They are very sure indications of the form of the udders his heifers are going to have, both as to the position and the length of teats.

If there is a great amount of flexible skin under his belly, just ahead of the scrotum, what does that mean? That corresponds to the udder in the dairy cow. Take this bull and put him at the head of the herd, but don't use him for breeding purposes until he is at least a year old.

There are more failures from using immature animals than from any other source that I know of. Above all things, do not give the bull excessive service. One service is better for a cow, and more sure than the repeated services that are so often allowed where the bull runs at liberty.

Another mistake is in saving the calf from every cow. We want to select our best dams (the same will apply equally well to the pure-bred herds) and save the calves from those cows only, and only those that come up to the standard of excellence. We save everything, as a rule, and we save for superficial rather than individual points on the calf itself. I never save the first calf from the cow. I don't know what she will be, and I do not think the first calf is as well developed. It is certainly smaller. So the first calf of a heifer is always discarded, save those that come up to the general line of excellence. If that is done it will mean in a grade herd 50% of the calves can be saved.

In a pure-bred herd it ought to mean more, if the original stock is well preserved and well selected.

After the animals are six months or more old, select them, and we had better sell those not up to the standard for what we can get, even for their hides, than to keep them in the dairy, eating expensive food, and then have disappointment all along the line. I have a couple of such heifers. They are from excellent cows and they were excellent themselves, and yet we found before six months that they were not good feeders, but I kept them for what their parents had done, and it has been a loss to me.

The first requisite is constitution, the next is the general type that we must have in the cow. If the sire shows power to reproduce, I would use him again on his daughters. Then I would have half the blood of the sire in the first, and three-quarters in the second generation. Don't you see, we have fixed the strain there? I would use that sire as long as he was capable of reproducing. I do not care if he is six or ten years old, keep him. When you purchase another don't follow some fashionable fad that comes in, but stick right to the same breed, and, as far as possible, to that same strain, and then you have perpetuated in your herd those qualities you are aiming for: and in ten years' time, I believe, it is possible to have a herd of animals of beauty, of uniformity, of power of production that is as valuable, or more valuable, than most pure-bred herds as we find them today.

There must be a great culling out among the pure-bred of those that do not come up to the standard, those that are bred along the fancy lines, if we are going to improve the dairy cattle.

I do not think it is practical for the farmer to raise his own calves and sell *all* his milk. I do not believe that there is anything made by using any kind of patent calf food. I do not think it will make the calf grow as it should. There is nothing equal to the mother's milk, or the mother's milk with the fat taken out. It has been said that we are breeding men in this country faster than cows, and I find when we buy our cows it is a very expensive matter, and a very difficult matter to find those that are worth keeping. Where is this going to end? I do not know. It is going to be worse and worse. I believe that the raising of cows to sell is going to be a very profitable industry. How are you going to do it if you sell the milk? In that case it will pay us to purchase two or three cows that are large producers of milk solely to furnish the milk to grow calves.

I have gone over this matter pretty thoroughly, and I have told you what I believe. I have tried to give the reasons that lie behind, because I have very little patience with a statement that has not a good reason behind it, and I say to you, by way of recapitulation, get the good cows, whether they be pure-bred or grade, whatever their line of breeding may be; have a type in mind, a productive type, with a sire of individual excellence, with pedigree behind him, of one selected type, a pure-bred sire either used on a pure-bred or graded, carefully selected mother, a carefully selected calf that comes from this mother; and then give careful attention to the feeding of this calf, because many a calf has been ruined in the first six months of its life.

PLANT GROWTH.

By Forest Henry, Dover, Minn.

We have met today to study plant growth and animal life. It is the business of the farmer to make the conditions such that the animal or plant that he has under his care can do its best. The great majority of farmers think that a plant grows entirely from the soil. This is not true. The greater part of the food a plant takes it gets from the air. The gasses of the air combined with bright sunshine form the starch of the plant in the plant's leaf. The leaf is the laboratory where this work is carried on. In other words, the leaf is the stomach and lungs of the plant. How necessary then, it is that a plant has a good leaf growth. Every farmer knows that when the potato beetle eats away the leaf of the potato plant his potatoes will be small and few in numbers. It is because the potatoes contain starch which can not be stored up when the leaf growth has been destroyed. While it is true that the bulk of the food that a plant takes it gets from the air, it is also true that certain elements of food it takes from the soil, and it is very necessary that the soil has these elements of food in a form where the plant can make use of them as needed. Nearly all soils have an abundance of mineral plant food stored up in them; but very little of it is in a form that the plant can use. We say it is locked up. All mineral plant food must be in a condition so it can be taken up in solution in water before the plant can make use of it. We buy commercial fertilizers so as to get this plant food in a liberated form or in a form where the plants can use it right away. The farmer should rather liberate these mineral plant foods in the soil so far as possible and save his money. One of the best ways to do this is to introduce vegetable matter into the soil. When this vegetable matter begins to decay it forms humic acid which eats away little particles of these mineral plant foods and thus puts them in a condition so water can dissolve them. Another way to liberate plant food is by tillage.

The rough stirring of the soil loosens it up and lets in more air and also grinds off particles of mineral plant food. The old Romans said 2000 years ago that "Tillage is manure," and it is just as true today as it was then. The more we till the soil the more productive it becomes. This is where weeds come in as a blessing in disguise to the farmer. Many farmers would till the soil but very little were it not for killing the weeds. A plant to grow must have more than plant food. It must have air, moisture and warmth. When we put vegetable matter into our soil we also put it in the best possible condition to hold moisture. Soil is made up of ground pulverized rock and vegetable matter. Ground rock alone will not hold water. The water will leach down through it. Mix with it rotted vegetable matter and you make a sponge of the soil which will hold the water in suspension right where the plants can use it at will. Again, vegetable matter separates the particles of soil and admits air and sunshine that are just as essential to a plant's growth as plant food. Without this vegetable matter in it, the soil packs closely and does not admit the warm air. It has been shown by testing a soil filled with vegetable matter and one that was not, that the soil that had the vegetable matter had several degrees of heat more than the compact soil. In other words, by inserting vegetable matter in a soil it warms up much better and quicker in early spring. Two weeks' time can often be saved in growing a crop by having the soil well filled with decayed vegetable matter. Vegetable matter by admitting more air into the soil gives the bacteria of the soil a better opportunity to multiply and work. It is through the working of these bacteria that plants largely get their food and the more abundant these bacteria are in the soil and the more active they are the faster the plants can grow. In fact, when a soil is well filled with decayed vegetable matter as a rule the plants growing on this field do not lack for plant food.

How shall we get vegetable matter in the soil? One of the best ways to put vegetable matter in the soil is by growing clover and plowing it down either before or after the second crop is harvested. If one's soil is sadly deficient in vegetable matter better plow under the second crop, but not before the frost has cut it and the weather becomes cool. A heavy growth of green clover plowed under in hot weather will often sour the soil by its rapid decay. I prefer on general principles to pasture off the second crop. The animals leave just about as much on the field as they take off and it furnishes pasture at the time of the season when the pastures are usually short. While you are adding vegetable matter by the use of clover you are also filling the soil with nitrogen that the clover has stored up during its growth, from the air, through the bacteria on its root growth. One of the most expensive plant foods the eastern farmer is buying is nitrogen. Why not use the supply that God has given us and then we can save our money. We can do it through the agency of the clover plant. Another way to add vegetable matter to the soil, and plant food also, is in a judicious use of the barnyard manure. Do not throw it out into the yard and let it lie there six months or a year. Experience has shown that fully one-half is wasted by this method. More than 50% of the plant food in manure is in the liquid form and if it is allowed to lie around this certainly is largely wasted. Haul it directly to the field and spread it preferably on the young clover plants. It will make a vigorous growth of clover which will in turn add more plant food and your field will be in fully as good shape to grow a bumper crop of corn or potatoes next season as when applied directly to the corn or potatoes and you will have the extra clover for nothing. If one has not the clover field I should apply it to some hay field that I intended to plow up the following year. One thing I should never do, and that is to plow manure under as soon as applied. It is a great waste. Manure works downward and not upward largely. By plowing it under at once you get it altogether too deep in the ground. Apply it to the surface and let it incorporate with the surface soil before plowing it down. Don't be afraid of its evaporating or washing away unless it be on a steep hillside, and then there is not nearly the loss that would be supposed. All our manure on our Minnesota farm goes on the surface as a top mulch and we have saved hundreds of dollars by so doing. All experiments will confirm this idea of keeping the manure as near the surface as possible.

Grow more clover to make more hay, to grow more stock to make more manure to grow more clover and save fertilizer bills and feed bills. There is no reason why Maine should not grow her own horses and her feed to feed them on, as well as her own cows and their feed largely. Clover with the manure rightly handled will furnish the feed to feed them on, and feed the soil as well.

Oxford Down Ram, owned by Ben Hilton, North Anson.

THE FUNDAMENTAL ESSENTIALS OF SUCCESSFUL FARM MANAGEMENT.

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

The kindly greetings of the citizens of Turner I receive with pleasure. Some thirty or more years ago, under the auspices of your distinguished citizen and my beloved friend, Hon. Z. A. Gilbert, I first came to Maine, since which time, at irregular but somewhat frequent periods, I have been speaking to Maine farmers, and have come to feel that Maine is a sort of foster-mother of mine.

Great changes have occurred in general industrial conditions and in farm life. During the last few years these changes have been of a semi-startling character. From the exportation of $1,000,000,000 worth of agricultural products, we have rapidly descended in the past few years to one-half the former amounts in food products. The exportation of live stock has very nearly disappeared. Available lands have been so completely taken up that there is a great movement from the West into the Canadian Northwest and into our own southern states. Land, in the past five years, has nearly doubled in our West, and has reached, in parts of Illinois, to $200 per acre. Consumption has overtaken production. Prices of farm products have increased with such rapidity as to give rise, in our great manufacturing centers, to a cry for cheaper bread and cheaper beef, a cry that has so often been heard in Europe and attended by bread riots, sometimes by bloodshed. It has given rise to a political revolution such as seldom passes over the stable affairs of American political life. This means that we are confronted with new industrial conditions in which the more rapid rise of farm products than other classes of products has changed the whole outlook of our farmers. It is evident that the old equilibrial conditions between country and town are being changed; that farming is to be an ascendant movement in the future and, relatively speaking, manufacturing centers the reverse, since the consuming population of mechanical products is of a somewhat stable quality, while the manufacturing area is rapidly increasing. It is a favorable time for a new birth in agricultural New England. It is a more auspicious time than at any period heretofore for enlarged investment of capital, higher and better prices, and an extensively enlarged tillage.

Before presenting the fundamental essentials of successful farming, I invite attention to the fact that New England has an opportunity for the most successful agriculture of the Nation. Here we have the best markets of the world because they have the largest purchasing power of any markets of the world; because the purchase price of plant food for the growth of a carload of corn or other farm products is less than the transportation cost of a similar carload of products from the West. I believe, too, under conditions now clearly arising, that the income of the New England farmer at his best will equal or exceed the income of the average industrialist.

We are apt to underrate some of the manifest advantages of farming. We are accustomed to the score card in determining the merits of corn for seed, of cattle, horses, and dairy products. We may score industries and ascertain which are nearest to one hundred. The vital statistics of Massachusetts show that the farmer lives about fifteen years longer than the average industrialist. We know that his income and a competency are assured. He is the most independent of the industrialists: that is, he is a self-directive man, has the privilege of doing his own thinking and evolving his own plans, and receives that growth, breadth and strength of character that come only to men who have to take the initiative and meet exigencies, and must rely on their own mental resources. In the town there are a few leaders, while the mass of men have their thinking in business life done for them. They are a spoke in the wheel, a dependent part of an industrial system, directed here and there as a horse or an ox might be directed, and never can attain that resolute self-dependence and personal growth as can the man who owns his farm in fee simple. Socially the farmer expands along the line of natural tastes uncompelled by a conventionalism that compresses all social factors into one smooth groove; which cuts out spontaneity while he is a slave to a conventional system. His industry, as it is now developing, is unquestionably the one requiring the highest intellectuality. He is associated more completely with nature and her ever complex laws, and comes more in contact with the deeper mysteries of nature than any other professional man does or can. While, in addition, he must have executive and mercantile experiences, his work is done in the open amid the charms of nature and in the more complete exercise of all the bodily faculties in their development than can come to any other man.

There are three great fundamental factors essential to agriculture at its best, viz., first, the continuance of farm ownership in the family; second, intelligence of a high order; and third, the expansion of the present business.

Tenancy farming, which is forty per cent. of the farming of the West, is one of soil robbery unaccompanied by improvements since the tenant farmer has no interest in perpetuating soil fertility or encouraging the improvements associated with land, nor does sentiment impel him thereto. The changing of farms of the past generation of New England farming has led farmers to look upon land as a temporary method of obtaining a living from which they are to be released by westward moving, by other business, by retiring to town, selling or exchanging farms, or after a fair competence is secured, the allowing of a farm tó drift and to even decline. The farm home should be regarded as the permanent home and property of the family. This from sentimental reasons invites those improvements and surrounding conditions that are inviting and for the permanent interests of those we love. It is on such a farm alone, in such a district or in such a town alone, that we make the highest efforts to develop a permanent and rich social life for the neighborhood or the town where our descendants are to mingle and whose conditions are to determine the culture and the happiness of those through whom we attain a form of immortality. Good roads, landscape gardening about the home, generation by generation the gathering in the home and about it of those things which make for culture, the acquisition of a fixed moral standard for the family that the sons and daughters who inherit the traditions of the family in the neighborhood hesitate to violate, are a part of incentives to help achievements. The permanency of the family on the farm invites permanent improvements in drainage, clearing the fields of all obstructions and their enlargement for modern machinery, the fitting of the field for great and profitable crops and the pressing of the whole of the farm into service in the forming of its forests and the carrying of its pastures into fields. Money in the bank is a temptation and a danger to those who inherit it. The tilling of the soil invites and must have both intellectual and bodily activity, factors upon which a worthy manhood and womanhood alone can rest. There is, my friends, no permanency of the family and will not be, apart from land, since such has never been the case, in its physical, intellectual, material and social conditions. Let the New England farmer, surrounded by great markets, a splendid civilization, and among a people whose ancestors have done more for religious, civil and industrial liberty than any other equal people in the history of the world, and whose example is now the inspiration of all peoples to the remotest ends of the earth, determine that their farms shall, so far as their example and influence can so determine, become the permanent home of the family. On this basis alone can the highest order of farming be developed and the State at its best be developed.

Second, the New England farmer must possess himself of the highest order of industrial intelligence. The productive power of man is measured exactly by the intelligence of his efforts. Nations understand this, as applied to their mechanical industries, and are girding themselves up for the largest possession of the markets of the world upon the advancement of technical education. The necessity of such an education as applied to farming is greater than for all other avocations since the farmer comes in contact with a larger body of natural laws and must add to his technical knowledge a keener observation than others, since the cross currents of these natural laws often tend to neutralize favorable ones. How to guide and control to our ends these mysterious forces of nature is a fascinating problem. Emerson said that nature never permits us to extort all her secrets and thereby lose our curiosity in finding them out. These are accompanied by the necessary exercise of mercantile and executive faculties. I will not dwell upon this problem since it must be obvious that the man who works in harmony with nature works to the best advantâge, and he who works in opposition to the forces of nature tends thereby to neutralize his own efforts. The value of agricultural knowledge has come to be recognized by all civilized countries. State and national experiment stations and research by scientific men at home and abroad, the former employing a couple of thousand or more of investigators of scientific problems relating to farming, are creating a scientific and general literature of a volume so great that no man can acquire, digest and assimilate it as rapidly as it appears. It has acquired the richest of all industrial literature. We must as a body encourage education by the State of farm youths in the essentials and to some degree in the arts of agriculture, while we who are of adult age must keep actively alive to the current literature of agriculture, especially that part which relates properly to the investigation of the problems of our industry. At least our high schools receiving farm youths must organize courses in the elementary principles of agriculture. How, it is not our province to discuss, only that it must be. Nor are you primarily interested in this education. Other industries, and the city itself, have a larger interest, since the type of your agriculture and the result of your efforts are the measure of the price of food of every child of the State, and through the workers of other industries set the price of secondary products, and set the bound of human progress.

Thirdly, we must increase the volume of our output. Before discussing this subject, in a preliminary way I desire to say that the farmer should not be satisfied with more hours of labor than other classes of people, nor with less reward. When I inquired of a young man at the station in relation to the Institute he said he could not inform me and had no interest in it; that he had left his farm because he could get $2 a day for seven or eight hours' work, and that he preferred his present place to his father's farm. This more perfectly marks the real attitude of our youths toward land than anything else can, since this young man preferred a life of intellectual dependence and industrial subserviency to one of individuality and to the independent position of land owner where he might develop those qualities which make for a strong and resolute manhood. In visiting a meeting of Grangers, I found the subject of discussion was "Can farmers limit their day to ten hours?" All the speakers agreed that it was necessary for them to work from thirteen to fifteen hours a day in order to accomplish their tasks and maintain a balance sheet. In response to an invitation to speak upon the topic, I asked them if they thought it wise and best to exchange their thirteen to fifteen hours a day at $1.50 for the mason's or carpenter's day in Boston at 50 cents per hour for eight hours, on equal terms? So long as we are willing to do it, other industries are willing to accept our long day and cheap pay for their shorter day and higher pay. If farmers would cut their day down to other people's hours, they would receive higher pay for the shorter hours than they now receive for longer hours. At any rate, it is one of the greatest industrial tragedies that the farmers who feed all other workers and whose food cost determines the price of every pound of steel and every product of the arts, should be compelled to be the "hewers of wood and drawers of water," so to speak, of other industries. Equal pay for equal service, and surroundings as congenial and uplifting as others have, is the natural right of this most important of all industries as compared with the pay and service of other industrial workers. Your boys and daughters, in their Hegiras to the towns, proclaim that conditions are not satisfactory to them. Inadequate income is one of the impelling motives. How shall we command an income to support this larger life on farms that I want you to have and that you should have? I cannot detail but only in a very condensed and swift way generalize upon phases of the methods by which I arrive at this increased income. Our times are those of great captains of industry, of enormous output whose volume of profits is made up of excessively small margins and an enormous number of things turned out. Our agriculture is still burdened by the slogan of the era when our sons went west for free farms, to the cities to organize new industries; of small areas well tilled. Decrease of capital and of labor was followed by a decrease of tillage and by a decreasing of farm operations until we used less of capital, labor, plant food and other factors of modern agriculture than those of any other civilized people. Our fixed charges of family expenses are now double and triple those of past generations, and still expanding, while the fixed charges of tools and teams, machinery and building, not only are great but greater than heretofore, and all together absorb up close to the line the gross income of the farm. We cannot live more broadly or gain more revenue until our income, like that of every other industry of the day, is increased. How shall it be increased? Not by the undemocratic process of adding farm to farm, but by lapping our intelligence over every acre of the farm, asserting the sovereignty of mind over matter, the force that is the measure of all success. Old field areas now averaging a ton of hay to the acre must be tripled in acre production under a food rotation and the area of the farm used increased to its tillage limit. The five acres now required to pasture a cow, and the twelve required to keep her the year round, on the basis of better returns, could keep twelve cows. Carry these pastures into fields, cut out your weed wood and grow only economic trees, making the present area give better returns than now and put the cut area saved into tillage. Put mind at its highest and best possible service, and extort of every acre of the farm all its resources. By this process I have increased my own production eight-fold in the past sixteen years. In another place and reported in the Commissioner's annual report for a prior year, I have covered the possibilities of income per acre of ground and the methods of securing that income. I have there shown that a revenue of less than $10 per acre for the entire farm must be lifted at least to $65 or $75 per acre to leave the net revenue essential for this larger life that your children aspire to live. I have there shown that my own eight years' rotation so distributes the labor of the year that I am able to keep men and teams at constant economic service all the year round, thereby decreasing the man and team cost per unit of work turned off, giving labor such an opportunity for continuous service that I have no trouble in securing ample and fairly good labor. My friends, catch the spirit of the times; apply capital, labor, tools, plant food and higher intelligence to all the acres of the farm so that the present fixed charges of the farm will bear a much less ratio to total revenue than now. From experience I can assure you that intensive methods applied more extensively solve the problems of higher level of farm life and a less strain of prolonged hours.

The stumbling block which has prevented the most of you from expanding your tillage area and at the same time securing larger crops from each acre has been the assumed inadequacy of plant food for the type of farming you are advised to pursue. Crops are the measure of our income and plant food is the measure of our crops. Plant food then becomes the problem of problems, the chief corner stone, the under-girder of all possible higher agriculture. Indeed, as the volume of our crops is the great determining factor of all industrial life, it would appear that the volume of available plant food is the largest economic factor in the life of nations. It is the problem towards whose solution you must bend every intellectual energy. The expansion of my area of tillage and the increase of crops has rested on six sources of plant food. Time will not permit a discussion of the scientific whys, nor the processes involved, in my method of fertilization. Suffice it to say that it is all a fundamental part of a scientific course of farming. I get plant food for this volume of business from six sources. First, I use muck as a source of nitrogen humus. Before it is used you must think out its relations. From an artificial reservoir we draw the waters of irrigation as a source of plant food, and as an antidote to drought. Third, I use a fixed system of crop rotation as one of the great conserving forces of soil fertility and as one of my chief means of economizing crop production.

I use, as you will observe by the following, an eight years' rotation which runs as follows: Corn for silage, treated to six loads of yard manure of ten tons and 750 pounds of fertilizer adapted to this crop; oats and peas, for which I use the previous amount of chemicals or yard manure. Third, clover, using some 700 pounds of chemical fertilizers. Fourth, potatoes, with about ten tons of yard manure plowed under and 1500 pounds of chemicals, spread on the surface and harrowed in. Fifth, Hungarian, treated to ten tons of yard manure to the acre. Sixth and seventh, timothy for sale, treated with 700 pounds of chemicals to the acre each year. And, eighth, pasture also fertilized with chemicals. This system, you will observe, is one of fertilization of the soil of every acre every year and one of constant increment of soil fertility and increase of crops.

This, it will be observed, as the third source of plant food, is quite prominent. The fourth source is tillage, which is manuring. Your everlasting grass crop gives only a minimum volume of air through the soil, while tillage opens it up to air circulation. The investigations of men of science in Europe and America have shown that soil decomposition is very much accelerated by tillage, so that tillage is really manuring in that it increases the amount of available plant food.

Fifth, we feed the soil through purchased protein foods fed to our cows. A ton of cottonseed meal for this purpose is worth something like four or five times as much as a ton of corn meal. These protein foods vary in their fertilizing value.

And, lastly, we depend upon chemical fertilizers. These are plant foods, and when bought and used right, profitable foods. The speaker uses one hundred tons of them on a farm fifteen miles from his market and four and a half miles from the railroad, and can say with authority that not only chemicals but intensive farming is profitable, and, so far as I can perceive, is the only method by means of which we can acquire an income essential to the necessities of our times.

In conclusion, I wish to express the belief which I feel that the coming conditions, industrial, social and intellectual, are all making for a new and higher life on the farm, and one that shall not suffer, but otherwise, in contrast with the opportunities and lives of other industrialists, and the man on the farm in his intelligence, his ambition, his purpose, will be the determining factor that is to measure the type of life and culture that he is to live. It may be an enviable one or otherwise as he wills it.

WHY AND HOW WE KEEP MILK RECORDS.

By H. O. DANIELS, Middletown, Conn.

This morning I attempted to tell you some of our ways of producing feed for the dairy cows by our intensive crop rotation system, giving as well as I could, our reasons for adopting the system, and the results obtained. This afternoon, if you wish, I will try to tell you the kind of cows to which we are feeding these farm crops and the important place the keeping of milk records has had in securing for us the kind of milk-producing cows we own at Millbrook Farm today.

First, if you please, we will deal with the question of why? If I were a preacher and seeking for a text to illustrate this question of why, could I find one more applicable than this, "Ye shall know the truth and the truth shall make you free." If we keep an accurate, every day account of each cow's production, study the lessons shown by a comparison of these records and the cows that made them and do what we are taught in this truthful work is best for us to do, we shall retain in our herd only such cows as unmistakably are paying us a profit.

Then I verily believe we dairymen will not be considering ourselves as subjects of slavery, who unwillingly have to milk cows twice a day every day in the year, but free men who have a highly organized machine capable of taking raw products of the farm as we men produce them and transforming them into marketable products that will bring revenue enough, not only to supply us with the necessaries of life but also many of the luxuries and furnish us with that freedom of thought and activity that makes farming a first class business occupation.

If you will study these charts with me, we shall find first, *we know* we can feed our cows more economically. Why? Because we feed every cow according to the work she is doing. If one has a large herd and can not milk all the cows himself, the milk record tells him the quantity of milk each cow is giving and he can feed the high priced grain ration accordingly, giving the cows grain in comparison to the way they are paying for it and as he finds by close study they need, to do good work. It places every cow on her merit. One does not need to keep a cow much over a year before he knows whether she is going to be able to make a profit and if you have never kept records you will be surprised to learn perhaps for the first time which cows really excel in your dairy. It is not always the cow that begins by giving a large flow of milk when fresh that makes the best record for a year or a series of years. Sometimes it is a smaller milker when fresh but one of the persistent sort, keeping up a more uniform milk flow, that makes the most profit.

Keeping milk records creates a desire to have a standard for the amount of production of milk or butter every cow you keep should attain, and promotes a study of individual cows.

By watching the milk records, you will be inclined to study the form of the cow that is giving the most profit and the conviction will be forced upon you that there is a certain style or form or type of cow that augurs well for making a profit and if you keep milk records for a series of years, or ask anyone that has kept records, invariably you will find that a good dairy cow has a special dairy type altogether unlike the beef type of cow. She is a distinctly wedge shape, clean cut, active appearing cow. Then again, keeping records quickens the interest of the laborer. Your hired help will be more certain to get all the milk they can from each cow. Your boys will take more interest in the development of the heifer growing up to make your future herd. You, yourself, will see that the heifer calves from the best cows are raised and you will be inclined to start them well in life by giving those heifers a good pure bred sire that will make such decided improvement in the quality of the herd that it will not be long before you start to raise dairy cows of only pure bred ancestry.

Such has been the general result of hundreds of men that have begun keeping milk records. It also acts as a safety valve in the running of the engine. The milk record tells first of all when the cow's condition is getting out of order. Watch the record and one can often prevent a serious loss of milk production by taking the case in time and so keep the machine in steady running order.

Now we will turn for a few moments to the question of *how* we keep records. We have a spring balance milk scale with the pounds and fractions of pounds marked in tenths and so adjusted as to just balance with the weight of pail on hook. Then any weight of milk in pail will immediately register on this circular dial and all one has to do is to take the small fraction of time needed to mark up on the record. We have a record sheet divided into periods of 10 days, so as to make easy computation and as these three periods of each month are added together the sum total of each cow's milk is added to what she has produced previous to this, since her last freshening, and by continuing this record from the first of a given year to the first of the next year we can tell just how much milk each cow has produced every month, or day or year we keep her. We begin our records all on the first day of January of each year and close on the last day of December of that year, regardless of when the cow freshened, and then transfer them off the daily sheet on to a herd record book which is complete and large enough to keep the records of 50 cows or more for five years.

The record sheet also tells, or has spaces to be filled in, when the cow calved, when bred and when due and also per cent. of butter fat, and there is also a space for a number and name for each cow, as I believe one can more readily become acquainted with the individual cow if she has a name distinctly her own.

At the end of the year we add up the total amount of milk produced for all the year and compare these amounts with each other, and we find some useful lessons by this comparison. We find the total amount of milk produced by the whole herd. We have columns on each monthly record stating how many cows were milking, how many cows were kept as a whole herd, how many bought or raised or sold and how many cows were kept on an average each month, and what the average production per cow is for the full year. To make the study still more instructive and interesting we recently compared the yearly output and average of our herd for the past seven years and found some striking results.

We found our average record per cow for the first four years did not materially increase, while in the last three years our records have increased at the rate of 300 to 400 lbs. of milk per cow each year, until we have raised the average of the herd of

1906 of 5876 lbs. to 7267 lbs. in 1909, due partly to a better knowledge of feeding and better farm grown feeds, and partly to a better class of dairy cows as we began to have heifers of our own raising, giving milk in 1907 while previous to that time we bought all the cows needed to replenish our dairy. Since that time each year has added to the home raised cattle until at the present time more than half of the milking herd were raised on our own farm. In 1906 we had only two cows that gave over 7,000 lbs. of milk that year, while in 1909 we had 26 that gave over 8,000 lbs. each and 19 of these were two-year-old and three-year-old heifers doing their first season's work, with a credit of over 7,000 lbs. as the average of this young flock. These figures are encouraging and help stimulate us to reach our goal, which is to own a herd of 50 cows with an average annual milk production of 8,000 lbs. We hope in a few more trials we shall be able to attain this object.

One more thought I would like to leave with you. I find in the past seven years we averaged to keep 64 cows and that the average yearly production for these years was 6344 lbs. During that time there was always one cow superior to all the rest in milk production and one that fell far short. Now in making comparison of these two kinds of cows for seven years, I found if the whole 64 cows had been as good as the best one and we had sold the milk at the farm at wholesale at 4 cents per quart, we would have had nearly $50,000 more money for the 7 years than we would have had if the whole herd had been like the poorest one and yet, if all this herd of 64 cows for seven years were like the poorest one, they still would have been better than the average of the cows of the United States for the past 10 years in milk production, while the average of the herd of 64 for seven years, if all had been as good as the best one, would have just about equalled the average for 10 years of the cows of Holland.

Surely here is food for thought that we Americans can do well to consider. Our profits would be greater and our hope of improving our homes, educating our children and getting out of this life all that the Divine Creator intended for us will be much better if we make use of the power he gave us in the management of our dairies, and if we accept his command in the fullest sense,—"By the sweat of thy *brow* shalt thou earn thy bread."

In closing, if you are not already doing so, let me urge upon you who are keeping cows, especially those of you that are keeping them for commercial purposes, to study the individual cows in your herd, weigh at each milking every cow's milk separately, add up their records every month for a year, then compare one cow's record with another, and if you are marketing your product where the butter fat content is the basis of value, test each cow's milk at least four or five times a year, or better yet, take a sample of four milkings in succession each month and make a test of this composite sample and you will find that no work on your farm today as a dairyman will pay you so much profit for your time. The few hours needed for this work in a year will have a tendency to change the whole character of your dairy and will be of such wide influence as to make you farm better, live better, and think better than ever before, until the cloud which seems to hover over us dairymen will be lifted and we shall see not only the silver lining but some of the gold that belongs to this great industry of ours.

THE MANY MAINE OPPORTUNITIES.

By D. H. KNOWLTON, Farmington.

More than a century ago an early settler in what is now the town of Strong yoked up his steers to a hay-rack and drove over a spotted road through the forests to the town of Winthrop, some fifty miles away. He had learned that in this town, since made famous from the excellence of its fruit, he could buy apple trees to set on his newly cleared land. He selected his own trees, many of which appeared to have been grafted. While he knew nothing of varieties, he concluded that these were grafted because of some merit and were likely to prove better than the natural fruit, so he selected all he could of these. He was wise in his conclusions for the orchard—the first in the town—became famous for the excellence of its fruit. Among these trees there was one or more of the Winthrop Greening. Not knowing its name the people around named it for the settler. There are many better orchards in that town today, but there are none that have given more pleasure or exerted a wider influence in fruit growing, for its fruit was sought by many when fruit was scarce, and many a man when he had trees of his own came to obtain scions of some variety growing there and known to be better than his own. To the writer it appears as the one object lesson in fruit growing, enjoyed and sought for more than any other in the locality, where year after year it blossomed and bore the most luscious apples for miles around. Recently driving past the old farm I noticed the remains of some of those pioneer trees, shorn of their beauty, but living monuments still of their own usefulness to the community in which they stand.

"Each year shall give this apple-tree
A broader flush of roseate bloom,
A deeper maze of verdurous gloom,
And loosen, when the frost-clouds lower,
The crisp brown leaves in thicker shower.
The years shall come and pass, but we
Shall hear no longer, where we lie,
The summer's songs, the autumn's sigh,
In the boughs of the apple-tree."

My revered mother was born and brought up on this farm. There were apples and pears in great abundance, and when she married and settled on a distant farm, no one will ever know how much she hungered and thirsted for the fruit she had so much enjoyed in her childhood. From her I inherited my appetite for fruit. Fearing I was eating too much fruit recently, I asked my doctor if he thought my aches and pains were due to that fact. "No," said he, "eat all the fruit you can, it will do you good."

As an introduction to what follows, attention should be called to favorable conditions for profitable apple growing in Maine. While these facts seem to be well known by our own people they are too often overlooked in the anxiety of many to drop a good thing and go for some "get-rich-quick" bubble, and the opportunity of a lifetime is sacrificed. While we have long winters and frequently much cold weather, apple trees thrive everywhere over a large part of the State. The trees like the rocky loam of the granite hills, and their roots will crowd their way in among the rocks, and how they get so much plant food from the hillsides no one can tell. Even in the valleys where the soil is damp and heavy with moisture some varieties will grow and thrive and when such land is properly drained the trees will grow fast and bear the best apples. Away from the sea coast there is hardly a foggy day during the entire season; the skies are clear the most of the season, and nowhere does more of the sunshine get into the fruit than here. Say what we may of other things, there is nothing that makes such delicious fruit.

Our best orchard land is the rocky loam, and here the trees seem to grow in many places under the most unfavorable conditions. It is because their rootlets like to creep down among the stones and drink in the food Dame Nature has stored away for them. Many of our best orchards are upon this kind of soil, and there are thousands of acres of such land available at ridiculously low prices. Supplement these conditions with a flock of sheep, a herd of pigs, or a flock of poultry, and the results are wonderful in the growth of trees and yield of fruit. The fruit growers of the irrigated orchards of the West are happy over the production of a crop of fruit. Under the best system of culture in Maine, the orchard will produce an additional crop in the growth of the animals that will thrive a large part of the season among them. A crop of fruit and a crop of live-stock products and an enriched orchard besides.

Not long since the uncultivated lands of Washington were advertised as great bargains at $400 per acre and were said to be cheap at that. Cultivated lands were advertised at the same time for $2000 per acre. At Benton Harbor, the great market centre of Michigan fruit, a small farm of twenty acres with only small buildings upon it was recently purchased for $10,500, or at the rate of $525 per acre without reference to the buildings. It takes lots of money to own and operate a fruit farm there.

Eighteen years ago 80 acres of land by the side of a railway in Franklin county were purchased for $350. There were a few native trees upon the land which the owner worked over to market varieties, and then he set out other trees until there were about 2,000 trees in all. Nine years ago this piece of property was in the market for less than $1,500. This property was sold a few weeks ago for more than $5,000. A gentleman interested in it said that in less than five years it would be worth $8,000, and extravagant as this may seem to some people, it is only at the rate of $4 per tree. With good care there will not be a tree on that lot that will not produce from one to ten barrels of fruit. At $2 per barrel this will yield a revenue of $2,000 a year if only the minimum yield is taken. Should the trees under good management yield an average of two barrels the revenue would be doubled, or $4,000.

Thousands of acres of good orchard land in Maine may be had for $10 per acre or even less, and there are more or less bargains in orchard lands like that mentioned, where some trees are set and need only the care of an intelligent and skillful man to produce big money for the purchaser. The opportunities are here waiting for the men to pick them up.

A young man only a few months ago in an Androscoggin town purchased 80 acres of good orchard land for $400. The land was in timber to a large extent. So was the famous Nova Scotia orchard of Ralph S. Eaton less than a dozen years before it began to bear fruit. The young man said he was going to get enough for the stumpage to pay for the land, and then he was going to set it out to apple trees. Measure this with a city clerkship or a nine-hour-a-day job in a shut-up factory. The money is well invested, and the young man has graciously accepted the opportunity.

Just out of the village of New Vineyard a lot of land containing about 80 acres of land was purchased 18 years ago for about $700. Like many other tracts there were many seedling apple trees upon it. These were worked over and in a few years began to bear fruit, and from the product of those trees the owner built a good home and at his death left to his widow a handsome annuity from the orchard. This year there were about 150 barrels of good fruit for market. Oh, how many places there are of this sort that need only the hand of a willing worker to become productive and profitable!

There are few farms in the State upon which there are not many good seedling apple trees. In many cases they are of little value for tillage, but with a little care and pruning the trees will grow and thrive and bear fruit. They need the trained hand to prune and graft and care for them. The interest on the investment is slight and the fruit is near a good market. Add to these volunteer trees enough from some good nursery to cover the land and there is nothing in Maine that will pay better. There are here and there neglected farms and orchards of this class. Under good care they will soon come into profitable production. They are opportunities for men in and out of the State.

I realize the shortage of men to operate such farms, and it is much to be regretted that our rural schools are not training the boys to prune and graft and care for the orchards. It has long been a neglected opportunity for practical school work. The boys are entitled to it and the farmers of the State should help along this line. This situation is all the more important when it is learned that these trees of which we speak have been producing natural fruit, and that thousands of barrels are sold for canning and cider every year. The trees are ready; in fact, as in other agricultural lines, Nature seems to be waiting to help the man who is willing to help himself by improving the opportunities offered.

Some years ago the State Pomological Society held a field meeting on the farm of S. H. Dawes in Harrison. The year before Mr. Dawes had applied to some of his trees a fertilizer new to the State. The results were so favorable that he was glad of this opportunity of having his neighbors and others see the trees for themselves, so the fruit growers in large numbers were his guests for the day. It was a pleasant surprise to those in attendance. To make sure in regard to results, Mr. Dawes had left check rows through his orchard without the fertilizer, and as far as the eye could reach the difference was apparent. The foliage was a darker green and on closer examination the trees were making an extra growth. As we were talking over the situation Hon. Z. A. Gilbert, whose life has been spent largely among the apple trees of the State, said to the writer: "Do appearances deceive us, or must we admit the effects of this fertilizer? The scientific men have been teaching us to use phosphoric acid and potash and have fought shy of the nitrogenous fertilizers. It is clear to my mind that Dawes' trees take to the nitrogenous fertilizers instead."

So it was from that meeting conclusively taught that Maine fruit trees needed more nitrogen, and many others have applied this same fertilizer with good results. One orchard near the writer's home has received an annual dressing every year since. His trees have grown and borne fruit every year. In 1909 the owner and his wife spent the winter in California, and this year he says he has money enough from his orchard to go there again. It may be that more potash and prosphoric acid are needed in that orchard, but he is about the only man in town who has had fruit every year. Although this formula has been in print several times and some of the fertilizer manufacturers have it all mixed, the formula is here given, believing that there are some who would be glad to have it.

The Fisher Formula for Orchard Fertilizer.

Nitrate of soda	350 lbs.
Sulphate of Ammonia...............	150 lbs.
Sulphate of Potash.................	230 lbs.
Acid Phosphate	220 lbs.
Keiseret	50 lbs.
Total	1000 lbs.

The ingredients should be thoroughly mixed before applying. Then just after the bloom, or a trifle earlier, apply around the trees at the rate of five to ten pounds to each tree.

This fertilizer seems to act first as a tonic and then as a food for the trees. This seems to be what the fruit trees need—something to stir them up and make them grow. Then beyond all this it is little less than robbery to take crop after crop from the trees without restoring anything. "Feed the trees and they will feed you," someone has truly said.

The apple crop this year has been a pleasant surprise to many people. Most of us early in the season thought the summer conditions were unfavorable at the time of bloom, so that little fruit set. But when the harvest came the most of the orchards that had been well cared for were bearing fruit. Not quite as much as in a full crop, but with the prevailing prices it proved a profitable crop. I have asked myself many times how this came about and the answers bring to the front other opportunities for those who have orchards, and to these your attention is called. The most important of these is to give the orchards at least expense—just the same as you do to the cows and the pigs—all the food they can use to advantage. The object is to make more and better fruit.

The highest hill farm in my town supports a large herd of cattle and the manure they produce the owner applies very largely to his orchards every year. It is his boast, as well as his pride, that the orchard bears more grass than his fields per acre and a big crop of fruit besides. The fruit is good, too. The rest of the farm may suffer in consequence of this orchard treatment, but he insists that two crops a year—hay and apples—are good enough for him. He supplies the trees with plant food and they respond. This is the way he makes his orchard do its best. It is his opportunity.

Two young men in another part of the town bought a run-down or neglected farm a few years ago. The orchard did not look very promising when they began to prune and work over the trees, so long had it been neglected. No sooner was this done than a flock of sheep was turned in. They came out fat in the fall, after doing good service in eating up the wormy apples that fell from the trees. The fruit from the orchard was just fine. It seems to the young men that their orchard was producing two crops—one of mutton and the other of fruit. It certainly is an inexpensive way of settling a fertilizer bill—much better than growing potatoes at prevailing prices.

In another part of the county a herd of pigs was turned into the orchard. They nosed around all over the orchard, lived on the grass until the owner wished to get them ready to sell, when a few bushels of corn were fed. They ate the drops, worms and all, and more than all this they fertilized the trees until the orchard bore its largest crop of the most beautiful Maine fruit. There was a handsome profit to him from the sale of the pork besides a large crop of fruit. This was his way of feeding the trees, and it is one of the least expensive and most effective. Pork and apples make a good crop.

Only a few days before the preparation of this paper I visited a large poultry plant. The yards had been planted with apple trees and they had been growing furiously all through the season. The trees were too young to bear, but the poultry had made them grow—a little too much, for the wood had no time to fully ripen up for winter. It will be strange if the trees are not killed back. This suggested to me that here is nothing better to make trees grow than the poultry, but they should be removed from the orchard as early as August if the best results are wished. However, it is a cheap and desirable way of fertilizing an orchard. From our own experience we believe poultry is about the best means of fertilizing an orchard where it can conveniently be used for that purpose.

These opportunities are available for two classes of people—first, to those who own farms and want to get more profit from them, and second, to those who do not own farms in Maine and are looking for opportunities to invest their funds in a paying enterprise. People are seeing these opportunities and are improving them. The man who bought the $5,000 orchard is a Boston physician. Two other men, one a practical Connecticut fruit grower, put in an appearance just after the bargain was closed up, just a little too late. It will be a great pleasure after all these years of labor to help the industry to have still other opportunities improved. We believe in the future, and we believe the efforts of fruit growers should be directed towards growing more fruit and better fruit. The opportunity which Maine offers should not be neglected.

Hereford Bull Fairfax, 2 years old, girth 7 feet 2 inches.
Owned by D. H. Tingley, Readfield.

REPORT OF PROCEEDINGS

OF THE

State Dairy Conference

AND

THIRTEENTH ANNUAL MEETING

OF THE

Maine Dairymen's Association

DECEMBER 6, 7, 8 AND 9, 1910.

The annual State Dairy Conference was held at City Hall, Augusta, Tuesday, Wednesday, Thursday and Friday, December 6-9. It was a meeting of much interest and the exhibit of dairy products and dairy and farm machinery was exceedingly attractive and instructive. As the annual meeting of the Maine Seed Improvement Association immediately followed this Conference, there was a very fine display of corn and various other grains during both meetings, which added much to the interest and value of the exhibition.

TUESDAY EVENING, DECEMBER 6.

The meeting was opened at 7.30 by F. S. Adams, president Maine Dairymen's Association. Invocation by Rev. L. W. Coons, Augusta.

ADDRESS OF WELCOME FROM THE BUSINESS INTERESTS OF AUGUSTA,

By E. C. CARLL, President Augusta Board of Trade.

Gentlemen of the Maine Dairymen's Association and the Maine Seed Improvement Asosciation:

I take great pleasure in tendering to you the welcome of the Augusta Board of Trade and of the commercial interests of the Capital City of Maine. Others will speak for Capital Grange with its splendid membership and for the city of Augusta. Speaking for the Board of Trade, I welcome you to our business street and to our mercantile and manufacturing establishments, assured that you will find prosperous and progressive business men. Cotton and shoe manufactories, pulp, paper and lumber mills, all have recently increased their capacity and added up-to-date improvements, and more are under way. The construction contracts completed in Augusta in 1910, including the State House, Rines Hill crossing, post office, Insane Hospital, improvements of the Edwards Manufacturing Company and extensive mercantile and dwelling construction, amount to nearly one million dollars. Our two great publishing houses have nearly 500 employes and a circulation of 3,200,000 copies per month. At the present time the Augusta post office is dispatching four full carloads of publications a day. $80,000,000 of mail matter passes through our post office each year, making it one of the largest offices in the country. Two great institutions, the Maine Insane Hospital and the National Home at Togus, each with a population equal to a good sized town, help swell the city's trade. An important factor in Augusta's prosperity are her great banking institutions. The two national banks, two trust companies and two savings banks have resources, per last statements, of nearly eighteen and one-third million dollars, a showing of which few cities of our size can boast.

We are especially favored in transportation by water and rail. The electric cars that pass our doors make the longest direct run of any in New England, 56 miles. The entire Lewiston, Augusta and Waterville Electric Railway system, 145 miles in length, gives ample passenger service, and freight and express service twice a day.

Augusta is centrally located in this great State. Nothing can promote our commercial welfare more than prosperous agriculture. Business depends upon crops. He who makes two blades of grass to grow where but one grew before not only helps the man who gets the grass but promotes commerce, manufacturing and transportation. He also makes two freight trains to go where but one went before. When I first took an active part in board of trade work I was impressed with the importance of bringing farmers into the organization. Our State Board of Trade has ever made agriculture a prominent feature of its work, and I believe more farmers should be with us. We are to witness in the near future a wonderful development of Maine agriculture. Aroostook is the pioneer; other sections are following. Kennebec Valley has heard the call. From tide water to our great northern wood Maine is coming into her own. The Maine Dairymen's Association is entitled to great credit for these results. I believe the people of Maine fail to fully appreciate the value of this organization, or to grasp the tremendous possibilities of the near future. Perhaps while intent on the great work before them, they have been too modest in making known its value to those not directly interested in their particular lines of work. The man with the cow is learning, the dealer is quick to approve, but I wonder whether the consumer fully realizes the importance of the work. All have to thank this association for better dairy products on the table. I distinctly remember the way butter was made 100 years ago. I helped churn forty years ago and the process had not changed any for the previous sixty. Now all has changed. The process has become standardized, like all other great manufacturing processes, until it seems nearly perfect. In dairying today, as in fruit culture, stock breeding, poultry raising and general agriculture, the need is not so much for new ideas and improved methods as for a general campaign for promoting the ideas and methods that have already been tried and proven.

The Maine Seed Improvement Association is also engaged in a work of inestimable value. No eastern state ranks with Maine today in the work of seed improvement. Great railroads in the West have taken up the work and eastern roads are coming into line. Better seed means heavier crops, which means more traffic. With our Maine Association and all those men like our good friend Dr. Twitchell who are giving time and the loving devotion of trained minds to this work, it is largely a labor of love. No compensation awaits them; no great financial gain is sought by them; but from their labors all may profit. Let us hail them as benefactors.

"To him who, in the love of nature, holds communion with her visible forms, she speaks a various language." Nothing in nature appeals to me like the rustle of the bladed corn. I know the merit of cotton and of wool; I take off my hat to the Maine potato; I even love the tobacco plant; but Corn is King. In the old country schoolhouse that I remember years ago, we used to stand up and recite in concert Whittier's corn song:

"Heap high the farmer's wintry hoard,
Heap high the golden corn!
No richer gift hath Autumn poured
From out her golden horn!"

How high that hoard has been heaped, statistics given in bushels or in barrels our minds fail to grasp, but we do know that by statistics Maine's yield per acre is the greatest and Maine's sweet corn is the best.

"Then let the good old crop adorn
The hills our fathers trod;
Still let us, for His golden corn,
Send up our thanks to God!"

ADDRESS OF WELCOME FROM THE CITY OF AUGUSTA.

By FREDERIC W. PLAISTED, Mayor.

It is my pleasant duty and my privilege, in behalf of all the people of this fair city, to extend to you, one and all, a most cordial welcome. I would give you the keys to Augusta but years ago we opened wide our gates and threw away the keys. Now those gates give a glad welcome to every visitor to our city. I think it was Confucius who said that: "He that bloweth not his own horn, his horn shall not be blown." It seems to be the duty of the Mayor to speak well of his city, and when you can say kind words, as every Augusta Mayor can, it is no hardship. I am happy to say tonight that, take it all in all, for men and women, for happy homes and glad hearts, for business and hospitality, Augusta is the best spot this side of Heaven that the good Lord ever made. In behalf of all the people of this fair city, my friends, I again bid you a most cordial welcome. We welcome you as good citizens of this great old State; we welcome you for what you are and what you stand for, the upbuilding of Maine's most important industry, that of agriculture. Why, my friends, when the farmer prospers all industries flourish, for the farmer feeds us all. We welcome you because you believe in Maine and in Maine's future; you believe that Maine should be something more than the playground of the Nation. It should take its place at the head of all the states of New England, where it belongs. You believe in the prominence of our State's location, as the gateway of the earth; you believe with me in the productiveness of her soil, in the skill and ingenuity of her workmen, in the public spirit of her business men, in the truth and virtue and purity of her women, and in the happiness and prosperity of all her good people. I trust that your visit to Augusta, and this session of these two bodies will bring to you much good and bring much good to the people of the State of Maine whom you represent.

While you are with us, my friends, you give us great pleasure, and when you leave us I trust that you will take with you only the most pleasant recollections of Augusta and of the hospitality of her people.

RESPONSE TO ADDRESS OF WELCOME,

By Dr. Geo. M. Twitchell.

In coming in here and looking at this magnificent exhibit, we begin to realize that the State of Maine is awakening to its possibilties along this line. It is a pleasure to me, gentlemen, and friends of Augusta, to come back to this city and speak in acknowledgment of the welcome you have given us, because memory is active with me tonight. I cannot forget the hearty sympathy and the spirit of co-operation and assistance which were ever mine during the years I spent in business on these streets. It is a pleasure to stand here and testify to this,—to that helpful co-operation which ever aided me in my humble efforts while in business here. It is a pleasure to come here and speak for our work as an association, to express our thanks to you, Mr. Mayor, for this cordial welcome; and to you, citizens of Augusta, for what you have done; and to you, Mr. President of the Board of Trade, for making attractive this hall and adding to the effectiveness of the work of this week; because, unless we stand together and are working together along these lines we cannot hope for the best results. The evidences of prosperity seen on every side in this beautiful city, the appearance of your business street, the improvements in your buildings, the multiplying of beautiful homes, the evidence of increased business in every department, tell of that prosperity in the good old State of Maine which brings joy, comfort and rejoicing to every heart. For unless we are all united in this work of upbuilding agriculture, we surely cannot measure up to the standard.

Ladies and Gentlemen, while you are working in the city of Augusta to establish its business prosperity others are working out upon the farms and in the rural districts and in the homes, seeking there to do what you are doing here, to plant upon a higher level the standard of the work and the achievements of the good old State of Maine. We hear a great deal said about the captains of industry, the men who have been working at the great financial problems of the age, but we make a mistake when we mark those men as the captains of industry. The real captains of industry are the men out on the farm who are taking the raw forces and working them over for the glory and the satisfaction of men. You and I want to remember that agriculture is the only productive industry. Yonder cotton mill produces nothing; yonder pulp mill produces nothing; your shoe factories produce nothing. They simply take the cotton and the wood and the leather and through the skill of labor convert them into a finer form. They change the form of the product; they add nothing to it, save the labor involved in the transformation. Commerce adds nothing, it simply moves the goods from one point to another. Trade adds nothing, necessary as it is, helpful as it is in building up prosperity. But agriculture produces; agriculture is the great productive industry and it should be so recognized.

What is agriculture doing in the State of Maine? Ten years ago Aroostook County produced practically all of the potatoes grown in the State,—five million bushels. This year Aroostook County produced 18 million bushels, and the State of Maine produced thirty-five million bushels. A few years ago we were producing only three-fourths of a million barrels of apples. The output of the State of Maine in apples last year was close to 3,500,000 barrels. Ten years ago the sweet corn industry was measured at about 10,000,000 cans and the farmers realized about $40 per acre at 2 cents per pound. Now the price has advanced to 2¼ cents, and this year the product was 28,000,000 cans and the farmers have realized upon an average $70 per acre. These illustrations indicate only a step in the great march of progress. What have we been doing along dairy lines? During the past ten years the State of Maine has been taking a great forward step in dairy work. There is no state today in all the East that can compare with the State of Maine in the progress that has been made since 1900 in its dairy achievements and in its agricultural development. There is no state in all the East that tonight is so thoroughly organized in all its dairy work, and so closely united, as is the State of Maine. In every department of agricultural work this is true and if wisdom prevails and we are able to stand together and work together along these lines, we are just on the eve of the possibilities in agriculture, and the next ten years will show a marvelous advance. And you and I must remember that our hope is in the life and energy of the young people that come from the country.

WEDNESDAY, DECEMBER 7.

ANNUAL ADDRESS OF THE PRESIDENT.

By W. G. HUNTON.

At this meeting, our thirteenth annual meeting of the State Dairy Conference, we have but to look at the exhibits in the lower hall, the number of the old members present today, the large and interested audience of last night, and the grand welcome extended to us by the citizens of this city, to prove to us beyond a doubt that the farmers of Maine have entered upon an era of prosperity and progression that means much to the future of our State. And for this organization that represents one of the largest and most important industries, is it especially necessary that while we are conservative yet we shall accomplish something that will advance the enthusiasm and general interest in our State in dairying. In reviewing what we have accomplished for the past year, we feel that much good has been done by the association; but it has also made it more evident that we have the opportunity to do much, *very much* more. Notwithstanding the fact that the price of all dairy products has been far above the average for the past year and the price of all live stock high, yet statistics of last April show a depreciation in numbers of several thousands. This I believe to be largely due to the high price of veal. Many farmers cannot understand that it is for their interest sometimes to refuse an immediate profit to protect themselves against a future want that will curtail their business. At our last annual meeting the officers of this association were authorized to hold a preliminary meeting in each county, to stimulate the dairy interests in the State and encourage a larger attendance at this, our annual meeting. But the association forgot to provide the officers funds for travelling from county to county, advertising the meetings, and obtaining suitable halls and speakers for the several meetings. But it does not require a very extended acquaintance with our secretary to know that he is equal to almost any occasion and not at all timid about asking for assistance to advance any interest pertaining to agriculture; and we were astonished at the apparent pleasure with which all our wants were supplied. And to the Maine Department of Agriculture, to the University of Maine, to the Department of Agriculture at Washington, to the railroads, to the State Master of the Grange, to the subordinate granges and to the newspapers of the State, we owe the opportunity of holding these meetings and accomplishing whatever good we may have done. At the 16 meetings held in the State under this vote, there has been an average attendance of 70. In all cases the larger part were interested and showed it by the many pertinent questions asked of the speakers. The subjects discussed were entirely confined to the dairy cow, her wants and the care of her products. At fourteen of the meetings samples of milk, cream, butter and cheese were offered for scoring. The results of the scoring were in all cases publicly discussed and this never failed to bring out many helpful suggestions, and the opinion was always expressed that this feature of our work would result in materially advancing the dairy interest and stock husbandry of our State. At this meeting let us not forget that its principal business is and should be the discussion and interchange of ideas on practical, every-day questions that have had material influence in the success of our individual business; that we may take advantage of all that others have gained by their experience.

If we but use the time allotted for this meeting for this purpose, and are as ready to give as to receive, we need have no fear of the great practical results that will come from it. Let all committees appointed at the last meeting remember that they are to report the result of their deliberation and findings at this meeting, that we may have an opportunity to discuss them and adopt their recommendations if we believe them good. In short, let us all try to feel that the success of this meeting depends on ourselves and the results will satisfy all.

REPORT OF THE SECRETARY.

To the Maine Dairymen's Association:

Complying with the instructions of the association at the close of the last annual meeting, the secretary forwarded to the chairman of each of the special committees authorized, a copy of the resolution under which they were appointed, together with the names of associated members of the committee.

In preparing the program for the present convention, the secretary confesses he had entirely forgotten instructions passed at the last association meeting, directing the executive committee to provide place in the program for the election of officers on Thursday. It will be noticed that the program calls for the election of officers on Friday morning. Under the circumstances, of course, this part of the program will not be carried out. It will be necessary to immediately decide the hour on which this election will be held Thursday.

The resolution passed by the association petitioning the Maine Central Railroad to provide a flag station at Highmore Farm was conveyed to the proper officials, who promptly acknowledged receipt and promised to give the matter due consideration. Later the flag station was established as requested.

During the year two meetings have been held by the executive committee. The first meeting was held at Augusta on the 22nd day of March, at which time corresponding secretaries for the several counties were elected. Several of the men appointed declined to serve and their places finally were filled, so that the list of corresponding secretaries, as finally settled upon was as follows:

Androscoggin County—C. R. Millett, West Minot.
Aroostook County—Ira J. Porter, Houlton.
Cumberland County—John P. Buckley, Stroudwater.
Franklin County—Jos. H. Merrill, Farmington Falls.
Hancock County—Norris L. Heath, West Penobscot.
Kennebec County—Chas. S. Pope, Manchester.
Knox County—George E. Nash, Camden.
Lincoln County—John M. Winslow, Nobleboro.
Oxford County—F. H. Morse, South Waterford.
Penobscot County—C. L. Jones, Corinna.
Piscataquis County—F. W. Leland, East Sangerville.
Sagadahoc County—Frank S. Adams, Bowdoinham.
Somerset County—A. P. Howes, Palmyra.
Waldo County—E. C. Dow, Belfast.
Washington County—C. L. Pike, Lubec.
York County—John Pease, Cornish.

The secretary desires to say that the corresponding secretaries have performed their duties in an exceedingly satisfactory manner. They have been especially prompt in replying to communications addressed by the secretary and other officials of the association.

Arrangements for holding the Dairy Institutes in the different counties were also under their immediate direction. At this meeting of the executive committee it was voted to hold a Dairy Institute in each county of the State some time during the months of October or November, and that they should be held in co-operation with the Dairy Division of the Department of Agriculture, that division having expressed a willingness to cooperate.

The second meeting of the executive committee was held at South Waterford on the 2nd day of June. At that time the invitation extended by the Augusta Board of Trade, to hold the next annual meeting of the association in the city of Augusta, was accepted. It was voted to open the annual meeting as usual, on Tuesday evening, and that the session should continue until Friday morning; that the annual banquet should be held on Thursday evening. It was voted to leave the arrangement of the program and exhibits in the hands of the president and secretary. The secretary desires to call your attention to the following list of Dairy Institutes that were held under the auspices of the Dairymen's Association and the Maine Department of Agriculture:—

LIST OF INSTITUTES.

Oct. 24,	York County,	Cornish
" 25,	Oxford County,	South Waterford
" 26,	Androscoggin County,	West Minot
" 27,	Sagadahoc County,	Bowdoin
" 28,	Somerset County,	Hartland
" 29,	Piscataquis County,	East Sangerville
" 31,	Penobscot County,	Brewer
Nov. 1,	Aroostook County,	New Sweden
" 2,	Aroostook County,	Houlton
" 3,	Washington County,	Machias
" 4,	Waldo County,	Monroe,
" 17,	Hancock County,	North Castine,

"	18, Knox County,	South Warren,
"	19, Cumberland County,	Portland,
"	21, Lincoln County,	Damariscotta,
"	23, Franklin County,	Farmington,

These institutes were, most of them, well attended. The interest manifested by those in attendance was a very encouraging feature of the meetings. The secretary regrets to state that he found it impossible to attend more than three of these meetings. They were under the personal direction of Hon. W. G. Hunton, president of this association, and Mr. R. W. Redman, our State Dairy Instructor. The Worcester Salt Company very kindly offered premiums for the best exhibit of butter at all of these meetings, provided Worcester Salt was used in the manufacture.

The president of the association communicated with the three different state fairs in relation to a revision of premiums offered for dairy products and the method of conducting the dairy exhibits. Arrangements were made for a conference with the trustees of the Central Maine Fair at Waterville and the Maine State Fair at Lewiston. The secretary is very glad to report that the trustees showed evidence of desiring to meet the requests of the association in every possible manner; in fact, a revision of the premium list was secured and in consideration of that action, the Dairy Division of the Department of Agriculture and the Dairymen's Association acted in co-operation with them in securing and caring for the dairy exhibits made at those two fairs; and this co-operation resulted in a largely increased exhibit at both fairs.

The secretary desires to present for your consideration the following recommendations:

1st. That the association continue its efforts to secure a still further revision of the dairy premiums offered by the several state and county fairs receiving aid from the state treasury.

2nd. That this association shall endeavor to secure from all agricultural fairs receiving aid from the State of Maine a change in the methods under which the judging of all live stock is to be done, so that said judging shall be as educational as possible.

3rd. That the plan of offering premiums for judging contests in dairy products at the annual meeting of this association be continued and further that it be approved as a general policy of all agricultural organizations in the State.

4th. That this association recommends that a conference of representatives from all agricultural interests of the State be held sometime during the coming winter.

Respectfully submitted,

LEON S. MERRILL.

The report of the secretary was accepted and it was voted that the recommendations suggested be referred to a committee on resolutions, to be appointed by the Chair. The appointment was made as follows: P. A. Campbell, Dr. B. A. Bailey, C. R. Millett, W. K. Hamlin.

REPORT OF COMMITTEE ON HERD RECORD BOOKS.

Immediately after the adjournment of the last convention of the State Dairymen's Association, the committee undertook a collection of the herd books to be deposited in the Library of the Maine Agricultural Experiment Station, per the vote of the association.

Although the association voted to appropriate $100, if needed, for this purpose, your committee has made no expenditures. The cost of postage, expressage, etc., has been met by the Maine Agricultural Experiment Station. In some cases it will probably be necessary to purchase the books in whole or in part if the sets are to be made complete.

The volumes which have been received are shelved in the library of the Maine Agricultural Experiment Station and are available to the members of the association and other citizens of Maine.

Your committee recommends that

(1) The American Aberdeen Angus Breeders' Association Volumes 1 to 16, costing $16.00 be purchased by the association.

(2) That the volumes needed to complete the Ayrshire As-

sociation be obtained and that Doctor Ness be empowered to obtain them at the best possible terms.

(3) That the committee be continued.

CHAS. D. WOODS,
C. L. JONES,
P. A. CAMPBELL,
Committee.

LIST OF RECORDS NOW ON DEPOSIT AT THE MAINE AGRICULTURAL EXPERIMENT STATION.

Cattle.

1. The American Aberdeen-Angus Breeders' Association. American Aberdeen-Angus Herd Book. Vols. 17 and 18. Current volumes to be sent as published. Vols. 1 to 16 can be obtained "at the regular members rate of $1.00 per volume for a set."

2. American Devon Cattle Club Record. Volumes beginning with 1881 to 1908 inclusive. Current volumes to be sent as published.

3. American Galloway Breeders' Association. Have Vols. 8 to 17 inclusive.

4. American Guernsey Cattle Club. The Herd Register from Vol. 1 to Vol. 18, 1908, complete. Current volumes to be sent as published.

5. American Hereford Cattle Breeders' Association. American Hereford Record complete, Vols. 1 to 33. Current volumes to be sent as published.

6. American Jersey Cattle Club. Herd Register beginning with Vol. 28 to Vol. 66, 1910. Current volumes to be sent as published.

7. American Polled Durham Breeders' Association. Herd Book, Vols. 1 to 4. Current volumes to be sent as published.

8. American Shorthorn Breeders' Association. Have Vol. 12, Parts I and II; Vol. 45; Vol. 46, Parts I and II; and others complete to Vol. 74. Current volumes to be sent as published.

9. American Sussex Register. Vol. 1, all that has been issued.

10. Brown Swiss Cattle Breeders' Association. Vol. 1,—all that has been issued.

11. Dutch Belted Cattle Association. Vols. 1 to 9, complete. Current volumes to be sent as published.

12. Dutch Friesian Association. Vols. 2, 3 and 4.

13. Holstein Breeders' Association. Vols. 1 to 9.

14. Holstein-Friesian Association of America. Herd Books Vols. 1 to 27 complete. Current volumes to be sent as published.

15. Maine Jersey Cattle Association. Vols. 1 to 10. Current volumes to be sent as published.

16. North American Ayrshire Breeders' Association. Herd Registers Vols. 1 and 2, 1863 and 1868.

17. North American Ayrshire. Vol. 1, 1875; Vol. 2, 1887. Ayrshire Record Vol. 1, 1876; Vol. 3, 1881. Effort was made through the secretary of the Ayrshire Association and through Doctor Ness to obtain this set but it was found that it could not be obtained except on payment.

18. Red Polled Cattle Club of America. Vols. 13 to 22, complete. Current volumes to be sent as published.

Sheep.

19. American Shropshire Registry Vols. 2 to 22. Current volumes to be sent as published.

The report of the committee was accepted and the recommendations adopted.

FEEDING FOR MILK PRODUCTION.

By Prof. P. A. Campbell, Orono.

I think you will pardon me if I digress slightly from the subject given me on the program and take up the raising of the calf before we come to the feeding for milk production. In my opinion, feeding for milk production actually commences when the calf takes its first meal, and perhaps we might go farther than that and say that we should commence to feed for milk production by feeding the mother, before the calf comes into the world. I will take up that with the feeding of the dry cow, a little later in my talk. We must bear in mind when we are starting the dairy calf, that it is to be a future producer in the herd.

The first thing which the calf does after it comes into the world is to take a meal. The first milk which the cow gives, the colostrum, is purposely arranged for this calf. It is a natural laxative. It is different from the ordinary milk in that it contains more solids and less water; and chemically it is quite different from the ordinary milk. After four or five days the milk begins to change to the normal, and in about ten days it is entirely normal. We like to leave the dairy calf with its mother about two days. I do not care whether the calf ever takes its food from the mother or not, provided it gets this first milk. The calf takes its food more slowly when taking it from its mother, and the digestive juices of the stomach have a chance to mix with the milk more thoroughly and hence more complete digestion results. But a little later, when the milk becomes normal, it is too expensive to allow the calf to eat directly from its mother, using this whole milk which contains butter fat worth from 33 to 36 cents a pound. So, at the end of a day or two, the calf is removed from its mother, or perhaps we had better say the mother is removed from the calf and put back into the stable. She is pleased to get back with the other cows and scarcely misses the calf. The calf's only mission seems to be to eat, and if the supply of food which it naturally gets from its mother is provided, then the calf does not miss its mother. We commence to teach the calf to drink immediately, usually taking its mother's milk. If the milk is very rich in butter fat it may cause difficulty and we will have to partially skim it or use the milk of some other cow. That occurs occasionally but not generally. In starting we want about four pounds of milk, varying it with the size of the calf. It is a peculiar thing that the calf at this age will not take the same amount of milk from the pail as it would from the dam and get along all right. There is more danger, more trouble, with many of our dairymen, in overfeeding their calves at this time than in under feeding them. We know that when the calf takes its milk naturally from the mother, it takes it several times a day. That is very well; but when we feed the calf several times a day, the milk must be warmed artificially and the temperature will vary, and that will more than offset, in my opinion, any disadvantage from letting the calf go from morning until evening without feeding. We feed only twice a day. In teaching the calf to drink, we generally remove the cow about the middle of the day and by evening the calf is hungry. If he does not eat readily at that time, let him go until morning. By morning he will be hungry enough so that he will learn to drink with practically no trouble at all. In our experience in teaching calves to drink, we have found that those calves from dams that had been accustomed to drink early in life learned very easily, while the calves from those accustomed to range conditions gave us more or less trouble.

After the calf has been eating the whole milk for a week, possibly ten days, we begin to realize that it is taking too much money to feed it, and consequently we commence to change it over to a cheaper ration. Skim-milk is the food to which we change it, and at this time we must realize that the stomach of the dairy calf is a delicate organ, and we must not allow any digestive or other difficulties to arise. So we make the change from the whole milk to the skim-milk very gradually, substituting not more than one pound of skim milk a day at the most, and we take pains that the temperature shall be the same as the temperature of the milk when it comes from the cow, and are careful not to overfeed. In a few days, then, the calf has been changed entirely from a whole milk ration. Now, one of the difficulties that frequently arises with calves fed in this manner is scours, and we prefer to use a preventative rather than be obliged to use a cure. If about a spoonful of dried blood is put into every feed of the calf, there will be no difficulty in this line. This dried blood can be purchased in the form of flour or meal, through the Swift people or the Armour people and it will cost three or four dollars a hundred pounds. I think that even if there were only one or two calves that had any trouble and the others came along all right, you would be well repaid for the cost of this blood meal for the whole lot of calves. I have been accustomed to using it for a long time, and I can say that among the calves that we have raised at the University there have been only two which had any touch of scours at all.

We also realize, after the calf is changed from whole milk to skim-milk, that we have taken away a part of its food. The milk fat has been removed from the milk and sold or manufactured into butter, and we have robbed the calf of so much. How shall we replace the amount of food we have taken away? We can do it by boiling ground flax and making it into a jelly. A spoonful of this flaxseed jelly in the skim-milk is fine for the calves, it will make them grow. If you follow that method I am sure that you will come out all right. But if you are raising a good many calves and have a small amount of help, that takes considerable time, and if you handle your calves as carefully as you ought, I think you can get around the matter by feeding dry grains. By the time the calf is put on the skim-milk ration it will know enough to eat grain, and I believe there is no better grain to feed a young calf than ground oats. We feed oats to people and we feed oats to horses, and they are exactly as good for calves. If I could have all the ground oats I wanted, with linseed meal, I would not ask for any other grain ration for the dairy calf. Some years, however, when oats are scarce and high, we can hardly afford to feed them. And yet we must take into consideration what we want to do with the calf,—what the calf actually is. Ex-Governor Hoard in one of his speeches said that the young calf when it comes into the world is a large mass of protein stretched over a bony frame-work covered with a nitrogenous skin. That is a pretty good illustration of what the young calf is. What shall we do with it in order to grow and develop it into the future dairy cow? We must not develop the paunch abnormally, without giving the other parts a chance to grow. We must not grow the fore quarters and the hind quarters and leave the barrel devoid of growth. We have got to watch the calf and keep it growing all over. Consequently we wish to make up a grain ration to supplement the skim-milk, which will do this and I have found that about two parts of bran, which is a laxative, furnishing ash and bulk, and one part of corn meal, which is heat-producing and energy producing, together with one part of linseed meal, old process, if you can get it, makes a pretty satisfactory ration. If you can supplement that with oats, you will have a ration which will keep the calf growing all the time. The question comes up: How much shall we feed this young calf? Start in with just a handful.

Do not give it any more than it will clean right up immediately. Put the grain in a little box in the pen where the calf can get at it and it will learn to eat in a short time. What kind of roughage shall be fed to the calf? The second winter perhaps you can feed it straw or swale hay if you haven't anything better, but the first winter when the calf is young, when it is developing its digestive system, we want to give it something nutritious. If the farm has produced some second crop clover hay, I do not believe there is any better roughage for the calf than this. If I could not give it second crop clover, I would give it the first crop, and if I could not give it this, I would select the best mixed hay the farm affords and give the calf what it wants of this. In this way I would keep the calf growing all the time. By watching it every day you can tell whether it is growing or not. The question frequently is asked me, through letters and in meetings of this kind, How long do you feed skim-milk? and I always answer, Just as long as I have skim-milk to feed, because it is a cheap food and it keeps them growing. I would like to say in this connection that if you are feeding skim-milk to your calves and their hair is long and their skin thick, do not get worried. It is bound to thicken up the skin somewhat, but a little later the calf will take on that thin, soft skin that we want in a dairy cow.

The question comes to us, How can we keep our calves growing all through the year? In our ordinary Maine pastures we too frequently turn our young calves out where they have to use up more energy in gathering the food than they actually gain from the grass they get. I do not believe that is profitable. If we had a good blue grass pasture or a honeysuckle pasture as you sometimes find, it might be desirable to turn them out where they could fill themselves quickly and then lie down and digest that food and make it over into muscle and other constituents. But calves that come along at this season of the year, or even two or three months earlier, I would rather keep in the barn the coming summer, because the flies and the scarcity of the grass are not an incentive to good growth and development. I would say this, however,—that as the fall approaches I would prefer to turn the calves out during the day, feeding them in the barn, so that they will get accustomed to getting out and running around the pasture. Then the next spring when they go out to pasture they will get ahead faster than if they had not been out the previous fall. Perhaps you think it is a little bit hard on the calves to keep them in all summer.

The better way to do would probably be to screen your windows with some coarse material and then turn the calves out into a paddock at night when the flies will not bother them, and put them back in the morning.

I suppose the question, At what age should we breed our dairy heifers? is asked 100 times a year. There is no definite answer that can be given. I simply say, breed them so that they will freshen about the time they are mature. I think it depends more upon the man who is feeding the calves than upon any other one thing. The breed of course makes a difference, also. We know that the Jersey, for instance, matures considerably earlier than some of the larger breeds, like the Holstein-Friesian. From general observation I do not think it is advisable to breed the heifer so that she will freshen much before she is two years of age. I would like to call this to your attention,—that there is a great difference in the individual so far as maturity is concerned. Two heifers starting out just the same when calves, when they reach 27 or 30 months of age will vary in regard to maturity. One will take on the mature form, the cow form, while the other one perhaps will still look like a large calf. I believe this is more a matter of inheritance than anything else, and you must study the individuals.

Now the question comes up, What about feeding the heifer while she is carrying the foetus, or what about feeding the dry cow? If there is any one point in the feeding of the dairy cow that should be given more attention, I think it is the feeding of the dry cow, getting her in shape so that she can do the work after she freshens. I have seen so many times, not only in this State but in other states, instances where as soon as the cow went dry a large portion of the food was cut off. When we do that we are robbing ourselves, as well as the cow. If we do not feed the heifer while she is carrying the calf we are robbing her and indirectly robbing ourselves. The udder of the dry cow, as you all know, looks like a large mass of cellular tissue, pinkish yellow in color. There are little ducts running all though it. When the cow is dry those are contracted. If she has not a fleshy udder it is naturally much smaller than when she is giving milk. We have got to increase this in size. We must get up steam so that when we start off with our work we shall accomplish something. I was interested not long ago in looking up what one of the best feeders in this part of the country is doing. He is making some of the largest records in the country. I happened to know the herdsman and I wrote and asked him if he would tell me what they were feeding their heifers. I would not dare to tell you the amount of food those heifers were getting, three, four or five months before calving. They were getting as much as our largest producing cows are eating. Another thing that was very noticeable was the variety of grains which they were getting. In making up our grain rations we frequently put in just as few as possible to save work. A variety helps out in feeding the dairy cow. I would try to feed the dairy heifer in such a way that she will be gaining in flesh and can nourish the growing foetus. I am convinced that you can save one or two weeks, and perhaps even more, in the growth of the calf by the way you feed the dam before the calf comes. The amount of food that you will give the dairy cow when she is dry of course you will have to learn by studying the cow. We cannot say definitely what you should feed at that time because of individual differences. We are feeding one of our dry cows, or did until she calved, nearly as much as she will get on her full production. Although this is her fourth time of calving, she is giving more milk per day than she has ever given in any lactation period since we have had her. She is one of the slow maturing cows. The dairy cow goes dry by nature so that she may turn the food nutrients you are giving her into other channels. The dairy cow that is a natural milker is bound to take part of the flesh from her body and convert it into milk, after she calves. If she does not do that you can rest assured she is not as good a cow as she ought to be. As the lactation period advances she perhaps will commence to put herself in condition again. But while she is dry you should get her into the best condition you can. Perhaps the question comes up, If the cows are in this good condition when they calve, what about milk fever? I am not here to discuss milk fever but I will simply say this: If the dairyman has a milk fever outfit, which every dairyman ought to have, he need not worry very much about milk fever. I think this disease can be prevented in a large measure by the proper handling of the dairy cow. As the parturition time approaches, three or four weeks before she is ready to calve, commence to feed so as to get her in shape. If she is on grass, in June, she will be naturally in good condition; but we only have a month or two of this good pasture feed, and then we must supplement it from the barn. And as the cow approaches the time of calving, as the udder commences to enlarge, we would leave out the fever-producing foods. If we had been feeding corn meal we would gradually leave that out. We generally leave it out entirely the last week or ten days before calving. I would like to say here that if you have plenty of ground oats you will not have to bother with any other grain ration, because it is bulky, it has the ash, it supplies the food nutrients. Oats are about as near to a full ration, for the dairy cow or any other animal, as possible. We like to feed bran mashes occasionally as she approaches calving, and silage if we have it. I like to give her a little additional food, also, in the form of roots—turnips or mangels, because they are naturally laxative and keep her in good condition. Aside from the nutritive value in the extra foods you are giving to the cow, there is something else which you do not realize. You are getting into sympathy with the cow and the cow is getting into sympathy with you and you are being more careful than you would be if you were simply letting her go along in the regular channels of feeding. The cow likes sympathy, and I think if you will study your animals at that time you will be able to get considerably more out of them.

Again, after the cow has calved how shall we feed her? That is a question that has come to many of us, and I want to deal with it from an economical standpoint because in the feeding of the cow at this time lies a large portion of our success. We may have fed her carefully as a dry cow, but if we think our work is all done then we will make a mistake. Just after the cow has calved I like to feed her almost identically the same as she has been fed previous to calving. The first thing we do is to give her a drink of warm water, and then give her bran mashes, one or two a day, at the beginning. Give her roots, to keep her in a good natural laxative condition. As soon as the parturition fever has left the cow, we commence to feed her towards milk production. It may be the first day, it may be the second day or it may be the third day after she has calved. Now we are sure that bran will not hurt her, nor ground oats, if we do not overfeed on them. We generally start out on a small ration, that is, what we call a dry cow ration, the ration she had just previous to calving, perhaps two or three pounds, or it may be eight pounds. We know all our cows and feed the ration that is particularly adapted to that cow or set of cows, as nearly as possible. I am not going to give you any definite ration, because I believe the time has gone by when any one can advise definitely so far as a feeding ration is concerned. Your conditions and my conditions are different. The roughage you grow on your farm may be different from the roughage I grow on mine, or the grains you grow may be different from those grown by your neighbors, or the market conditions are such that you can buy one sort of feed cheaper than another man can buy it. Of course this will have to be determined by your conditions, but I would like to leave out the fever-producing foods for the first few days, and then work up. I assume, of course, that you have milk records and are weighing your milk daily, because I do not believe any dairyman can afford not to do this. The question is not, Can I afford to weight it? but, Can I afford not to weigh it? I know you say that you cannot afford the time, but I know this to be true,—that the men in the State of Maine who are weighing their milk know more about their cows and are able to get more out of them than the men who are not weighing it. It is very well to weigh the milk one day a month but I should certainly say that you could afford to weigh it every day. The actual amount of time it takes is very small. And I am beginning to believe that it is just as essential to have a sheet up where the feeding records can be recorded also. I do not mean necessarily that every time you feed your cows you should weigh the feed, but it will be an easy matter to weigh the amount a certain dish will hold and you can come very near getting the same amount each time. I do not mean, either, that you should weigh the hay every time, but I think it is advisable to occasionally weigh it to see how much the cows are eating; not to limit them, but so that you can know the amount they are eating and determine the cost. I found that in weighing hay for a bunch of cattle for a period of six months, after the first two or three weeks we could reach down and grasp within a very small fraction of a pound of the amount we wanted. So you can get it approximately in that way. The herdsman having his milk record and his feeding record is able to watch the two together, and that means considerable. For instance, if he starts the cow on the grain ration of a dry cow, perhaps six pounds, and then gives her ration No. 2 of 8 pounds, and she goes up to 26 pounds of milk on the No. 2 ration, he knows immediately when she has come to her maximum production on that amount of feed. Then he increases it one pound and watches the milk record. He knows what it has cost to give the cow the extra pound of grain,—we will say 1½ cents, and he knows when that cow has increased her milk production 1½ cents' worth. Perhaps she goes up three cents' worth or five cents' worth, and then it is a good investment to give the extra pound of feed. Or perhaps he is beginning to give her a different ration,—he increases the food nutrients slightly but does not increase the cost very much. He allows her to go to her maximum on that. Then if on looking at her milk record the last half pound of grain gives only an increased production equal to the actual cost of the grain, there is nothing to be gained in that way, unless he is a milkman and needs the extra product for his customers. By watching the milk record and the grain ration, in this way, he is able to strike the point of economical production. And not only in bringing the cow to the point of economical milk production is it worth the time, but it does far more than that. It shows you exactly how your cows are standing.

There is another thing in relation to those records: We go along and look them over and we find that every cow is doing about the same as yesterday, until we come to a cow that is three pounds short of what she did yesterday. The chances are that the milker did not notice that until he hung the pail on the scales. I find that they notice it very quickly then and are apt to let me know, but if it was not for the records they would probably never say anything about it even if they did notice it, which is very unlikely. On seeing that the cow has dropped down three pounds we endeavor to determine the cause. There may be various causes. The first thing that we naturally do is to see whether the cow was milked carefully or not. Once in a while we catch a man slighting the milking, but they are usually pretty keen on that as they know that we can tell from the milk records. We know that there is something wrong and nine times out of ten we can remedy that before the cow is actually sick, simply because the milk records have indicated that she is not just right. That one thing is worth more than anything else in weighing the milk.

There are other things that we must consider in feeding the dairy cow. But few of us realize the cost of maintenance of the dairy cow; but few of us realize that she has to utilize a large portion of the food which is fed to her for maintenance alone and the actual profit comes to the dairyman from the amount of food which is fed in excess of the amount required for maintenance. That one thing has led numerous investigators and a good many who are studying the problem to endeavor to discover why it was that one cow was capable of producing more than another,—a cow that seemingly was bred the same and was the same in every way as the other. It may be that the ability of the cow to eat, digest and assimilate an extra amount of food above maintenance compared to that of another cow is partially responsible for the fact that the cow is able to do more work. That perhaps is a small feature but it is something which we have to take into consideration.

Just a word relative to the rations which we feed our cows; simply a few suggestions. One of the prerequisites in making up a feeding ration is that it shall be bulky. If you make up a ration of concentrates that passes into the cow's stomach in a close mechanical mixture, like cottonseed meal, corn meal, gluten feed or some other compact feed, I think you will agree with me that you do not get the best results. We probably do not get a complete digestion of these foods, or as complete as we ought to, whereas if we had put in some bulky material even though it had contained no food nutrients at all, we would have got better results. In studying feeding conditions in the growing of beef, several things came to our attention, one of which is that it was possible in feeding beef cattle to get approximately the same amount of gain from a pound of corn and cob meal as it was from a pound of clear corn meal. We know of course that there is considerable more digestible food nutrients in the pound of corn meal than in the pound of corn and cob meal. I think we will have to say that the reason we got the same results was that the one was bulky and there was a completer digestion so the cow actually got about the same benefit from the corn and cob meal as from the corn meal alone. The same principle will apply in the feeding of dairy cows.

Again, we should in our dairy ration, endeavor to make it as cheap as possible, while still doing the work. By that I mean that we should endeavor to buy those feeds which will supply the food nutrients cheapest in the form that we want them. A few years ago, when grain feeds were cheaper, we could afford to buy practically all our concentrates and raise all the roughage that the farm would produce and could make more in that way. But times have changed. The grain concentrates are much higher and the prices of the dairy products have not quite kept up to the increase of the feeds, and it simply means that we must do a more intensive farming, and I am going to make this proposition,—that the dairy farmer who is growing to a large extent his own feeds, and buying perhaps just a few of the concentrates, like cottonseed or linseed meal, is the one who is going to make the greatest success in the future.

We find it to be true, that certain men are feeding a far greater amount of protein than their cows actually demand. We find that others are not feeding anywhere near as much protein as their cows need. We should each of us study into our own conditions and determine as closely as possible what our cows need. For instance, I presume it would be safe to say that any cow that is owned by any man in this audience would not need over three pounds of protein if producing 60 or 70 pounds of milk daily, and probably there are no cows represented here that would require less than 1½ pounds. We cannot say definitely. We find that the most approved rations are running from 1.8 up to about 2.8 pounds, from the highest producers to the lowest producers. Another feature which I think is the worst feature of all is that overfeeding of protein is wearing out the cows far more rapidly than there is any necessity for wearing them out.

I think men who are feeding dairy cows ought to supply them at least some form of succulence during the winter. Different sections of the State of Maine vary materially in regard to the crops which can be grown. I would say to those farmers where corn can be grown, and who have silos, that they should grow silage corn. In other sections where it is impossible to grow corn, by all means grow roots of some kind. Undoubtedly, for your milking cows, mangels or sugar beets would be the most advisable. For the young stock and dry cows you might grow turnips. To summarize, in making up your dairy ration, make it bulky, make it to fit the needs of your cows, make it as economical as possible and be sure to have some succulent feed in it.

Ques. How wide or narrow a ration would you recommend to use regularly?

Ans. We are using a ration that will range from 1:5 to 1:6. Part of the time it goes above 1:6. That will vary, of course, according to the amount that the cows are producing.

Ques. Do you allow young heifers, from two months up, to run out-of-doors in the winter? Do you think it will make them stronger, better animals?

Ans. I think in the course of ten years you will find every dairyman growing his calves in that way. I would start them in reasonably warm quarters because they are tender, but I would gradually harden them up until when they are a few months of age if it was possible I would give them a chance to run in and out, about the same way we handle our sheep. I know of one breeder who is keeping about 250 head of cattle. The last time I visited him I made inquiry, and learned that they are letting their calves run out at will. This breeder has practically proved that he is getting hardier cows than where the calves are penned up or tied up.

Ques. What do you think of salting calves?

Ans. In studying into the needs of the dairy cow in regard to salt, we find that they vary greatly, and we really know very little about the amount of salt they actually receive in the food they are getting,—the amount that is already in the food. If I were feeding cows I should prefer that they have a place to get at salt and eat what they wanted, only making sure that the salt was there all the time. We usually mix it with the grain because depending on help we are more sure that they get a little of it.

Ques. Isn't it true that dairymen today as a rule are successfully feeding a wider ration than they thought they could a few years ago?

Ans. By all odds, and in some of the states they are feeding as high as one to seven, very satisfactorily. We are feeding 1½ to 2 pounds wider than a few years ago.

Ques. Doesn't that tend to give the dairyman an opportunity to raise more of his feeds?

Ans. It certainly does. The exact ratio will vary with the cow. One cow will produce milk on a ration of one to six or seven; another cow with less dairy tendencies would be laying it on her body.

REPORT OF COMMITTEE ON NATIONAL LEGISLATION RELATING TO DAIRY PRODUCTS.

December 7, 1910.

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

Mr. J. D. McEdwards, F. S. Adams and R. W. Redman respectively make report as the Committee on National Legislation for Dairy Products. We have at various times during the year written to the representatives in the national Congress relative to the present tariff on butter and cream and the way in which oleomargarine is handled. Copies of the letters and the replies from the representatives have been filed with the secretary. The general tone of their replies was to the effect that a tariff revision would not be possible during the present session of Congress, and that they would do everything in their power to attend to the oleomargarine situation. Relative to this latter, we would respectfully call your attention to the work done by the National Dairy Union of which Mr. E. K. Slater is secretary, as we believe by the co-operation of this association with this Dairy Union that possibly more immediate results may be obtained for improving the dairy situation with reference to substitutes than by any other medium at the present time.

Very truly yours,

R. W. Redman,

Secretary of Committee.

A collection for special prizes for boys in the judging contest for corn and potatoes was started by Dr. B. A. Bailey of Wiscasset, who contributed $2 for this purpose. A fund of $15.50 was raised, and on motion of Dr. Bailey it was voted that a committee of three be appointed to make the proper distribution of the fund raised. The committee was appointed as follows: Dr. B. A. Bailey, John P. Buckley, Rutillus Alden.

SILOS AND SILAGE.

By E. A. Stanford, West Kennebunk.

Mr. President and Gentlemen:

I felt some little hesitancy in coming here to speak to you men who are, for the most part, thoroughly acquainted with silos. Fortunately, I found one man who has not a silo, and I now feel that the time will be well spent if we can show that man that he can well afford to build and maintain a silo on his farm.

The subject of silage and silage crops is not a new one. The Egyptians built silos way back in the time of their prosperity. These silos were built for storing dry grain rather than green fodder, but were nevertheless to all intents and purposes, silos. In 1786, the Italians preserved grain and forage in pits and stone jars for feed. In 1883, we read of the preserving of vetches and clover in Germany in silos. Between 1860 and 1870, Samuel Jones, an Englishman, stored chopped rye cut green, and fed the fermented material to a great extent. In 1875, Manley Miles, of Michigan, and in 1876, Francis Morris of Maryland, were the first two men to build silos and use silage in the United States. In 1882, the Department of Agriculture of the United States in making a study of the subject, found only ninety-one silos in the country. It is, however, probable there were others. Eighty-one of these were along the Atlantic seaboard. That is a brief history of the silo. At the present time there is hardly a dairy section but that is blessed with at least a few silos within its borders.

CONSTRUCTION OF THE SILO.

The construction of the silo is the point I would like to take up here this afternoon, and the first point to bring to your attention is—*Make the silo deep.*

Make the silo deep for two reasons. The first is that in the deep silo the amount of surface at the top exposed to the air is less than in the shallow one per ton capacity. Another reason is that in the deep silo the silage becomes very solid by its own weight, and thus the necessity of weighting the silage after it is put in is avoided. Make the silo deep, and in that way the air is quickly excluded after filling, and the silage is prevented from becoming unpalatable.

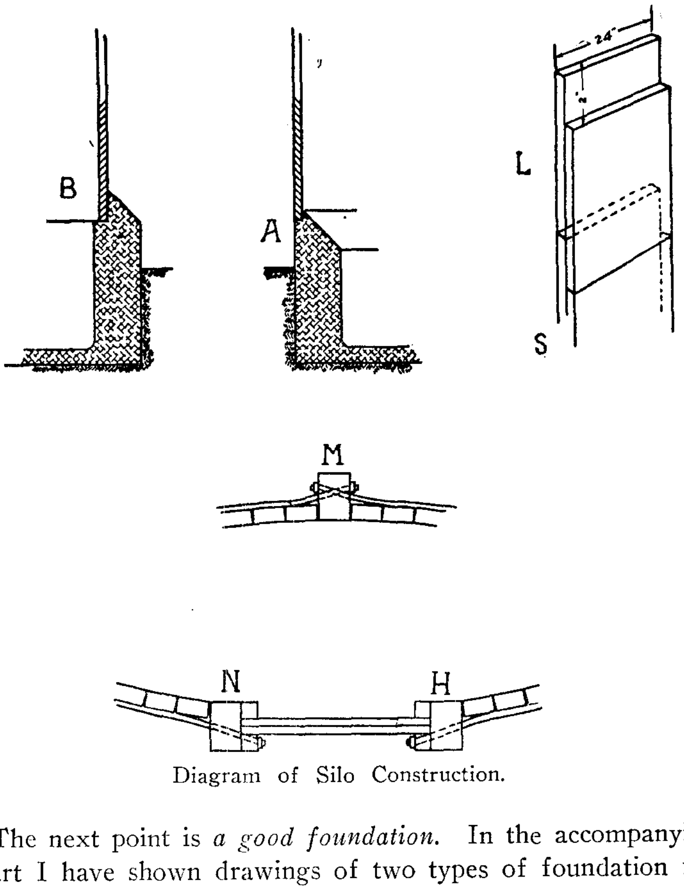


Diagram of Silo Construction.

The next point is *a good foundation.* In the accompanying chart I have shown drawings of two types of foundation for silos, whether of wood or stone. If the silo is to be outside, I should recommend the type of foundation marked "A," as there the wood material is well above the ground and flush with the outside of the foundation, so that moisture will not collect at the bottom of the woodwork on the outside and cause early decay. The inside is well beveled off so that the silage is permitted to settle quite uniformly. The type of foundation marked "B" is a good one for inside silos, as it is more roomy than type "A," there is less outside pressure on the walls, and less seepage at the juncture of wood and foundation.

In case the silo is to have sills see that there are bolts embedded in the foundation, extending up so as to pass through the sills and hold them firmly in place. In the construction of the stave silo, this is not necessary, as hoops will maintain the shape of the silo, while the foundation extending up beyond the woodwork either on the inside or the outside will hold the structure in place.

The third point is to *have as few corners as possible.* If it is necessary to build a square silo in your barn, see to it that there are no sharp corners. You can distribute your silage much more evenly and have a much more uniform silage to feed if this is done.

Make the silo air-tight. This is one of the most important points in the construction of the silo. Even a hole as large as that made by an eight-penny nail will oftentimes cause the decay of at least a bushel of silage around that hole, and will give a disagreeable taste to a great many bushels more.

If the silo is not an open-top structure, it should be well ventilated. This one thing will oftentimes improve the condition of the silage.

The silo may be square, rectangular or round. It can be built of stone or cement, brick or wood, but I shall discuss today only the wooden stave silo. I take this type because it is a silo which can be used at first to advantage by all men. It is the silo that the beginner ought to put up. The man who is unacquainted with silos and silage ought to build the round stave silo, and in that way get acquainted with silo conditions. Then, because of the small expense of construction, it can be discarded and a more expensive structure put up in its place. The outward pressure of the silage while settling is very great. It is about eleven pounds to the square foot, per feet of depth.

That is, at the depth of twenty feet the outward pressure of the silage while settling is about 220 pounds to the square foot. I speak of this point to draw your attention to the importance of good material going into the silo, the importance of numerous hoops, and hoops of adequate size. You will find silos constructed throughout the State of Maine, and in other states, where the first two hoops around the bottom are two feet or more apart. Then this distance will be increased a foot at a time in some instances, until the distance is four feet between hoops. You will find a good many times after the first year, or possibly the very first year, that the silage fed from these silos is unsatisfactory. The owners say that their silos are tight, that the silage is good, but the cattle do not like it. It is almost impossible to make a silo tight where the hoops are such a distance apart, and the fact that air has been allowed to enter between the sprung staves makes this silage unpalatable, and that is why the cattle do not like it. Bring the hoops at the base closer together. Put on the first hoop, two or three inches above the foundation, the next one six inches above that, and then increase that distance six inches with each hoop until you get to a distance of 3½ feet between the hoops, and maintain that distance for the remainder of the height of the silo. In that way you have a large number of hoops at the base of the silo where the greatest pressure is, and where, with ⅝-inch iron hoops, it is impossible for the staves to spring enough to allow the admission of air at any time. Then those who have condemned certain crops as silage crops will find that their troubles have ceased, and these crops make good silage.

There cannot be too much stress put upon the point of having enough hoops on your silo to keep it in place. Silos should have perpendicular, smooth walls, so that the silage will settle uniformly, filling the entire structure and excluding all the air.

COST OF SILOS.

In an investigation of the cost of silos recently made, there were fourteen round, stave silos which had an average capacity of 149 tons. These silos were inside the barns, and built similar to those to which I have referred, with perhaps a little less sub-structure. Their average cost per ton capacity, as given by their owners, was 65 cents. These were round, stave silos.

There were twenty-five rectangular silos built inside, average capacity 144 tons, and average cost, per owners' statement, $1.46 per ton capacity. Now let us compare those figures before we go further. The round, stave silo was constructed at an average cost of 65 cents per ton capacity. The square or rectangular, under the same conditions, cost $1.45 per ton capacity, a little more than double the cost of the round, stave silo. One round, cement silo—I am sorry that I could not get the cost of more than one—had a capacity of 300 tons, costing $500, an average of $1.67 per ton capacity. Nine square or rectangular stone or cement silos—I will say that these facts were gleaned from bulletins and not from personal investigations—with an average capacity of 228 tons, cost on an average $1.93 per ton capacity.

There are two points I want to call to your attention particularly. I referred to the round, stave silo as the cheapest to construct, and I referred to the round silo as the cheapest form of silos. I have shown you from investigation of silos in use that the round silo, whether built of wood or stone, is much cheaper than the square silo of the same material and capacity.

Now for a specification for a stave silo: Take one 12 feet in diameter and 24 feet high, having a capacity of about 49 tons, built inside of the barn. This would require 2 2-3 barrels of rock and gravel, 6 barrels of sand, 2 barrels of cement for the foundation, 1780 feet of 2 x 4 staves, 24 feet long, 144 feet of 4 x 6 timbers, 24 feet long, 378 feet of ⅝-inch iron hoops, which will weigh about 490 lbs., 100 feet of one-inch boards and 10 lbs. of nails, with 50 nuts to go on the hoops. In case the silo is to be made of staves entirely, three 2 x 4 staves will take the place of the three 4 x 6 timbers referred to, and it will then be necessary to have 20 lags for the hoops.

In the drawing are shown portions of a cross-section of the silo to which I refer. The square piece of timber at "M" shows its relative position at the back of the silo, with the hoops passing through it with several staves at either side. The two 4 x 6 pieces at "N" and "H" are door posts in their relative positions with staves on either side. The staves, you will note, are not tongued and grooved, neither are they beveled, but bear on each other only upon the inside edge. This is desirable as the silo will dry out quickly when empty, and decay will not take place as rapidly as though they were tongued and grooved or beveled to give a larger bearing surface. After decay has started, the hoops may be tightened each year, and the live wood of one stave brought against the live wood of another, making it as tight as when first built. The hoops go through the timber in the back as shown in the drawing, and also through the two door posts. These timbers act as a lag on the hoops, and also a support for them, so that as the silo shrinks, when empty, the hoops will remain in position. In the front where the two timbers make the door posts it will be necessary to put a truss across the doorway every four feet, to prevent the silo spreading at this point.

The door boards are held in place by bolting two 2 x 2 joists up and down these posts two inches apart, as shown in drawing at H and N, or better still, by cutting a 2 x 2 inch groove into each of the posts the whole length.

The doors are made by taking two one-inch boards and nailing them firmly together. Let one board lap by the other some fixed distance, say two inches, and let every pair of boards that you nail together lap by the same amount, as shown in the drawing "L." Then it makes no difference how wide these boards are, or in what order you use them, they will always fit the next pair below, as shown by "L." "S." These boards can be slid down this groove, and in that way form a continuous door, and one that will be tight, for the boards are held together by the pressure of the silage and there is no air leak between them. To my mind, and from observation of silo construction, a silo built in this way will meet the demands of a greater percentage of farmers than any other type constructed in the State today.

SILAGE CROPS FOR MAINE.

The different crops which may be used for silage are corn, wheat, rye, peas and oats, millet and clover. There are men in this audience, I believe, that have used each one of these crops successfully. The corn should be the entire plant, sufficiently matured so that the kernels are in the glazing stage, as this gives a much more nutritive silage than corn cut more immature. Dr. Jordan of the Maine Experiment Station found that a hundred pounds of corn silage from the mature plant had a feeding value equal to one hundred and eighty pounds from the immature plant. The tendency, I believe, in the State, is to feed wider rations, and I know of no more economical way to widen the ration than by feeding corn silage containing a good amount of the grain. Of course, I realize that some of you men are planting corn for the factory, and in this case, you cannot use the entire plant for silage, but where the crop is planted for silage alone, I strongly recommend the use of a corn that will reach maturity. This will necessitate a larger acreage than where the larger varieties are used, but this is not a serious drawback, as it simply helps to shorten the rotation of the farm. I believe that rye and wheat, sown in September and put into the silo in the early summer, will solve some of the problems of succulent feed that you are now confronting here in Maine. Your silos are probably empty by June, and you find it necessary to feed silage by the latter part, or by the middle of July. It is hardly time to cut your corn, and your clover is so good that you want to make hay of it. The winter rye and wheat can be used here and prove a profitable silage.

FILLING THE SILO.

Filling the silo you will say is a simple process, but it is not so simple if done well and most economically. The corn can be cut by hand, or by a specially constructed V-shaped drag, with a knife along one side, or with a corn harvester. The drawing to the barn may be accomplished with a low platform wagon, or where only one wagon is used and the haul is a short one the tip-cart is often preferable.

The ensilage cutter should have, preferably, the blower attachment, as there is less waste about the silo with this type of carrier, and the delivery of the silage on the inside is more satisfactory. The corn should be cut, preferably, from half an inch to an inch in length, as this will allow it to pack more uniformly in the silo, and it can be fed out much more easily to the stock than when cut coarser or put in whole.

COST OF FILLING THE SILO.

The cost of filling the silo depends upon the number and distribution of men, quantity of corn per acre, the efficiency of the machines, and the length of haul. Mr. Carrier, in the United States Department of Agriculture, investigated the cost of filling silos upon thirty-one farms. The distance from the fields to the silos ranged from 10 to 320 rods, and the cost varied from 46 cents to 86 cents per ton, with an average of 64 cents. This cost included labor of men and teams, twine, fuel and engine hire.

THE VALUE OF SILAGE.

As to the value of silage in the feed ration, I believe that, except under special conditions and in limited localities, it is impossible to conduct dairying in Maine on a profitable basis without feeding silage. I modified that statement, not to avoid criticism, but simply because I know that occasionally there are men whose conditions are such that they can afford to run a dairy without a silo; and there are men in certain localities who can best afford to grow root crops, or substitute by-products for their silage.

We farmers have not always an opportunity to weigh our animals, and to note their production to determine the value of a certain feed, but our Experiment Station can do this for us. At the Ohio Experiment Station with five cows of different breeds fed silage, they found that 96.7 pounds of milk and 5.8 pounds of butter-fat were produced per 100 pounds of dry matter fed. With the ration, where the silage was dropped out, but with an equal nutritive value, the five cows in the same test and in the same time alternated at different periods, produced 81.31 pounds of milk and 3.9 pounds of butter-fat per 100 pounds of dry matter fed. Compare these two productions and note the value of the silage in the ration. The silage feed cost, per 100 pounds of milk, was 68.7 cents; the cost of butter-fat, 13.1 cents; the grain feed cost, per 100 pounds of milk, was $1.05, and the cost per pound of butter-fat, 22.1 cents. Now, these figures were obtained under carefully conducted experiments, and they show that there is a difference of between 13 and 22 cents per pound for butter-fat. This difference in the cost of butter-fat might mean the difference between profit and loss in the whole dairy business.

In Ohio at the same time they conducted an experiment of fattening cattle on silage. With 42 steers divided into six lots, 7 steers in a lot, during a period of 140 days the cost of feed for those steers—three sections of 7 steers each—fed grain was $694.50. The cost of feeding three sections of 7 each, on silage, was $390.43. The average daily gain on the grain ration was 2.13 pounds; on the silage ration, 2.37 pounds. The cost of 100 pounds of gain in the grain ration was $10.21; the cost of 100 pounds gain on the silage ration was $9.04.

Growing horses and even work horses can be fed silage to good advantage. You men who attended the Live Stock Breeders' Association meeting, listened to a discussoin of this point by George M. Rummell, of the Bureau of Animal Industry, United States Department of Agriculture, who strongly advised feeding silage to horses.

Sheep can be fed silage economically. I have found several flocks about New England, in places where the root crop has been given up, and the only succulent feed the sheep received was silage. Men who are feeding silage to sheep most successfully are not feeding over 2½ pounds per hundred weight per day.

Those are a few of the facts that can be brought up in favor of silage, a few figures that can be shown as to the cost of the silo. There are other advantages. One is economy of space for the storing of the material grown, hence making smaller buildings necessary. There is less loss in the curing of corn in the silo than there is in drying in the fields under most ideal conditions. More cattle can be kept on the same area where silage is fed. Crops not fit for hay can often be made into good silage. The silo makes it possible for one to feed succulent feeds through the winter, and also to have some good material to supplement the fast deteriorating pastures during August and September.

These facts ought to be of sufficient importance to influence every dairyman in Maine to build and maintain a silo on his farm.

DISCUSSION.

Ques. What about Japanese millet as a silage crop?

Ans. I have found men in the State using it both chopped and whole, and they have been very well satisfied with it, it not being a hollow-stemmed plant. The trouble with crops with a hollow stem is that they carry so much air into the silo with them, the process of ensilaging is apt to go on a little too far, and you get a disagreeable taste.

Q. Is it possible to use a hollow-stemmed plant and get good silage?

A. Yes, sir. Mr. McIntire has used clover silage successfully. He has used the second crop of clover cut in with corn very successfully. He is a careful worker and a man who will put in a little extra work to put the crop in in the proper manner.

Q. Would it be possible to put in oats and tramp them hard enough to keep them good?

A. I don't know. Professor Campbell has tried it, but not very successfully. Where oats and peas are used together it is possible.

Q. What hinders the staves in your silo from slipping?

A. They rest on their ends, and they are bearing from the inside. Like all stave silos it may be of advantage to watch them a little the first few years, to see that they do not shrink enough to tip in, and as they shrink take up the nuts.

Q. I have a silo 14 by 28 feet. The first four feet is of concrete, and when this silo was filled it forced out some of the juices through the concrete, and still more where the concrete and staves came together. Can I avoid that?

A. I think you can avoid most of it by skim-coating the inside of the foundation. You expect a slight leakage.

Q. I understood you to say that cut corn silage is much better than corn put in whole. Have you data to prove that?

A. It is better only in that it is handled much better. It is only under exceptional conditions, and when put in by exceptionally good men that the whole corn is as good. I have seen men putting whole corn in the silo, where they were careful in packing, and it was as good as any cut silage I have ever seen. Generally speaking, it is much better to have the corn cut; it handles better and the percentage of loss is apt to be less.

Q. Will not second-crop clover make the ensilage better than if the corn did not have the clover with it?

A. It will, most decidedly.

Q. Would you expect it to keep as well?

A. Yes, sir, with what experience we have had it keeps just as well with the clover in. Mr. McIntire has done quite a lot of that. As they haul it in they plan to put in one load of clover to two loads of corn, and the amount of clover put in does not injure the keeping quality of the corn, and the corn helps the clover to settle.

WHAT THE DAIRY TESTING ASSOCIATIONS CAN DO FOR THE FARMERS OF MAINE.

By R. W. Redman, State Dairy Instructor.

What can the Dairy Testing Association do for the farmers of Maine? That is a broad question. We say, What is there in the future? and none of us can see far enough to answer all, but I believe there are a great many things we can see. Let us look at a few of them.

These local organizations, known as Dairy Testing Associations, can be and are a great factor in increasing the agriculture of Maine. Each member taking his part in the association can have a broader life that will be better and more useful; he can get greater returns for his labor; he can get an increased knowledge of agriculture; he can increase the number of his dairy animals, and increase the value of the product that he receives from them.

In support of this I want to bring three points to your attention: First, that the Dairy Testing Associations organized in Maine can increase the knowledge of agriculture among the farmers of Maine and thereby increase their profits. Second, the Dairy Testing Associations can open the way for all kinds of co-operative work. Third, the Dairy Testing Associations can increase the value of a man to his family, to the community and to the State.

First, the increase in the knowledge of agriculture and consequent increase in value of products. Many of you are members of these Dairy Testing Associations, and know about their working plan. I do not therefore need to go into the plan of operation. They are cow book-keeping associations, calling for a balance with the animal as to the amount of food she receives and the returns she is giving. This work directs the man to the dairy value of the cow.

I think there is a man in this audience who told me a week ago that he offered to sell one of his cows a year ago for $35 and did not sell it, and in eleven months she gave 401 pounds of butter fat.

Book-keeping increases a man's knowledge of the value of his feeds; he has the figures to look at right along and see what the cow thinks of it; the cow tells him in the pail what she thinks of the feed. Feed is not the only thing with the cow. Two or three years ago the New York Herald offered a premium to women for the best essay on "How to Keep the Love of a Husband." The prize essay was short; it was simply "Feed the Brute!" That alone will not work with the cow. Let us give her just as comfortable quarters as we can; let us have them tight, clean and light, making them so comfortable that the cow is happy and wants to go there. Let us feed her by the clock, and just as far as possible, get around to feed and water her regularly. Let us give her about the same amount of food and water, regularly.

And the man, from the records he keeps and the records kept by his neighbors, soon realizes the value of care. The man, looking over his record, soon begins to find out that he needs better cows than some he is keeping. Of course he has always believed there were poor cows in the county—but that they were in his neighbor's herds—until he kept a record and found out just what he was doing; then he found the advantage of a record pretty quick.

When a man is studying his cows, and their feed and care, and the breeding problems, he begins to realize that he has to raise more of what he feeds them on his own farm; and he begins to think of crop rotation, and handling his manures for the least loss, and the labor it requires to raise the crops. He studies his dairy problems in order to produce the greatest possible amount with the least possible expense. All these things mean more profits, and a greater desire for knowledge.

Second, the Dairy Testing Associations can open the way for all kinds of co-operative work. In some of the states it might be that some other kind of co-operation was the opening point, but in Maine it was the Dairy Testing Associations, and when the bookkeeping was well under way they asked, "Why can't we purchase our feed co-operatively?" and later they did. The more they co-operated the more money they saved. Feeds were not enough, they had to have seeds, and they have begun to co-operate in the purchase of seed. One association sent in 87 orders for grass seed, worth over $1,300. They secured a first-class article and saved between three and four hundred dollars on the purchase.

The co-operative purchase of fertilizers is another thing that associations are taking hold of. I look for more co-operative buying next spring.

The Dairy Testing Association can help in the purchase of some of the machinery that we need on the farm, as the corn harvesting machinery. We do not need that every day in the year, and if we are not doing a large enough business to purchase ensilage machinery alone, perhaps we can co-operate with our neighbors and thus do our work. We get in closer touch at the monthly meetings of the association. We need another thing in the co-operative work. The farmers are getting about 37 cents out of the consumer's dollar. That is too little. The consumer pays all that he can stand, but we want more of this dollar on the farm, and it is only through co-operative work that we can get it.

These co-operative associations follow in the wake of the Dairy Testing Association. The first thing that comes along, invariably, is a Dairy Cattle Breeders' Association. The next thing after the Cattle Breeders' Association came in the State Breeders' Association of Maine. Farmers are getting together; they realize that by co-operation they can accomplish better results.

Just before the State Live Stock Breeders' Association came the Seed Improvement Association, an association that is going to do more for the farmers of Maine than any other, I believe, that has been organized. You just watch it and take hold with it.

The sheep men began to realize that the dairymen were getting something out of their animals that they could not get alone, and there is one Sheep Breeders' Association organized in the State, and more coming.

The poultrymen are beginning to realize something of the advantages of co-operative work. There has been one egg circle organized, and I do not know but two. The future holds a great deal for Maine in the line of co-operative work, and the Dairy Testing Association has been the entering wedge.

Third, the work of the Dairy Testing Association can increase the value of the man to his family, to the community and to the State. Perhaps it looks a little peculiar to you that these meetings can improve a man socially, yet I learn from the families that things are pleasanter all around than before the advent of the associations, just because father is studying his work, and if he does, it improves his income and makes it larger. Does not that improve a man to his family? The members of the associations that study the records have increased their income through the knowledge of what they are doing; knowledge of dairy improvements, monthly increased by the records of the dairy. A man's interest becomes keener when he has figures on one line of his work, and sees there its relation to his pocketbook. And he will buy his feed co-operatively, and be a little more careful about the next day's sale. Possibly he will weigh his milk, and then he will begin to realize that some of the hard things laid to the creamery may be due to the milk fed to the cat and dog, and to the cup of cream for breakfast. When the man sees the income increase, he begins to look into the future, his dreams are broader, he can see the way to things he wants, things he has given up in years past. Then the best of it is the whole family gets interested in the cow, and the cow gets a little better attention, perhaps a minute or two of carding each day that she did not get before, and maybe the stable windows are washed more often. These things come by the whole family taking an interest. Then through the association we have new men in a new world; because it has been a school, a local dairy school, with a local dairy text-book, working under actual conditions, and the problems it solves are the problems of life.

The Master of the State Grange told me that the members of the associations were doing better work in the Grange than they did before the Dairy Testing Associations were organized. That was particularly pleasing to me, coming from the State Master. I have seen local ministers in the communities where associations are working, and they tell me they get better support from the members of the associations than they used to. Does not the Dairy Testing Association increase the value of the man to his family and to the community?

The Dairy Testing Associations can do a great deal for the State of Maine if we will work with them. Let us co-operate.

REPORT OF COMMITTEE TO INVESTIGATE THE NEEDS OF THE COLLEGE OF AGRICULTURE IN RELATION TO DAIRY AND HORSE BARNS.

To the Maine Dairymen's Association:

Your special committee appointed at the last annual meeting of the Maine Dairymen's Association to investigate the needs of the College of Agriculture in relation to dairy and horse barns have attended to that duty and beg leave to make the following report:

Complying with the direction of the association your committee visited the University at Orono and after careful investigation presented the matter to the Board of Trustees as stated below.

We desire to state at this time that a special committee was appointed at the annual meeting of the Maine Live Stock Breeders' Association to act in co-operation with the special committee from the Dairymen's Association, and at the time the investigation was made at Orono and the matter brought to the attention of the trustees, these two committees acted as a joint committee in the presentation of the following petition:

To the Honorable Board of Trustees, University of Maine:

At the annual meeting of the Maine Dairymen's Association held in Skowhegan, December, 1909, a resolution was introduced recommending that the cattle and horse barns at the University farm be so renovated and enlarged as will meet the growing needs of the College of Agriculture. This resolution received favorable consideration and it was ordered that a committee be raised to investigate the conditions and needs mentioned above and to secure from the trustees of the University favorable consideration of the recommendation.

At the annual meeting of the Maine Live Stock Breeders' Association held in Waterville, November 15th and 16th, 1910, the action of the Maine Dairymen's Association in recommending changes in the barns at the University farm was approved and the appointment of a committee was ordered to act in conjunction with the committee from the Dairymen's Association. We, the members of the above mentioned committees, have investigated the conditions of the cattle and horse barns and believe that the preamble of the resolution introduced in the Dairymen's Association meeting, a copy of which follows, accurately states the conditions and needs of the Agricultural College:

"In recognition of the splendid work that has been and still is being done by the Maine College of Agriculture, and of the fact that at present the Animal Industry department is limited in its usefulness by barns and outbuildings that are neither convenient nor of suitable size for carrying on its work educationally or commercially to the greatest advantage to the students or profit to the State:—"

We therefore respectfully request the trustees of the University to take immediate steps to carry into effect some change which will meet the needs of the College and the State.

L. E. McIntire, East Waterford.
John Pease, Cornish.
Dr. H. M. Moulton, Cumberland Center.
M. E. Williams, Winthrop.
John A. Ness, Auburn.
L. S. Merrill, Orono.

Replying to a request from the trustees as to what suggestions our committee had to offer, the following was presented as the proper solution of the conditions we found there:

Suggestions for changes to be made in cattle and horse barns at the University Farm.

That the upper cattle barn (100 x 40) be moved to a suitable site and remodeled to a suitable stable to meet the needs of the work and breeding horses.

That the lower cattle barn (100 x 50) have an addition built to the east end and this barn be used as a storage barn for feeds. That wings be built large enough at least for 80 head of milking cows, and that a suitable place for growing the calves be provided.

The committee desire to state that they were received with the greatest courtesy and received assurance that the trustees were in entire sympathy with the move, and believed that the work could not be undertaken at too early a date. We have since received an official communication from the secretary of the Board of Trustees as follows:

To the Committee of the Maine Dairymen's Association and the Maine Live Stock Breeders' Association:

Gentlemen:—As secretary of the Board of Trustees of the University of Maine, I am directed to extend to you the cordial thanks of the said Board, and through you to the associations you represent, for their interest in the welfare of this institution, and to say to you that the trustees of the University have long recognized the need of changes and additions to the college barns, and that, in order to extend the work and make it better, these improvements are essential. It is a matter of sincere regret, however, that no funds of the institution are available for this purpose. The improvements needed would be ordered at once if the Board was financially able to meet the expense.

We greatly appreciate the interest of the Maine Dairymen's Association and the Maine Live Stock Breeders' Association in the work of the University, and fully endorse the action of these associations, and approve their intention to ask the Legislature for an appropriation necessary to make the needed changes in the barns, and pledge them our earnest support in their effort.

We beg to assure you that your action in coming before the Board of Trustees will give us added courage in the work before us.

S. W. GOULD, Sec.

In view of the fact that no funds are available from the treasury of the University to carry into effect the recommendations of the committee, and complying with the direction of the association to report at this meeting and to make such recommendations as in their judgment they thought best, your committee desires to offer the following resolution:

Resolved, That the Maine Dairymen's Association re-affirms the opinion expressed at the last annual meeting as to the needs of the College of Agriculture in the matter of renovation of dairy and horse barns; that in view of the fact that there are no funds available at the present time, the special committee having this matter in charge be continued; that they make such further investigation as they find necessary; that they prepare estimates of cost and use every honorable means to secure at the next session of the Legislature an appropriation sufficient to carry into effect the recommendations made in this report; that the executive committee from the Dairymen's Association be directed to give the special committee every assistance possible in the securing of an appropriation and that the special committee appointed by the Maine Live Stock Breeders' Association be requested to still further act in co-operation in this matter.

In closing your committee desire to express their appreciation for the valuable assistance given by the Maine Live Stock Breeders' Association to the very important move we have undertaken.

L. E. McIntire,
John Pease,
Leon S. Merrill,
Special Committee.

AN ESSENTIAL TO WELL-BEING.

By Laura Comstock, Professor of Domestic Science, University of Maine.

(Stenographic Report.)

Ladies and Gentlemen:

It is with some trepidation that I appear before you this evening, for Ladies' Night is an innovation. If it is not successful it may be that in the coming year no such privilege will be granted us. Still, I believe that having been granted this boon, we can so impress the men with our earnestness that they will consider it a favor bestowed upon themselves to be allowed to incorporate this work into their yearly program.

The topic for this evening is "An Essential to Well-Being." Possibly some of you have been puzzling over the problem as to which essential was to be singled out. It is true there are a number. Even in the field of domestic science or home economics there are many. Still, one seems to be paramount, to be of vital importance to each and every person. It is the subject of food. It is a large topic, and far too comprehensive to be considered in one evening, even one phase of it. Therefore we will take a bird's-eye view of it addressed to some points that will stand out with great vividness.

Let us deal with this subject under three heads. First, food principles and their significance, second, the cost of food, and third, the preservation of this food after it has been purchased.

First, as to the food principles. Dr. Langworth of the United States Department has recently published 15 food charts which are a wonderful aid in the study of the subject. These charts will be shown later on.

To develop this subject in a logical manner we should begin with the constituents of the food. What are its component parts? The chemists have determined that there are between 15 and 20 elements that comprise the body, and those 15 or 20 elements are found in the foods that man commonly uses. The principal elements are carbon, hydrogen, oxygen and nitrogen. Then, besides these four constituents, we find sulphur to be a very important element, and phosphorus, the sixth being found the most important of the food principles. Nature has shown how well she provides for man's benefit as these same elements that are required in the body are found in the common foods that we prepare each day.

To speak briefly about some of these elements, we know that oxygen is present in the air. It is also present in water, forming the principal part, and in the earth's crust, as well. We find that it is necessary in the body for the production of heat, just as it is necessary outside the body for the production of heat. With regard to carbon, that is contained in all living things. It is burned in the body to produce heat and energy. Hydrogen is another constituent that we find in the air to a great extent. It is also another constituent of water; we have the oxygen and the hydrogen, forming water. It is found in the body, too. In a considerable portion of all animal and vegetable matter hydrogen is found. That, too, serves as fuel. The nitrogen is found in most animal and most vegetable matter, but not in all. It is not so universally found as the others. In the different magazine articles and the different books dealing with foods, we find food principles mentioned. We find there are five food principles, they being the foundation work of the study of domestic science or home economics.

The first of these principles we will consider as water. The second will be protein, the third fat, the fourth carbohydrates, and the fifth of them, found in small quantities, is the most important thing and that is the mineral matter.

Water is the important constituent of the make-up of the body. Sixty-one per cent of the body is composed of water. With the mineral matter we find that we have phosphate of lime and sodium and potassium, all necessary for the formation of food, consequently very necessary for adults, and also for small children where the growth of the bone is of so much importance.

We find an example of the fats in olive oil, and we find animal fat. The carbohydrates, taking the starch and sugar, are found in all plants. We know there is a very important framework in plants. Perhaps we could see it more clearly in vegetables. That framework is called the cellulose, and that comes under the carbohydrates. Protein is the most important of the five constituents. A good example of protein is the albumen of the egg—the white of the egg—or the gluten of wheat. The gluten is developed in the process of bread-making when water is added to the flour, and makes it possible to have bread formed. Another example of protein is casein in cheese. We want to consider that cheese is one of the most important protein foods we have. And as housewives if we can provide cheese in different forms, provided the members of the family can digest it readily, it is an excellent protein food.

With regard to the composition of the food materials, we can consider them in the raw material, under two heads, the non-nutrients and the nutrients. The non-nutrients are those that do not benefit us in any way, like the refuse we find in all foods, bones in animals, the bran in bread, shells and potato skins and banana skins. The amount of waste varies greatly in different foods. For instance, in bread there is practically no waste; in beef the waste is about 10%. In chicken, take out the skin and bones and there is about 40% waste. So in buying we must consider what we are buying for.

Water, perhaps, is not classed as a nutrient, as it does not help out in the building up or repairing of the tissues of the body, nor give us energy to do our work. Nor yet does it give us heat, yet water is essential for us to have. Without it we could not live. The nutrients, properly speaking, would be protein, carbohydrates and mineral matter.

Why does the body need food? There are perhaps three needs. We need food to build up the tissues. In children the building property is stronger, and when the child is grown there is need constantly of the repairing. There is always the need of repairing, and it is going on in the body from infancy until death. We need that class of food that will supply the repairing property, and also the building, and then the energy producing power. We must have the necessary food so that we can have the energy for our work and for play. Of course in speaking of playing, we speak of muscle playing, and that is always work. And then we need the food not only for energy, but to produce heat.

The one point that I wish you to surely remember tonight is that there is just one class of food that will go to building up and repairing the tissues, and that class of food is the protein food, but protein, fats and carbohydrates, all three can help to produce energy in the form of muscular heat and power. But we find out if we study further that the protein food is the most expensive fuel food. We want to take into our bodies enough fat and carbohydrates to give us all the energy necessary for us to have for the 24 hours' work, and not have to draw on the protein to supply that.

Of the agricultural bulletins gotten out by the United States Department there are several that help us wonderfully in the subject of food study, and if you are interested and write them to send a list of their publications they will do so, and out of that list you can select some bulletins that will help you in this study of food, so that you will know and understand how much food is necessary, how much food we ought to take in the 24 hours, in order to have the right amount for a person to work on.

Of course, in the consumption of food, the result is what we look at. When taken into the mouth a great deal must be made of that food before it can be used by the cells in the tip of the finger. It is all to be changed in the process of digestion. After it has been changed by that process, passing into the stomach and intestines, then the food is to be absorbed. It must go from the intestines into the blood stream, and there be carried to all parts of the body. But even if taken to the extremeties of the body, if it is just simply washed back and forth and the cells do not take out of the blood stream what is necessary for growth, it will not help the cells. There are three steps in order to have the food do any good: We digest it, first; then it is absorbed, and then each cell takes unto itself just what food is necessary. The process is called assimilation. It is a peculiar thing that those cells have the ability to pick out of that blood just exactly the food necessary for them at that time. If to build they have the ability to pick out what is necessary, and if to repair, to take what is necessary for that.

We all must have a great deal of energy to get along. Energy is stored in the muscles and in the nerves and brain. Fat is a fine storer of energy because by its combustion heat and mechanical motion may result.

I am sure we have all felt the effect of heat in our work. There is a fine distinction between hurry and speed. It has been said that we should never hurry, but certainly we have to work up to the next point and get speed.

The uses of the different nutrients we have spoken of. The mineral matter we do not mention very much. Yet it is necessary for bone forming, and then it is necessary to have a certain amount of mineral matter present in the blood; our hearts naturally require a certain amount of mineral matter to be in the blood stream; our nerves are helped by the presence of mineral matter.

Water is a fine aid to digestion, and also absorption. We know, when we think about it, how much the blood stream is made up of water. We must have this fluid in order to have the blood carried to the different parts of the body. Then water is a fine regulator of the temperature.

To go deeply into the process of digestion would take far more time than is allowed to us. There are a few practical suggestions we can all profit by. The first one is that suggested by Horace Fletcher,—chew the food very, very carefully. The second would be to avoid all doughy substances, like very fresh bread. Have you not seen mothers give to children very fresh bread? You know, yourself, that fresh bread is appetizing, but if you take it into your mouth and chew it you know how it forms a bullet, and when the bullet is swallowed, it cannot be digested.

Then another suggestion is to drink plenty of water. We ought to drink two quarts of plain water every day in order to keep us in good health.

With regard to our food as affecting our digestion: The first point would be to have good, wholesome food, and the second, be sure to have the starchy foods, like the breakfast foods, thoroughly cooked, so that the starch before eating has partially been changed. Then, too, in the cooking we want to develop the flavors, and also the odors, so that we can smell the food. In regard to the quantity, the best thing to do is to eat moderately. As a matter of fact, we can digest food best when the stomach is moderately full; if quite empty it does not have enough to work on, and if too much distended, it is powerless to do the work as it should be done. So we should be quite moderate in our eating.

In regard to tea and coffee and vinegar,—food accessories: If we drink tea or coffee at our meals it will interfere in a measure with the digestion of the food. It has been proven by chemists that it retards the juices. If we are willing to pay the penalty, then all right. It has been said that variety will help in food, but we Americans go to the extreme in variety, in this age. We need a certain amount of variety, but we think we must have more variety than is actually necessary. The point is for us housekeepers to try to cook things in different forms so that they will be attractive.

There are certain things that affect digestion, as the age of a person, whether old or young, and the amount of exercise taken. If you are working in a bank and sitting on a stool most of the day, you will not require as much food as if working in the field. In regard to climate, you will need more food in the North than in the South.

The reasons for cooking are to render the food more palatable, and develop the flavor. In cooking turnips, we know that the turnip is more easily masticated; in cooking potatoes we cook the starch so that it is easily taken care of by the digestive tract. Then again we cook foods to get them warmed up so that when introduced into the system they will also cause a greater fluid supply, for cold things will check that fluid supply. If we take specific examples of cooking, like meat, think of the different ways in which we can cook meat. Roasting is a much better way than boiling if you wish to retain the juices. Just last week we made an experiment with cottonseed oil at the University. We used it for cooking crullers. We had a kettle of hot lard, and another of cottonseed oil, which has some olive oil in it. We tried to see if there was any difference in the flavor of the crullers, and we found absolutely none. The cost of the cottonseed oil which was bought in Boston, was $1.25 for a gallon. We used about three quarts, so that would make about 75 or 80 cents. In our fat kettle where we cooked our crullers we used 3¼ or 4 lbs. of lard, so that the cost of the oil and the fat, or lard, has been just about the same. The advantage of cottonseed oil or olive oil is that it clears itself of flavors so that the flavor of one article of food cooked in it does not remain to permeate that which is cooked next. In this respect it is better than lard for cooking purposes. We also made Mayonnaise dressing out of cottonseed oil. There is a difference in the taste, and anyone especially fond of olive oil would declare that they could not get used to the cottonseed, but you can, I am sure, for the flavor is not disagreeable at all. If we want to have fat introduced into the body, coming from an agreeable food, there is no better way than through Mayonnaise dressing. In the cooking of the fat in meat there is little change that takes place.

One of the greatest faults with housewives in the country and the city, is the lack of keeping accounts. How many in this audience tonight know how much is paid for the groceries in a year? How much is paid for meat, and for clothing? It has been estimated by Mrs. Ripley that a person living on a salary of one to five thousand dollars spends about 20% for food. Then if the family is living on $800 or less, they have to spend a greater per cent for food, for you have to get food to live by. Keeping accounts need not be laborious; have as simple a method as you please. At a glance one can see what has been expended for meat, for green groceries, for dry groceries, etc., and if necessary retrenchment along some lines can be had. If the account is accurately kept you can see where to cut down expenses.

With regard to keeping food after it is purchased, and caring for food in the home, many suggestions might be given along this line. For instance, I wonder if many keep tomatoes? Gather them before the frost comes, wipe them dry, place them on straw and cover with sacks in the cellar, and if they are not turned, and are firm and well grown, they will ripen excellently and you can have a very great delicacy during the winter with these ripe tomatoes.

It can be seen that the "hand that rocks the cradle" should have a thorough knowledge of food, its constituents and its value; should be capable of judging raw food and knowing that which would return the best results, and should know how to care for the purchased food so that it will not deteriorate in her keeping.

THURSDAY, DECEMBER 8.

DIRT AND ITS RELATION TO BACTERIA IN MILK,

By Prof. H. D. Evans, Director State Laboratory of Hygiene, Augusta.

Members of the Association:

I will not be so falsely polite as to say that I am glad to be here at this time, for I certainly do not enjoy public speaking; but I can truly offer you my sympathy in having to spend the next few minutes under me. I shall, however, be as brief as possible, and shall hope to bring to your attention some matters that my milk work for the Department of Agriculture shows to be in need of your attention.

In assigning me the subject for this paper Mr. Redman informed me that he was simply giving me a free and open license to roam at will about the field of bacteriology. It so happens that I have had considerable experience in a certain branch of this work, namely the side of sanitary bacteriology as applied to the diseases of the human family; and it also happens that for the past two years I have been handling the milk samples of the Inspector of the State Department of Agriculture, and, during this time, I have had occasion to report to him upon a large number of samples, which I have classed as "dirty" in varying degrees. It has apparently been thought that I must know something of the bacterial contamination which this dirt brings into the milk. What I do know about this subject I will try to present to you.

In this paper I cannot touch on the part played by all of the varied species of bacteria that occur in milk, nor dwell on the important part that bacteria play in dairying operations, where they are essential to the success of such operations. The subject limits me to the discussion of the bacteria that gain access to the milk through the dirt that falls into it, and so to the harmful species rather than to the beneficial ones. In a science as young as is this one of bacteriology there is necessarily great confusion in terms and nomenclature, and the many details of the work are of such interest that there is a constant temptation to use language that is almost unintelligible, and to bring in details that are of no interest to a body such as this. As a result I shall, in my attempt to avoid all big words and technical phrases, confine myself very closely to my notes, much as I dislike to do so.

First of all a few words in general in regard to bacteria are in order. These things, popularly called "germs," are extremely minute vegetable organisms; so minute that, in order to study them, they have to be magnified from 600 to 1000 times their true size. Their variety is infinite, but no more so than is their field of operation. Much of the life work of the world is done by these invisible multitudes. They change useless compounds in the soil into forms that can be used as plant food; they return the elements of both dead animal and vegetable bodies to the earth, and prepare them for renewed use as food for plant and animals; they are the scavengers who remove dead and decaying organic matter from our view; they ripen our cream for butter making; they change the proteid of cheese into digestible forms; they produce the pleasant and distinctive flavors and aromas of our hard cheeses; and on the other hand they make our milk to sour, and they produce disease in the animal body, for they are the cause of diphtheria, typhoid fever, cholera, tuberculosis, glanders and many other contagious diseases to which man and beast are heir.

We are interested now only in those that occur in milk, but these are numerous enough and troublesome enough, for, if we could get rid of them, we would be able to have milk that would keep without souring, and there would not be the usual summer outbreaks of infantile intestinal diseases. Neither would we see the more and more numerous reports of epidemics of scarlet fever, typhoid fever and diphtheria that are appearing in our medical journals. In other words, we would have a milk that would keep sweet and be always healthful, for both the keeping and sanitary qualities of a milk are directly proportionate to its germ content. It is, then, of interest to us to determine the source of these troublesome organisms, and to learn how to eliminate them as far as possible, and, where it is impossible to eliminate them, to control their chance of entering the milk, and to keep those that do enter it from multiplying.

Before going farther we should get a few facts in regard to the habits of bacteria in general, which will help us to understand both the part they play in entering milk, and how they may be excluded from it in greater part.

Bacteria are not organisms possessing invisible wings. Of their own accord they do not fly about in the air, looking for a chance to cause trouble. Some of them have powers of locomotion when in liquids or on solids; but if they go any distance from their point of birth it is because they are carried by some outside agency. They are heavier than air and so, if the air is quiet, they will gradually settle out of it. However, they are so very little heavier than the air that, like the toy balloons of our country fairs, any movement of the air will keep them afloat for a long time, unless they are attached to heavier particles of dust or dirt, which drag them down.

Another fact of importance is that bacteria do not spring into being spontaneously and live on faith. They must have organic matter of some kind to live upon, and all kinds of dirt about a stable furnish this food in abundance. When they do have this necessary food they thrive and multiply with great rapidity. One typhoid germ will in 24 hours produce 17,000,000 of its like. Millions live and grow on a single dirty cow's hair, and manure dust is laden with their hosts. Couple these facts with the additional fact that milk is one of their favorite foods, and the possibilties of trouble from them about the dairy loom large.

Scattered everywhere throughout nature are these invisible bodies, living, dying and propagating their kind; some of them beneficial, some of them harmless, some of them dangerous to health and some merely troublesome. About barns and dairies always throng those known as the lactic acid germs, waiting to sour our milk. These it is impossible to exclude. The problem here is to keep as many as possible out of the milk, and to keep those that do enter from multiplying. About the barn are always the filth bacteria from the cow's intestines, living and thriving in the manure; and the comparatively harmless bacterial flora of the hay. Then, in addition to these regular inhabitants, very often chance visitors at times happen in, introduced through carelessness or criminal negligence, or occurring as temporary inhabitants of the dairy water supply, or brought in on the hands or person of some person handling the milk.

The word "dirt" usually calls up to our minds a picture of mud or earthy material of some kind; but this is a restricted use of the term. Any foreign substance in or on a material renders it dirty. A grease spot on a piece of cloth makes it just as dirty as does a mud spot, and has the added disadvantage that it is harder to get rid of. In this wider sense bacteria in milk are capable of rendering it just as truly dirty as dust, hair, grit or manure; and this form of dirt is the more dangerous inasmuch as it is invisible, and so we have no means of knowing its presence until it is too late. Between bacterial dirt and the dirt that takes the form of manure, grit and hair there is a still closer relation, for these forms of visible dirt are loaded with myriads of bacteria, and, together with other forms of dirt, they constitute the means of conveyance to, and of entrance into other substances of the more dangerous and troublesome bacterial dirt. If the visible dirt was all that entered our milk it might be possible to shut our eyes and drink, for the dirt itself would do us little harm.

Remembering these facts let us now consider the sources from which dirt, in the commonly accepted sense of sand, dust, hair, manure, etc., enters our milk. And in this consideration we shall only take into account the possibilities that lie before the milk before it leaves the hands of the producer.

First comes the stable dust which, in our ordinary barns, is always present in the air, and settling out of it. This dust will contain chaff from the hay with its adhering bacteria, but will largely consist of earthy and organic material from the hoofs, body and legs of the cow, which is stirred up and introduced into the air by every movement of the milker and of the animal. In the same way there is introduced into the air finely powdered manure dust, which can also enter the milk by direct dropping of the larger flakes of dried filth from the cows body, as it is loosened by every movement of the cow's tail or body. It has been estimated that over 600 pounds of solid dirt thus enters the milk supply of New York City per day, and is paid for as milk. When it is remembered that half of the organic material thus introduced into the milk dissolves in it, the possibilities of trouble from this source are at once manifest. Much of this dust also will collect on the ceilings and cobwebs of the roof of the stall and be later shaken down, some of it finding its way into the milk.

The milker can also be a source from which dirt, in the common acceptance of the term, enters the milk; and he is likely to be a very large element in the entrance of contagious bacterial dirt. Unless the milker takes pains to wash thoroughly his hands he should not be allowed to milk at all, for the hands of any person working about a barn are sure to be contaminated with much stable dirt, and the practice is but too common for a man to go directly from his work about the barn to his milking. No man should milk with his hands in such condition that he would not come to the table for his meals with them. The common practice of wetting the hands with the first milk drawn is unsanitary; for not only does it loosen any dirt that may be on the milker's hands, but when his hands have become dry the dust from the hands will carry with it into the milk the bacteria from the fore milk, which, as has been noted, is rich in these organisms. The milker's clothes should also be free from dust, if he cannot go to the expense and trouble to maintain a milking suit.

Next in regular sequence comes the milk room. Here the same element of worker's cleanliness and room dust enters as in the two preceding paragraphs; but new elements and chances of trouble also enter here. First, let us note the milk pails, pans and cans. In the milk room the chances for pollution by bacterial dirt far exceed those from grit, dust and manure. In the condition of the milk dishes lies the secret of many an epidemic of ropy, slimy, quick souring and colored milks. Unless the pails and cans have all the seams soldered smooth with the surface, and unless the most scrupulous care is taken to see that the vessels are washed not only clean, but absolutely clean, we shall find veritable cultures of starters of all sorts of bacteria, which have grown in the organic material left about the crevices and joints of the pails by the former milk. Material from a depression in the solder of one milk pail gave 25,000,000 bacteria per ounce of the sediment. Also there is the chance for bacteria from milk that has been splashed out of a vessel dropping into milk later placed on a lower shelf, and several cases of slimy and ropy milk epidemics have been recorded from this cause.

In addition to this an entirely new element enters here. I refer to the water supply. It is well known that water is sometimes contaminated with disease bacteria. It is often contaminated with other organisms, which, while they do not produce disease, do cause colors and other milk troubles. It is not necessary to actually add water to a milk to get the water bacteria into it. The water that is used to wash the milk dishes will leave many of the water bacteria in the dish, even when the water has drained or dried out. The troubles from this source will be taken up later in more detail. It is enough to here note that the water will be the source not of solid filth but of bacterial dirt.

Here also enters the chance for similar pollution of the milk and the milk dishes by workers who are either sick, or are in attendance on the sick. The milk epidemics of typhoid have more often started from pollution of the milk by handling by persons who have been in attendance on the sick, than by water contaminated by the sick themselves.

Before leaving the milk room the fact should be noted that the practice of creameries in distributing cans at random may, unless the cans have been first really sterilized, result in spreading epidemics of diseased and ropy and slimy milk among all of the patrons, if such a case occurs on one farm. Sterilization by live steam is not too much to ask of the creamery. It will do away with any chance of thus transmitting trouble from one farm to another, and thus result in avoiding financial loss to any milk producer except the one on whose farm the trouble actually occurs.

From the above it is seen that the stable offers chances of pollution of milk by both solid and bacterial dirt, while the milk room offers the greater chance for bacterial pollution alone. Now let us see what bacteria are introduced into the milk at these various places.

First, let us consider the milk as it comes from the cow. A healthy cow secretes milk that is sterile, or practically so. Bacterial contamination enters the milk after it leaves the cow, or in the process of leaving her. The healthy cow does not secrete a germ laden milk under any conditions, so she is never the guilty party. Still, milk does not come from the cow entirely free of bacteria. It is an impossibility to keep the teats of a cow sterile, and is a waste of time to try to do so, but it is no waste of time to try to keep the teats clean, and so keep down the number of bacteria that may come from them. Granting, then, the necessary presence of bacteria on the teats, and remembering that the openings of the teats are of great size compared with the bacteria and that the milk at the body temperature of the cow is a fine media for bacteria to grow in, we can readily see that the milk in the lower ducts will be of considerable bacterial content. Naturally then the first jets drawn will contain many bacteria, as these jets will wash out the ducts; and so the common practice of wasting the first few jets of milk has a solid bacterial basis. Each succeeding stream will wash the ducts more thoroughly, so that the strippings will be practically sterile as they come from a healthy cow. Under these conditions the bacteria which enter the milk in this way are of little consequence, provided their subsequent growth can be controlled so as to prevent such multiplication as will produce souring of the milk.

On the other hand, if the cow has any local disease of the udder the milk will come from her contaminated with the bacteria which cause this disease. That such germs can live to pass into the body of the user of the milk and there cause the same disease has had many a proof. Thus tuberculosis of the udder can cause the same disease both in human beings drinking the milk, and in the cow's own calves. I pass thus briefly over the question of milk secreted by cows with unhealthy udders, as none of us claims that it should be used for dairy purposes.

We have now gotten our milk out of the udder of a healthy cow, and into the air, and we find it free from any real bacterial trouble or danger. But now its troubles begin. First, it is exposed to the dust of the stable, which we have seen consists largely of dried manure and urine from the floor. The cow also is not a particularly cleanly animal, and the same materials that compose the floor dust will be found, in a greater or less degree, dried upon her flanks, belly and tail. If the cow is not brushed and the udder washed every motion of the cow or milker brings down a rain of this germ-laden dust, and the swishing of the cow's tail does not lessen the trouble. No matter how clean a cow may be the tail will always cause trouble if left to itself, and there is no remedy so good as a rope and a square knot.

The dried manure and urine dust are rich in organic material, and are loaded with bacteria from the intestines and urinary passages of the cow, which thrive and multiply on the organic matter thus given them. With this solid dirt they enter the milk and there continue to multiply. When we drink such milk we drink with it the former inhabitants of the cow's intestines. Even if the cow has no intestinal disease the thought of using such milk is not pleasant; nor does it become more so when we remember that the cow may be throwing off tubercule bacilli in the excrement before any signs of the disease appear elsewhere. The addition of these to a milk is certainly no advantage. All of these bacteria, when taken into the stomach and intestines of an infant may set up that terrible series of infantile diarrheal diseases, that reap such a frightful harvest of children.

Statistics show that one-half of the deaths of children under one year of age is due to infantile diarrhea. The deaths of breast fed children under one year from the same diseases are not over 5%. Since the introduction of pure milk laws, and their rigid enforcement in the District of Columbia the death-rate of children under one year of age from all causes has dropped from 27% to 18%, a decrease of 33%. When we remember these facts, and the additional fact that the principle food of such children must of necessity be milk, we begin to realize the importance of excluding dirt, which is laden with such bacteria, from our milk. Adults, owing to their greater resistance powers are not so much affected by these intestinal bacteria. Here we must also remember that milk forms the main food not of well and grown persons but of children and of the sick; the very ones who are least able to contend successfully with these outside intestinal invaders.

Naturally the dried filth from the cow's body contributes to this same kind of contamination, and probably plays an even greater part when the cows are kept in the filthy condition they are sometimes found in.

The stable dust may also contain bacteria from hay and straw. These will give rise to no serious diseases in the users of the milk, but they will hasten the souring of the milk, and often will give rise to growths that will give a taste to the milk. Thus this kind of dust in the stable is out of place as much as the other kinds, if looked at from a financial standpoint.

Here also enter the lactic acid forming germs, which are always present about a barn or stable or dairy, and which it is impossible to expect to entirely exclude. These are arch enemies of the dairyman as, otherwise, he could keep his milk sweet indefinitely. No stable or stable dust is without these invaders who, while they do not affect the sanitary qualities of the milk, affect the pocket of the producer.

And now we come to the milker and the handler of milk in the dairy room. Here enters another of the opportunities for pollution of the milk by disease organisms, as well as from the stable dirt that may adhere to the hands and clothes of the milker. These latter are the same as have been mentioned in the previous sections. Here is one of the places where typhoid and diphtheria and scarlet fever germs get into our milk. Milk as it comes from the cow never contains these germs. They always enter from the outside after the milk has left the cow. A person who has been in attendance on a sick person, or has handled the food, dishes or clothes of such a person cannot work about the dairy room or milk without being a source of danger to all who may later use the milk that he has touched. Typhoid, diphtheria and scarlet fever epidemics without number emphasize this point with their deadly results.

In the milk room, leaving out the employees as above mentioned, the milk has to undergo another ordeal in the vessels in which it is there placed. The trouble is not from bacteria natural to these dishes but from those introduced upon them in handling and in washing. This matter of washing is an important one from the standpoint of the water used. A polluted water will contain the germs of the polluting material, and some of these germs will remain on the dishes after the water has drained away and the dish has dried. When milk is put into this dish the germs at once begin to live and thrive, and usually with dire results. If typhoid germs are in the well water they will have a chance to contaminate any milk that is placed in dishes that have been washed in such water. If the bacteria that cause slimy, ropy or colored milk are present in the well water, they will have a chance to produce their disagreeable results in the milk that later comes into the dish washed with such water.

The condition of the farm water supply is a very important one, and many are the wells that need to be closed on account of barnyard pollution. No well that produces water unfit for human use should be used for dairy purposes. More latitude may be allowed in the case of the water used by the cattle for drinking, especially as cows are not subject to the more severe intestinal diseases like man, and so will not eliminate these bacteria in their milk. But the milk vessels can hand on such diseases if the specific germs are put upon them in the water used in cleaning them. The state laboratory stands ready at all times to examine these farm water supplies at the mere expense of the payment of the express charge on the sample.

Not only does the dairy water supply sometimes cause trouble through the transmission of disease, but it often renders the milk produced on a farm unfit for use by introducing into the milk those germs which cause it to become silmy, ropy or colored. These things, of course, destroy absolutely the market value of the milk.

The necessity of a healthy cow needs no emphasis, for, while we can to a great extent control contamination of the milk after it leaves the cow, we can do nothing with it while it is actually in the cow. Unless we have a healthy cow as the starting point it is a waste of time to try to produce milk free from bacterial dirt.

Next take the matter of cold. Bacteria, both of the disease and acid producing species, grow best at the temperature of the body. Any lowering of the temperature below this point retards their growth, and the more the temperature is lowered the more is bacterial growth retarded. A temperature of 50° F. retards their growth considerably. Below 40° F. the growth is slight, and at a freezing temperature bacterial growth stops. Thus a frozen milk can be kept sweet indefinitely. If, then, we cool the milk *at once after milking* to a temperature below 50° F. we shall be able to hold off the souring of the milk for a long time, since we are preventing the rapid growth of the germs that produce this sourness. It has often been noticed that morning's milk will sour quicker than will the milk of the night before, which has to wait until after the morning milking for delivery. We here have the effect of cold on the souring of milk well illustrated, for the night's milk is usually put in a spring, or well, or in a cool cellar until morning, and the cold there met with very greatly retards the bacterial growth. But the morning's milk is at once put into cans for delivery without any preliminary cooling. Here in the fresh and warm milk the bacterial growth soon exceeds that in the older but cold milk of the night before. The result is a quicker souring of the fresher milk, as it offers greater chances for rapid growth of the bacteria that cause this souring. Thus a dirty milk cooled as soon as milked and kept cool will remain sweet longer than a clean milk that has been allowed to stay warm; but it must be remembered that, while retarding their growth, cold does not kill either the acid-producing or the disease-producing bacteria, so that it can never take the place of cleanliness in the production of a sanitary milk. The bacteria in the cold milk simply have their power of reproduction curtailed. They still retain the power of resuming this function when temperature conditions become favorable. Thus cold really comes second to cleanliness, and not in the place I have taken it up for the sake of convenience.

We now come to the question of cleanliness in the production of milk. This feature of the question deals not with the keeping down of bacterial growth, but in preventing entrance of bacteria into the milk to cause the trouble that makes their later control necessary. Much has been written on this subject and, if the various recommendations of investigators could be carried out, milk perfectly clean both from dirt and bacteria could be produced. But the success of such schemes involves expense that, with the present price of milk, makes their application out of the question for the average milk producer. This is not saying, however, that even at the present prices he cannot make an increase in cleanliness that will greatly increase the quality of his milk, and this at a very small cost. The difference between the samples submitted to us at these Conferences, and those collected by the inspector from the home carts, shows this very clearly; for I do not expect that any producer has installed a new outfit simply to produce Conference milk. This difference between the two milks is mainly one of dirt and bacteria, as otherwise the milks are generally in good condition. It is not necessary for the man who owns a half dozen cows to have concrete stalls, tile-lined dairy rooms and steam sterilizers to produce clean milk. He can produce good milk, and clean milk, and milk that will keep by simply giving careful attention to a few simple details of his methods of handling milk, and this attention will involve but a small expense and but a small amount of his time.

Let us again start with the cow, the starting point of our milk. No person claims that the cow works to keep herself clean, as does the cat. She lies down where she happens to be, and in whatever happens to be about her. As a result she rises dirty if the place where she happens to lie down was dirty. Often she lies down on a little straw, which she has first covered with her manure, and spattered with her urine. Sawdust and dried horse manure were used as a bedding in one dairy of which we have record.

We cannot expect to give a cow a bath before we milk her, but we can use her as well as we would a dusty coat, and brush off with a stiff broom the loose and dried manure and the other filth that adheres to her sides and flanks. We cannot hope to make the udder perfectly clean, although this is a source of much dust and fine dirty particles, which will be knocked off with every motion of the milker, but we can wipe off the udder with a damp cloth, which will not only remove much dirt, but will also leave the udder moist enough to keep any rain of fine dust particles from falling into the milk. What a little care in this respect will do in improving the condition of the milk is shown by the following figures. The bacteria that were present in milk from a cow with unwiped udder numbered 7,058 per c. c., while those in a milk from the same cow when the udder had been wiped gave but 716 per c. c.; a decrease of 6,342 bacteria per c. c., due simply to going over the udder quickly with a wet rag. Also it is estimated that 32 times as much solid dirt falls from the dry as from the moist udders. Also we can tie down the cow's tail, so that she may not use it as a club to pound off dirt from her sides, while she is being milked. Such simple methods as these will give surprising results in the physical appearance of the milk, and will enormously cut down the bacterial content.

We cannot ask for concrete floors in our stalls, which we can flush clean with a hose, but we can see that the floor is dropped slightly behind the cow, so that all the excrement will fall to a slightly lower level, where the cow will not spend her time trampling in it; and the floor of the stall can itself be lightly sprinkled with water just before milking, so as to prevent dust being stirred up from it, which dust we have seen contains the causative agent of infantile intestinal diseases, as well as the other inhabitants of the cow's intestine. Cobwebs can be brushed from the walls and ceiling without any great expense or effort, so that they will not drop the dust that has accumulated on them in the milk; and the feeding of the animals can be done long enough before the milking, so that no dust need be in the air from this source to contaminate the milk, or the feeding may be done after the milking.

The milk pails need not be of the wide-top variety, which seem especially made to be dirt traps, but they should be of the small-top variety. This small opening can even easily be covered by a couple of layers of fine mesh cloth, between which is a layer of cotton. This will exclude the solid dirt while milking, but it does not take the place of cleanliness of animal and stall, as it does not exclude the bacteria not clinging to the solid dirt. If the precautions above mentioned are observed in respect to the cow and stall the bacteria that pass through the cotton strainer should not only be few, but should be only dairy bacteria. Here also further improvement can be made by the use of a pail of pressed metal in place of the common pail of tin with soldered joints. This pail will contain no uneven soldering in the depressions of which bacteria may escape the cleansing processes.

Similar utensils in the milk room will be equally advantageous, and often and thorough washing of the shelves on which the milk or the milk vessels stand will greatly decrease the bacterial content of the milk. Here is often the starting point of dairy troubles, for milk that has been splashed out of dishes and allowed to remain on the shelves becomes a veritable hotbed of bacteria which were in the original milk, and, when dry, the dust from these spots will introduce more acid-producing bacteria into the milk than all the previous precautions will have succeeded in excluding. The common practise of washing the milk vessels at once in scalding water leaves much to be desired, as the albumen of the milk is coagulated at this temperature, and is likely to form a scum on the sides of the dish, in which the bacteria of acid-producing species will thrive. It is much better to wash out the utensils in slightly warm water, which will remove the albumen without coagulating it, then rinse with weak lime water and later with boiling water. Even without the use of the middle step the successive use of warm and hot water in washing the milk dishes will give surprisingly good results in increased purity of the milk.

Enough has already been said on the question of the dairy water supply. I simply reiterate here that no water should be used for dairy purposes that you would hesitate to use for drinking purposes. A good and safe water supply is absolutely essential if disease and other troublesome bacteria are to be excluded from our milks.

And so we finally come to the persons who handle the milk. It hardly seems necessary to again state that no sick person, or person who has been in attendance on a sick person, or who has been in contact with such a person's clothes or food, should be allowed to either milk a cow, or handle milk in the milk room. Here lies the source of most of our milk-borne epidemics of typhoid fever, diphtheria and scarlet fever. In deference to common decency, if for no other reason, the healthy handler of milk should have clean hands and wear clothes free from dust when so engaged. Even a clean pair of overalls, used only for milking, will give surprising results, while the use of a milking suit, used only when milking, will still farther aid in eliminating dirt and bacteria during the process of milking. For this purpose a white suit has decided advantages over a colored one, for it tells at a glance whether or not it is dirty.

Here then we have the essentials of a clean milk and of a sanitary milk. It is milk from a healthy cow, which is kept clean; milked in a clean stable by a clean milker into a clean pail, and handled by clean and healthy employees in a clean milk room, and in dishes that are really clean; and which is then immediately cooled below 50° F. And by the use of the word "clean" I refer only to such a degree of cleanliness as has been pointed out in the above sections, which does not involve expense to the producer except in the extra care taken everywhere. Healthy cows and cleanliness will give a milk free from dirt and bacteria of disease. Cold will keep it in this condition. We cannot get a sanitary milk from a cold dirty one, or from a warm and clean one. All three elements are essential to success.

People are beginning to tip over the milk bottle and look at the bottom as well as at the cream layer on the top, and they are beginning to know what the presence of manure dirt and hairs on the bottom of a milk bottle mean, and to insist on their absence. The people are certainly demanding more from all food producers, and the milk producer is now being included in this list. Added expense will naturally have to be met by the persons demanding the added purity; but when the question is one of a milk that is not actually and physically dirty we can remedy much of this trouble by the simple expenditure of a little care, and this the people will not only demand but will demand rightly. That such results are easily possible of attainment is shown by the fact that the proportion of dirty milk samples fall off much after the first inspection of the milk supply of a town.

If any suggestions of value have by chance slipped into this paper the author will be gratified.

CAN ALFALFA BE RAISED IN MAINE ?

By F. S. ADAMS, Bowdoinham.

I have been connected with the Maine Dairymen's Association in various ways ever since it was born, and, in fact, I was present at the birth of the organization. It has always been the custom at our meetings, so far as I know, for the officers to assign subjects to members who have made a success of those lines. Surely at this time they have departed from that custom, and have asked me to come here and tell you of my failures.

I have realized, as you all have, that the alfalfa plant is a very important food for all kinds of live stock. It is adapted to feed all kinds of stock. The alfalfa plant itself is nearly a balanced ration; it contains about the right amount of protein and carbohydrates. I think if we can raise it here in Maine we shall make a long stride in advanced dairying.

I understood that alfalfa to be grown successfully must have some kind of bacteria. Some kinds of bacteria are all right; we need some kinds; other kinds are all wrong. The bacteria may be something like the inhabitants of this earth—some are good fellows and some have no place on earth except to make trouble.

I was told that if I sent to New York and got some of the earth where alfalfa is grown, it would contain the necessary bacteria. I sent for it. It cost me about $5.00 delivered. I selected a piece of land I thought adapted to alfalfa. I understood it should be well drained for the best growth of this plant. They told me that in Arizona the roots have gone down as far as 12 feet, hunting for water. I selected a piece of land that I thought would grow clover well; it is naturally well drained. I went out one moonlight night (like the old deacon who drove his trotting horse) and sowed on the alfalfa earth. This is the first time I ever confessed this to anyone. I understood it was necessary to have lime on the land. That I could put on in the day time, for it is quite a custom for farmers to use lime. I sent to one of the best seed firms and told them if they had alfalfa seed adapted to growing in Maine to send me five pounds. They sent it, and I cultivated this land the best I knew how, so that it was a good seed bed. I sowed the seed the last of May and watched it with interest. It came up all right and looked very well the first year. I was very much encouraged. That winter was unfavorable. You farmers know that we have winters once in a while that will kill out the clover plant. When the snow went off in the spring I was able to find only five alfalfa plants alive. I gave it up then and concluded that alfalfa under present conditions could not be raised in Maine.

I do hope and have faith to believe that the men who study these things will develop a plant hardy enough to grow in Maine. It has been grown in Asia ever since we have any history, and has been grown in some portions of Europe over two thousand years. It was brought to this country during the Spanish Conquest, and was introduced into the United States in 1854, brought from South America to California. It spread over that region and is now extensively cultivated in regions where irrigation is practiced. It has almost revolutionized the agricultural industry in Kansas and has made the farmers independent.

Ques. Did you sow the five pounds?

Ans. I only sowed three-quarters of an acre.

Q. Did you test the seed?

A. It came up all right; there is no question about that, but it did not live through the first winter.

Q. How high did it grow?

A. It got a good growth; it was high enough to get a good growth the first year.

Q. What did you do with the five plants that survived?

A. I plowed the piece up and planted it to corn with some other land.

Q. Don't you think that was a mistake?

A. I think so now.

Q. You spoke of the winter being unfavorable, what were the conditions?

A. Not much snow, and a good deal of freezing and thawing in the spring; and the ground not well covered with snow.

Mr. Fred J. Rose, Bath.—When we came to our place we found in one of our fields two or three alfalfa plants. Three or four years later we plowed the field up and bought some seed of a local dealer and sowed alfalfa on it. It lived all right, and we have some that is still growing. We cut it in haying time and it was three feet high, and then again the first of September, and it was 28 or 30 inches high. It was not thick on the field, but scattered around in bunches a few feet apart. We do not see any reason why it cannot be raised. I don't know where the seed came from that was there. Our seed came from Montana.

Q. What kind of land did it grow on?

A. Almost any kind; some gravel and some clay. We obtained our seed through a local dealer in Bath. We bought this spring what he had, about 200 pounds. We tested it and about one-third of it would grow. We have about 2½ acres plowed and will send west for more seed. All that we put on the land was some chemicals we mixed ourselves. We did not use any lime. We mixed our seed as we would with any clover.

Q. Did you cut it before it blossomed?

A. Before it was in full blossom.

Q. Did you ever let any of it set seed?

A. None to amount to anything. There were a few plants where we cut the second crop. We did not gather it, but let it seed itself. The roots where we plowed were as big around as your finger and were tough to plow. We took up a plant a few years ago and sent it to the Experiment Station and they said there were some of the bacteria tubercles on the roots.

DR. MERRILL.—This subject was introduced into the program to set people thinking. We have those in our State who are making progress in raising alfalfa. And the very fact that personally I have seen alfalfa growing wild in Maine, and that it has been growing there for years, convinces me it can be grown in Maine.

It is true that every man should not attempt to grow alfalfa. If we did we would make many mistakes and retard the successful growing of alfalfa in Maine. We have men who are beginning to grow alfalfa and all they need to observe is caution. They need to secure good seed and follow the best methods.

I think this association should lend its encouragement to those men who are striving to be pioneers in the growing of alfalfa.

DR. RAYMOND PEARL.—I do not know much about alfalfa but I would endorse what Dr. Merrill has said. It seems to me from what we know of the plant now, that there is no reason why it cannot be grown here, if we get the right kind of seed and learn how to grow it.

It seems to me that the important step at the beginning is to make an effort to grow the seed in the state where it is raised. I think that Mr. Rose of Bath, instead of buying seed should make every effort to save seed from his own plants. The best seed is that which is acclimatized.

A very important matter in growing alfalfa is the selection of seed. The best alfalfa grown in this country in the northern regions is the Grimm, grown in Minnesota, which came from chance seed brought from Germany, and has established itself and grows there without difficulty.

Explorers of the United States Department of Agriculture are sending into this country alfalfa seed from Siberia. It is grown there under conditions harder than they are in this State. Anyone interested in growing alfalfa in this State should get into communication with Dr. Piper of the United States Agricultural Department, and he will, so far as the supply admits, be glad to send samples of Siberian alfalfa seed to try out in this State. After it is established they should save seed from the plants grown here in Maine.

MR. G. E. BARNES.—It seems to me that if a few farmers who are interested in growing alfalfa would meet and agree to sow it on different kinds of ground and keep the seed, it would help to find out the kind of soil we need to raise alfalfa and whether it can be successfully raised or not. We should get the seed from some climate as near like ours as possible. I am ready to sow an acre.

MR. REDMAN.—This past summer I had occasion to visit many farms in Michigan and in Ontario. I found the climatic conditions and the soil about the same as in Maine. I believe we can raise alfalfa in Maine when we get ready to do it.

I am very glad to see this discussion come up here, for I believe we need the plant in the State, and here is the place to do something for it.

Q. I was going to ask Dr. Pearl if the nature of alfalfa and the nature of common clover are not quite a lot alike? Would not soil that would spontaneously raise sweet clover be a good soil to raise alfalfa on?

DR. PEARL.—I think that would be the best place to try it first. I think it is probable that alfalfa is harder to grow than sweet clover. It is not so hardy and will not stand the same treatment. The idea of growing it on sweet clover land is a good one.

REFLECTIONS ON SOME RECENT DAIRY EVENTS.

By GEO. M. WHITAKER, Sc. D., Chief Market Milk Section, Dairy Division, Bureau of Animal Industry, National Department of Agriculture.

One who has read New England newspapers during the last year might think that New England milk producers are subject to oppression and abuse which are peculiar to New England. But those of us who are so situated as to study the milk field in a national way find the same unrest existing all the way across the continent. Producers for the New York market and for the Chicago market are also sure that *they* are the victims of the extortion of powerful corporations and of bad local conditions. In the state of Washington on the Pacific coast the milk producers for the cities of Seattle and Spokane have the same discontent and believe that there is no profit in the production of milk. I have found many southern milk producers retailing their own product at 10 cents per quart and grumbling at their circumstances as peculiarly bad. If New England conditions are bad it is not the result of local hardship or oppression but of nation-wide causes.

This state of affairs may well attract the thoughtful study of friends of the dairymen in all parts of the country. What are the facts? J. M. W. Kitchen, M. D., of New Hampshire, in a letter to the Country Gentleman, October 6th, 1910, said:

"It is a fact that American agriculture as a whole is not prosperous . . . farm hatred has become widespread; . . . so far as the rank and file of farmers are concerned no pursuit in the whole land pays so little return for the labor, brains and capital expended as does farming."

Is this true? Is it applicable to dairying? Is the dairy business of today a losing proposition? Is the average milk producer running behind financially? Is he failing to get such a return for his labor and capital as similar amounts of labor, skill and capital return in other occupations? If so, why? If it is found that the *average* dairyman is losing money, are *any* dairymen doing well? If so, what is the difference between them and the unsuccessful?

It is noticeable in this study that there seems to be more unrest among the producers of market milk than among the producers of milk for butter and cheese factories or for the manufacture of butter and cheese at home, even when the returns are the same. At the outset, therefore, it is interesting to consider certain elements of human nature and certain psychological facts. It is characteristic of human nature for those in moderate circumstances to be somewhat distrustful and critical of those whom fortune has favored, especially when persons of the two classes have business relations with each other. A person keeping only 8 or 10 cows and selling milk to a powerful corporation easily develops suspicion and discontent, and in that frame of mind he cannot look at the situation logically or judicially. He may possibly be making a larger per cent of profit than is the prosperous middleman, but his dairy business is so small that he cannot make a living; while the aggregate profit of the middleman may be enormous on account of the size of his transactions, even if the per cent of gain per quart is comparatively small. When a number of such producers discuss their common and often actual grievances there arises the contagion of the crowd, and the grievance may be exaggerated and gain force as it attracts larger numbers. Then the demagogue politician, the thoughtless sentimentalist, and the superficial friend of the farmer come to the front—with profuse solicitude in his behalf, and all kinds of schemes for help (?), but possibly misleading him after all. Meanwhile he is in such a discontented frame of mind as easily to fall a prey to plausible sophistry. If he is not making satisfactory gains it is easier to attack middlemen or railroads than to study his own methods.

There should be honest effort on the part of dairy leaders to examine the situation, to investigate for the purpose of digging out the truth, and then to bring what information they get to the real help of the milk producer.

Last winter while discussion as to conditions attending the production of milk was at its height, evidence was adduced in a number of places as to the cost of keeping a cow a year. These figures so far as they came within the range of my investigations, varied from $40 per year to $186. The lowest figure was given at a meeting of the Michigan Dairymen's Association by a gentleman who hires all of the labor necessary to run his dairy and keeps a systematic set of books. The highest figure was made by a prominent Massachusetts dairyman of considerable experience, before a legislative commission on the cost of living. When the statements of practical gentlemen based upon what purport to be exact figures, vary from $40 to $186 per year, there would seem to be need of instruction either in bookkeeping or milk production before we try to reform the middlemen or railroads. Professor Sanborn of New Hampshire testified before a Massachusetts legislative committee that it cost him $122 per year to keep a cow. Mr. B. W. Potter of Massachusetts put the figure at $161, but he included family groceries, pew rent and grange dues in the cost of keeping a cow. A prominent Ohio dairyman at a meeting of the Northern Ohio Milk Producers' Association stated the annual cost of keeping a cow at $82. Edwin Van Allstyne before the New York Dairymen's Association placed the figure at $80, and J. G. Schwink before the Connecticut Dairymen's Association at $136 and $141. Among the college professors Professor Wing of New York places the cost at $79, Professor Erf of Ohio at $102, Professor Hill of Vermont at $107.

The cost of feed, alone, is given by various people at from $35 to $142 per year. The Ohio gentleman above referred to says $41; Professor Wing of New York, $47; Professor Erf of Ohio, $59; President Abbott of the New England Milk Producers' Association, $74; Mr. Van Alstyne, $59; average cost in Maine Cow Test Associations, $46. Some investigations by the Ohio Experiment Station among dairymen in that state gave a range of from $25 to $58. The dairy department of the Connecticut Agricultural College says the expense of keeping a cow a year, other than feed, is $45; the Ohio department says $43. The Ohio dairymen quoted above, $23 to $40.

From this it will be seen that producers are almost hopelessly at sea as to the cost of keeping a cow a year. These wide variations in statements of those who claim to keep systematic accounts are due to several factors:

First. Conditions vary. It may be cheaper to keep a cow in Michigan than in New England, but not enough cheaper to explain the difference between $40 and $186.

Second. Where a farmer is engaged in general agriculture—for instance selling potatoes, apples, poultry, eggs, and milk, the whole business being considerably mixed with domestic and personal expense—it is difficult to separate from other items and determine the cost of keeping a cow.

Third. Many producers are paying the higher prices because they put too much expense into feeding their cows. A producer for the Chicago market in a recent newspaper article showed how many dollars a day he was losing by selling milk to the big wholesalers in Chicago, of whom he was very critical, even abusive, for not paying him a living price. It was costing him $135 per year per cow to keep his herd, but he had no silo and a considerable portion of the feed was hay and corn meal, a poorly balanced and expensive ration. Where ensilage can be secured and where the ration can be balanced by some home-grown leguminous food, such as peas, soy beans, clover and similar crops, the cost will be materially reduced. One of my assistants when visiting a dairyman in New Orleans, who has a herd of 86 cows, proved to him how he could save $2,400 per year by substituting alfalfa for some of the more expensive protein feed he was using.

Fourth. Many persons, even those who keep accounts, do not know what items of expense are properly chargeable to keeping a cow, or how to interpret a balance sheet. It seems to me that the items to be considered in discussing the economics of milk production are labor (including any help of wife and children), feed, housing, including use and depreciation of cow-barn, depreciation of the herd, allowance for sickness and accidents to the herd based on experience of a period of years, incidentals such as wear and tear of utensils, delivery, cost of maintainig bull, taxes, bedding, veterinary bills, etc., and also a reasonable interest on the investment, 6% being none too much when the care and responsibility of the business is considered. Personal and family expenses have nothing to do with the case. The labor account should include a return to the proprietor for his skill as a superintendent as well as for the manual labor which he performs. With these items of expense if the income equals the outgo, it does not mean that the dairyman has made nothing—it means that the dairy has furnished a home market for much home-grown produce, has paid a fair rental on pasture and dairy buildings, has given the farmer a reasonable salary, possibly has provided employment for members of his family, and has returned 6% on the investment. What more could be asked? And yet such is the confusion of thought relative to farm accounts that you will find some very intelligent persons claiming that when, with the items which I have named as expense, the account balances, nothing has been made. At a hearing last winter in Massachusetts one speaker claimed that the milk producers of New England are ruined and do not know it. There is no such misunderstanding in the bookkeeping of a manufacturing company or in an investment in dividend-paying stocks. A writer in a recent issue of the Saturday Evening Post says: "One may search the files of the farm periodicals in vain for a farm balance sheet properly so called. Of all kinds of business done in the United States there is none conducted in a more haphazard way or with less knowledge of actual results than farming."

Applying my classification as above to Professor Sanborn's figures the result is as follows:

COST OF COW PER YEAR.

Feed	$72 90
Labor (including delivery of milk to R. R. station)	25 00
Owner's managerial service	5 00
Housing	6 00
Depreciation and risk on cows	12 00
Incidentals	1 75
Total	$122 65

On this showing of expense, crediting 6,000 pounds of milk per cow at 4 cents per quart, and the manure, there was $8.83 per cow to the good. If the dairy investment—not total farm investment—for cows, barn, milkhouse and utensils, averaged $100 per cow, the dairy paid a profit or dividend of 8.33%. This is more than the income from ordinary investments. The professor says it is not a great profit for the skill and risks involved, which is true. But he has included in his expense account $5 per cow for owner's skill and in addition what he thought was proper for risk.

You will recognize that here is a problem of considerable magnitude when practical men keeping accounts vary all the way from $40 to $186 in their ideas as to the cost of keeping a cow a year. It would hardly be possible to find any other business where the cost of production by different manufacturers would vary in the ratio of 40 to 186. It is impossible to conceive of such a condition in railroading, in cotton manufacturing or in anything else; and such figures incline us to endorse the expression of Sir Horace Curzon Plunkett, who, after a tour of investigation in this country, said that "the weak point in American rural economy is the failure on the part of farmers to adopt good business methods."

But this is only a part of the problem. Cows in regular working dairies are annually producing all the way from 3,000 pounds of milk and below, up to 10,000 pounds and even more. Exceptional animals have gone to 27,000 pounds. The whole problem, then, as to the cost of a quart or of one hundred pounds of milk is something like this: If it costs from $40 to $186 to keep a cow a year and if a cow produces from 3,000 to 10,000 pounds of milk a year, what is the cost of a quart of milk or of one hundred pounds of milk?

And with such variations in product the thought again comes to mind that the business end of farming is much neglected. And with such uncertainty as to precise data, the expense of producing milk becomes something of an enigma.

Professor Erf of Ohio says that if it costs $102 per year to keep a cow and if the cow gives 3,000 pounds of milk per year the cost is 7.3 cents per quart; if 4,000 pounds per year, 5.5 cents per quart; if 5,000 pounds per year, 4.4 cents per quart; if 6,000 pounds per year, 3.6 cents per quart; if 7,000 pounds of milk per year, 3.1 cents per quart. Here there is a range in cost of from 3.1 to 7.3 cents per quart, depending entirely on the amount of the product, the cost of keeping the cow remaining the same. Professor Haecker at the head of the dairy department of the Nebraska Agricultural College substantially confirms this point when he says he knows of farmers on farms almost adjoining where it costs one twice as much to produce milk as the other.

The milk agent of the Delaware and Hudson Railroad recently told me that there are shippers on his line of road whose annual product is as low as 2,780 pounds of milk per cow and that the shippers at one station representing 1,400 cows sold an average of 4,200 pounds per cow. Ex-Governor Hoard has developed a herd that averages 8,000 pounds per cow a year. Who can tell what is a fair price to receive for milk under such varying conditions?

Taking up some statements as to the cost per quart of producing milk, the secretary of the Massachusetts Board of Agriculture estimates, as reported in the papers, that the cost of producing a quart of milk is 5 cents for feed and 1½ cents for labor, depreciation, incidentals and interest on the investments—6½ cents in all; while Mr. Robert Edkins at the meeting of the Pennsylvania Dairy Union estimated the cost to him at less than half that amount, or 3+ cents. He says the cost of keeping a cow a year is $152 but the average yield of the cows in his herd was 9,500 pounds.

When intelligent, business-like men who keep books are so hopelessly apart as $40 and $186 as to the cost of keeping a cow a year, or 3 cents and 6½ cents as to the cost of a quart of milk, it might seem foolish to urge more attention to bookkeeping or to utter any criticism because so many entirely neglect it.

At a hearing before the attorney general of the State of New York it was noticeable how few farmers had definite statements as to the exact cost of milk production. One man "believed" that a fair profit might be obtained by selling milk for five months of the year for 3 cents and for 5 cents for the remaining seven. Another said, "I *think* it has cost me about 3½ to 3¾ cents to produce milk." Another gentleman said, "I cannot say how much it costs me to produce milk per quart, but I *should think* that it costs *about* 4¼ cents." Another gentleman said, "I have no figures, but it is *my opinion* that it cost me from 3¼ to 3 1-3 cents to produce a quart of milk during

1909." Another gentleman put the cost of production at 2¾ cents, and another at 3 cents, and another at 4 cents. I am forced to admit that these guesses varied less than the more carefully prepared figures of the others noticed above. The New York producers' estimates ranged from 2.75 cents per quart to 4.38 cents, with an average of 3.51 cents.

On account of the high cost of milk, due to too expensive feed and to cows of low production, probably many dairymen are losing money and are justified in feeling discontented. Even if the average dairyman is losing money the business may be a good one. An Ohio Experiment Station bulletin says: "A large number of dairymen in Ohio are not making a profit on a part or all of their cows," but it gives the items of one dairy which is paying a profit of $46 per cow. The Illinois Experiment Station selected 25 cows that make as much profit as 1,021 ordinary cows. Organizing to resist the undue greed of middlemen while very desirable is therefore not the only thing to be done. Should we not get busy with these common cows and make a study of the cost of production? Is it any wonder that dairy leaders are urging milk producers to weigh the daily product of each cow, to form co-operative associations for doing this work and for studying the most economical way of feeding, and to keep no cows except those that are profitable? And when it is proved to the average farmer by the experience of those who have gone into these associations that there is good money in it, is it not surprising that any hesitate or refuse to join the movement?

Notice the following results of the test, showing a year's record of a good herd, 1907. Michigan Cow Testing Association.

No. Cow	Lbs. Milk	Av. Test	Cost of Feed	Net Profit	Returns for $1 in feed	Food Cost of 100 lbs. milk
1	6,547	5.3	$37.17	$61.20	$2.65	57
2	7,009	4.9	37.02	61.32	2.66	53
3	6,397	4.9	36.21	55.89	2.54	57
4	7,912	5.0	36.60	79.41	3.17	46
5	6,280	4.8	36.08	48.30	2.34	57
6	6,579	5.4	37.60	61.36	2.63	57
7	3,120	4.8	25.23	15.83	1.63	81
Av. for 12 mos.	6,416	5.0	$35.98	$56.10	$2.56	56

Contrast the above with a year's record of a poor herd, 1907, by the same association.

No. Cow	Pounds Milk	Av. Test	Cost of Feed	Net Profit	Returns for $1 n feed
1	3,716	3.3	$28.85	$5.82	$1.20
2	4.835	3.2	29.89	15.41	1.52
3	4,532	3.6	31.75	14.55	1.46
4	3,677	3.5	32.11	4.44	1.14
5	3,469	3.5	31.37	2.73	1.09
6	2,066	4.2	31.37	–	.77
7	3,135	3.3	27.76	.87	1.03
8	3.411	3.7	31.02	4.88	1.16
Av.	3 5	3.5	$30.52	$5.17	$1.17

The cows in the good herd produced an average of 6,416 pounds of milk for the year and returned $2.56 for each dollar's worth of feed. The second herd returned only 3,605 pounds of milk per cow and $1.17 for each dollar's worth of feed.

Notice the following improvement in ten years in a Swedish herd as a result of systematic weighing and record keeping. Lundatrakten's Cow-testing Association, Sweden.

Year	Average number lbs. milk per cow	Average number lbs. butter per cow.	100 feed units gave	
			Lbs. milk	Lbs. butter.
1st year	6,890	236	266	9.1
2nd year	6,582	225	268	9.1
3rd year	7,357	256	294	10.2
4th year	7,692	268	319	11.1
5th year	7,653	256	336	11.2
6th year	8,268	277	338	11.3
7th year	9,155	307	352	11.8
8th year	9,338	324	353	12.3
9th year	9,183	319	355	12.3
10th year	10,064	345	366	12.6
Increase	3,174	109	100	3.5

Look at this picture drawn by Dean A. F. Woods of the Minnesota Agricultural College at the Farmers' National Congress last October, describing an inspection visit to a dairy farmer: "The stable was airy and fairly well constructed. It was clean and accommodated about 20 cows. The cows were in the barn and appeared to be an average grade herd. I said to my companion, 'Here is a man who is making money out of his dairy.' We asked the owner what his cows averaged and he replied, 'I don't know, I guess about 10 or 15 quarts.' We asked him how much butter fat? He did not know. He never had his milk tested. We asked him his feeding ration, but found that was indefinite and not measured, and no account was taken of the weight of the cow or of the milk she was giving. He had no silo and did not believe in silage. He shipped his milk to the city and received an average price for it. He did not know whether he made or lost on his dairy operations. He never figured exactly. He doubted if he was making very much."

This problem of varying cost has an important bearing on the question of what is a fair price to be received for milk. A producer has no right to ask the public to pay him for uneconomical and unscientific methods. If one man can produce milk at 3 cents a quart while it costs another man 7 cents, has the latter any legitimate cause of complaint if the wholesale price is fixed at 4 cents?

In this discussion let us not be confused by the use of the word "average." In the opening, I asked if the *average* dairyman is successful? Often he is not, in view of figures presented above as to the wide range in cost of keeping cows and in their product. But that proves nothing against the business. If only a small minority keep the cost of producing milk down to where a profit can be made, no argument can be drawn against the dairy business by reason of the failure of the majority.

Can a dairyman keep the cost of keeping a cow down, and the amount of production up to a profitable point? I believe many—some right in this audience—are doing it.

Another subject of much interest growing out of recent milk agitations is the attitude of many producers toward the middlemen, and a failure to realize that there are legitimate expenses of distribution and transportation. Yet it is common to criticise middlemen without discrimination. A quart of milk or a pound of butter at the farm in Maine has as much nutritive value as on the consumer's table in the suburbs of Boston, but its commercial value at the farm in Maine is almost nothing until to the expense of production has been added the expense of transportation and distribution. With these three, the product at the consumer's door has a greatly enhanced commercial value. And it seems to me that a reasonable number of middlemen and of transportation companies are necessary, and even entitled to be considered as producers. There is much confusion of thought concerning conditions where a producer retails his own product. If he is situated so favorably as to distribute what he raises, say, market milk, directly to the consumers, does it not cost him something for his time or the time of his hired man in delivering the milk, and for the wear and tear of team, bottling, the loss in bottles, and the bookkeeping? If the producer combines the function of retailer with that of producer, the larger amount of money that he receives is for production and also for distribution. That larger sum may mean no more income to him as a producer. A man doing two kinds of business should make more money than if he has only one business. If he does not get enough more for the milk or butter to pay the cost of distribution and a little profit on that, he would be better off to wholesale his product. Not long since I read a newspaper article urging butter producers in the vicinity of our large cities to retail their product directly to consumers, the article saying that "the producer could get 5 cents a pound more for his butter and in many cases his wife could do the work of delivering it." It seems to me that that way of looking at the case is entirely fallacious; if the wife delivers the butter an allowance should be made for her time and for the use of the team; as a sound business proposition it is entirely wrong to say that the farmer "gets 5 cents extra for his butter" because his wife delivers it. I should like to see consumer and producer brought nearer together to reduce the expense of transportation and distribution. If there is a profit in distribution I should like to see the farmer get some of that as well as any profit there may be in production. But some one has got to distribute the products that are manufactured whether on the farm or in the factory. Distribution is attended with expense and the expense is as legitimate as any item of expense in production. There may be too many middlemen and they may get an undue share of what the producer pays. Those things are evils that should be treated specifically; but the blind, indiscriminate abuse of middlemen does not appeal to me. In some lines of business the middlemen become extremely skillful and are entitled to some credit intermingled with criticism. It is skill of no small ability to collect from thousands of New England producers the daily milk supply for three-quarters of a million of people, always enough to go around and with no loss-causing surplus, to arrange for the sanitary transportation of that product, to receive it in the city on time every morning including Sundays and holidays, to distribute it clean, pure, and safe to hundreds of thousands of consumers every day, to collect the bills and make prompt and regular payment to the producers. How many here would care to undertake the job? And is it not proper that skilled labor of this kind should have a reasonable return? Suppose the farmers undertook to do this co-operatively (and I wish they might) the same skill and experience would be required in buying milk, in collecting it at railroad stations, in running trains, in caring for the milk on those trains, in bottling, in arranging a city distribution system, in delivering it to the consumers, in collecting the bills and making returns. And I imagine it would be very nearly the same whether it is done by some one who is regarded as a "malefactor of great wealth" or by the producer himself.

A third matter that has interested me much in connection with events of the past few months relates to the sanitary phase of the question. Opposition and skepticism still exist in the minds of many milk producers, and fallacious arguments are still used to prevent what seems to me to be a proper safeguarding of city milk supplies from the sanitary standpoint. I have spoken on this subject at previous meetings of this association and it has also been ably handled this forenoon by another speaker; therefore I will not dwell on it long at this time, but I see no reason to retract or modify what I have said on this subject on other occasions. As the years go by, increasing experience and study are confirming the necessity for and reliability of the tuberculin test both as a matter of economy to the farmer in having healthy animals and as a health measure in rendering the product pure and safe. The part which milk may play in the dissemination of contagious diseases is made more certain every year, as is the deleterious influence of common, dirty milk reeking with bacteria, even though skeptics may say that some of these bacteria are harmless. With increasing recognition of these facts a general improvement is being made all along the line; many dairy progressives are taking advanced sanitary steps and usually they are well satisfied with the results. "I do not see how I could have done business under old conditions," said a farmer to me not long since, who had recently put additional windows into his stable, whitewashed it and made other improvements. "The satisfaction of having a pleasant, bright, clean place where I must spend much of my time during the winter has amply paid me for the changes I have made," was the evidence of another. But there still remains a little of the reactionary influence which sees no advantage in modern progress. Sometimes the dairy standpatter gets back at the scientific world by claiming that it is under the domination of a thirty million dollar pasteurizer trust, or other similarly foolish charge. We still occasionally hear of farmers going out of business because they cannot afford the expensive (?) changes ordered by city boards of health, although the cost of the change from producing dirty milk to clean milk, from dangerous milk to safe milk, is not an expensive proposition and has been greatly exaggerated. "There will be a milk famine in this city," said some of the producers for the District of Columbia market, "if you require all cows producing milk to be tuberculin tested," but very few persons take such statements seriously.

Finally, and in conclusion, I would say, that if I have taken a more pessimistic view of the business acumen of the average milk producers than will make this address popular, I am sorry. I have tried to speak the truth fearlessly and I think that facts will warrant every assertion I have made. Sometimes a word of friendly suggestion or even criticism, may be more useful in the long run than gushing flattery or abusing the other fellow. I believe a spirit of progress is in the air and that conditions are changing for the better, especially in this State. With such instructors as are found in the Agricultural College and Experiment Station, with such leaders as Mr. Gilman, Mr. Merrill, Mr. Hunton, the president of this association, and others, the trend here is in the right direction. But much remains to be done. Those of you who are living ten years from now and have opportunity to look back to average methods of today, will do so with a smile at conditions that prevailed way back in 1910.

Officers were elected as follows: President, W. G. Hunton; vice president, L. E. McIntire; secretary, Leon S. Merrill; treasurer, R. Alden; trustee, W. K. Hamlin; member of advisory council of Experiment Station, R. Alden. Voted, that the corresponding secretaries be appointed by the executive committee.

DEMONSTRATION IN JUDGING MILK, CREAM AND BUTTER.

By Prof. P. A. Campbell.

In scoring dairy cows, beef cattle, horses or dairy products, you must have in mind an ideal by which you are measuring. For instance, if you are scoring butter for flavor, you say that 40 is perfect so far as flavor is concerned. You taste this butter and find that it does not come up to your anticipation of what perfect butter should be, in its flavor. We will say that it comes up to within an eighth of what you think is perfect. One-eighth of forty is five. The score which you should give that butter on flavor would be 35. If on the score card for milk 45 is allowed on flavor, and the sample you are scoring comes up to within a ninth, the score you would give to the milk for flavor would be 40.

Just a word relative to the flavors we have in milk, cream and butter. Perhaps we wonder where the flavors come from in butter,—I mean the undesirable flavors. If we stop to consider this for a few moments, we will have to start back with the cow, whether the flavors are in the milk, cream or butter. We know that the desirable flavors, aroma, etc., are dependent largely upon the food that the cow eats. It is also true that some of the very undesirable tastes which we get are dependent upon the food which the cow eats. Therefore it is necessary that we take those things into consideration, if we are dairymen. I do not know anything about the milk and cream which you have here, but it will be very strange if some of these samples will not give you a distinct flavor of ensilage or turnips, or perhaps ragweed in the oat fodder, and you will get sometimes, a sharp, bitter twang. It may be the cows have been fed dry corn stalks just previous to milking and the dust from them gives a flavor which is not particularly bad but is undesirable. What I mean is this,—if in anticipation of getting through your chores earlier you throw out the silage before milking and the atmosphere is permeated with the silage odor, the chances are very strong that the taste will be incorporated in the milk. I have known people to say that the cows ate those things in the field and the odor was not in the atmosphere of the barn but you could get it in the cow's breath. I think, although we cannot say authentically, that the taste comes not only from the cow but from the food. If the odor of the food is in the atmosphere of the barn or if the cows have recently eaten this kind of food, the flavor will be perceptible in the milk. Milk is very susceptible to odors and great care should be used in regard to these things. There are some other flavors which perhaps are not quite as pleasant as those which come from the food,—what we call barny flavors. These get into the milk and cream and later into the butter. These are of course the result of a piece of manure or a hair from the cow. Sometimes it comes from the bedding. They are easily recognized, and of course from the dairyman's standpoint in order to keep the milk and cream and butter entirely free from them it is necessary to use precaution. This flavor does not necessarily come from the fact that the manure drops into the milk. Frequently we get it from the fact that the barns are poorly ventilated. The odor arising from the gutters gets into the milk while it is being drawn from the cow.

Again, we get sometimes a musty flavor in milk, cream and butter; more particularly in the butter, which comes, of course, from storing it where the atmosphere is not clear, where the ventilation is not good, or from churning the cream in a churn that has not been used for some time; or it may come from putting the butter away in the refrigerator or in the pantry on a shelf that has not been carefully scalded. In regard to the butter, there are other factors which come in to give it an off flavor. One which perhaps we have noticed more particularly this fall than any other is what we might term old cream. We get in scoring butter a considerable amount of this taste which is easily recognized and which perhaps can be better designated by the term stale than anything else. That simply comes about from the way in which the cream is ripened.

The texture of the butter is what you perhaps recognize as the grain. Butter to be at its best should be such that when a piece is broken off it shows a rough surface similar to broken steel. When the butter as we look at it seems to be waxy and firm, we would speak of it as having a good texture, a good body. That is, it should be free from all salviness and conditions of that kind.

There are fifteen points allowed the color of the butter, and this is something that must be taken into consideration. The normal color of butter is a straw color. The various markets allow a different gradation of colors. Sometimes we get a cream which naturally is rather darker than the straw color and the butter ought not to be scored off in natural coloring; but if butter is very, very light, this should be taken into account. It is the dairyman's business to endeavor to have his butter uniform in color throughout the year. Those are the things which help to keep up your market. The butter should be of the same color all the way through. It should not be yellow in some places and white in others, or mottled, as we commonly term it. Sometimes this occurs when the butter makers have been careless in washing the butter and particles of the buttermilk have been left in it and when the salt was added the casein portion was precipitated, with the result that we get a mottled or streaked butter. Sometimes it is the result of the cream not being carefully strained after it has been ripened. There are several reasons why we get this mottled butter. If you find butter of that kind you must score it off, it is not perfect.

Now in regard to the salt. Salt is put into butter to give it flavor, not as a good many people think, because of its antiseptic properties. The amount of salt that you will add to the butter will not help very materially in keeping it. If you put in enough salt to do that, it will be salter than the average market demands. So if you get a good medium butter, so far as the salt is concerned, so that the crystals do not stand on the outside and when you take the butter into your mouth you get no granular results, you might say it is all right. The salt usually imparts to the butter a desirable flavor, but if it has been carelessly stored and has become musty it will give the butter one of those undesirable taints which has to be scored off in scoring the butter for flavor.

Under general appearance, of course you must take into consideration the way the butter appeals to you, the way it looks; whether it is in a nice condition to put on the market, or whether it has crystals of salt or water on the outside, is poorly printed or is unattractive in various other ways.

In the judging of milk and cream you will see that 15 points are allowed for acidity and ten points for bacteria. Of course in your judging work it will be impossible to carry through those tests. It would take a couple of days to determine the bacteria and considerable chemical work to determine the acidity. All the acidity you can determine is in the taste and that would naturally come under the flavor. In judging for general appearance, you will note the foreign matter and the unattractiveness. A nice clean bottle, with a paraffined pasteboard cap is what is generally considered to be the desirable type. One with a metal cap, although the pasteboard cap is underneath, necessarily has to be scored to a certain extent on general appearance, because most of our dairymen at the present time do not recognize this as being desirable. There is also the possibility that more or less dirt collects around the wire,—that the bottle is not entirely sterilized.

Under foreign matter you will have to designate or note the dirt which is in the milk. You will look through the microscope at the bottom of the bottle to determine whether there is sediment or not. The chances are that you will find some fine sediment and you may find some large particles. You may occasionally find some pieces of straw; this is not at all uncommon. You may find a cow hair and I have seen in one or two instances an eye winker. These things of course are foreign particles which must be considered, and you will have to score off accordingly. As most of us here are dairymen, it might be well to consider how we keep the sediment out of the milk. It means, of course, in the first place, clean cattle, a clean atmosphere in the barn, free from dust particles, a clean man to do the milking and careful straining. I think that if you use absorbent cotton and cheese cloth in sufficient amount practically all of the sediment so far as you can see it by looking at the bottom of the bottle, after it has been standing for ten or twelve hours, can be kept out of the milk; but I think there is another source of contamination which we frequently do not take into consideration, and that is, after the bottles are washed there are perhaps some dust particles floating in the atmosphere. They frequently get into the milk and cause a sediment, which is entirely foreign to the dairyman and at the same time is very noticeable.

CREAMERYMEN'S SESSION.

W. K. HAMLIN, South Waterford.

This is what we have commonly termed the "Creamerymen's Hour." I think likely many of you do not know much about the Creamerymen's Association, what they are doing and what is their purpose. In a very few words I will undertake to tell you something about why we are here. Seven years ago the seventh day of last July a few of the creamerymen by invitation of our Commissioner of Agriculture met in his office here at Augusta to consider some way to create a better feeling, a feeling of co-operation between the creamerymen and their patrons, and to consider means of promoting our dairy interest. I will give you our declaration of purposes as nearly as I can. The purpose of this organization is to raise the standard of quality of dairy products and to promote the interests of dairying whenever and wherever possible in the State. I am aware that a good many look on the organizing in this way as a means of squeezing the patrons a little, but this is not so. We are not a combination for putting down the price of cream or for raising the price of butter. We are a combination to produce better butter by every means in our power and better dairy products in every line. We meet to study over and devise ways and means to bring that about if possible. We are a combination for the consumer's interest, to adopt any means within our reach to produce butter more cheaply; we are a combination to try to devise ways to produce cream cheaper, so that the patron may get more out of it. I sometimes think that we are working harder and more persistently for the benefit of the patrons than they are for themselves. I am not going to take up your time longer as we have some good things on the program for you.

OPPORTUNITIES FOR PROFITABLE DAIRYING IN MAINE.

By C. E. HENRY, Pittsfield.

I wish to bring before your minds at this time three illustrations of lost opportunities as given by the Rev. Dr. Conwell of Philadelphia in his noted lecture entitled "Acres of Diamonds," and I am sure you will be able to make the application yourselves. "A certain man in California, in 1847 owned a ranch there. He heard that gold had been discovered in Southern California, though it had not and he sold his farm to Col. Sutton who put a mill on the little stream below the house. One day his little girl gathered some of the sand in her hands from the raceway and brought it into the house. While she was sifting it through her fingers a visitor noticed the first shining scales of gold that were ever discovered in California. A few years ago a one-third owner of this farm was receiving $120 in gold for every fifteen minutes of his life, sleeping or waking."

Prof. Agassiz, the great geologist of Harvard University, said at one time at a summer school of mineralogy that there once lived in Pennsylvania a man who owned a farm and decided to sell, but before selling wrote a cousin who lived in Canada that he would like employment collecting coal oil. His cousin informed him that he could not engage him because he did not know anything about the "oil business." So then he set himself at the study of the whole theory of the coal oil business with commendable zeal. He studied till he found out where coal oil originated, what it looked like, how to refine it and where to sell it. Then he wrote his cousin: "I know all about the oil business from the second day of God's creation to the present time," and so he obtained the position he desired, selling his Pennsylvania farm for $833. The farmer who purchased the old place, went out one day to arrange a place for watering his cattle but found that the previous owner had already arranged for that. There was a stream running down the hill back of the barn and across the stream from bank to bank a plank had been placed edgewise at a slight angle for the purpose of throwing over to one side of the brook a dreadful looking scum through which the cattle would not put their noses, although they would drink on the side below the plank. Thus, that man who had gone to Canada and had studied all about the oil business had been, himself, damming back, for twenty-three years, a flood of coal oil, which the state geologist stated in 1870, was worth to the State a hundred million of dollars. The city of Titusville stands, bodily, on this farm now.

A young man in Massachusetts studied mining at Yale College and became such an adept at mineralogy that after graduation he was offered a professorship in the college at a salary of $45 per week but refused the offer, being highly indignant to think they should offer him, a man with a brain like his, only $45 a week. He decided to move to Wisconsin, and there accepted a position with a Copper Mining Company at $15 per week with the proviso that he should have an interest in any mine he should discover for the company. He had scarcely gone from Massachusetts before the farmer who had purchased his place was bringing in a large basket of potatoes through an opening in a stone wall. As the gateway was narrow he had to pull the basket through and as he did so he noticed in the upper and outer corner of that stone wall next to the gate a block of native silver eight inches square. And this Professor of Mining who would not work for $45 a week because he knew so much about the subject, when he sold that farm sat on that very stone to make the bargain. He was born on that very farm and had rubbed by that very piece of silver until it was said it almost reflected his countenance. He would not believe in silver at home. He said: "There is no silver here in Newburyport—it is all away off somewhere else."

How many dairymen in the State of Maine have said: "There is no money in dairying here in Maine—it is all away off somewhere else."

There may not be actual gold mines, oil wells or silver to be found on your farms here in Maine but there is surely their equivalent, for there are, in the land over which you travel every day, opportunities for making money, and one of these opportunities is dairying. In a few words, let us enumerate a few reasons why dairying should be one of the leading industries of our State. In the production of any article we must have three things, namely a market, facilities for manufacture and raw material. Let us consider the market. We have a market for dairy products that cannot be excelled, for within three hundred miles of Bangor are centres that are distributing dairy products to about five millions of people. This does not include the market of our own State, for within the State, last year, were consumed seven millions of dollars' worth of milk and cream, not mentioning the large amount of butter, some of which was shipped into the State, of which there is no record. The home market is growing larger each year, owing not only in the increased amount consumed by our own population but to the attractiveness of our summer resorts, which are drawing thousands of people from other states each year. Last year the total income of all dairy products in our State was in round figures $14,000,000. I said there is a market of about five millions of people within three hundred miles of Bangor. Should we ever outgrow this market, by going less than two hundred miles farther we could find a market of over six millions more people, making a total of over eleven millions, all within shipping distance. You see, Mr. Dairyman, you do not have to seek a market, for the market is seeking you. The *way* you reach this market or the market reaches you is through the several creameries of our State which are returning to their patrons, an average of two to four cents per pound more for butter fat than creameries in most of the other northern states. This should be an inducement to dairymen to keep more and better cows.

I have told you about the market and how it is reached. Now I come to some of the opportunities you have for the production of raw material. I do not know as I can tell you anything new on this part of the subject but I will speak of a few well known facts. We have, here in Maine, good productive soil; in fact, Maine leads New England on per acre yield. Our soil is well fitted for the growing of clover hay and you should sow more clover, for clover hay fed with the silage and concentrated feeds makes one of the cheapest feeds for milk production. Clover is not the only crop to which our soil is adapted for there are several, but I will mention only one and that is corn. Corn can be grown in most of our counties and all dairymen should plant corn and have a silo. We have good pasturage. There are thousands of acres of pasture land in this State without an animal in them. This may not seem as surprising when we stop to think that there is only one cow to every fifteen acres of tillable land now under cultivation, and as you know doubtless, a little less than forty per cent of the available good farm land in this State is under any kind of cultivation whatsoever. So, you see, we have plenty of land.

In some European countries where land is scarce and high they keep one cow per acre. Every foot of land is under a high state of cultivation. Now I do not expect to see one cow per acre here in Maine but I do think you should have for a standard one cow to every two acres of land under cultivation. This, when accomplished, would mean over one million dairy animals in our State which would give us a gross income of over one hundred million dollars per year.

An important factor in dairying is good water. We have it and water that is free from contaminating surroundings.

We have, in our State, Cow Test Associations, Breeders' Associations, Seed Improvement Associations, all doing good work for the advancement of the dairy industry, and these are opportunities for you, Mr. Dairyman. You should be an active member of these associations.

There is one thing I believe, and that is that live stock must be the foundation of the farm, and the dairy animal is going to win out for the State of Maine, and not potatoes. Do not think, for a minute, that I am belittling the raising of potatoes, for I am not, as you should raise them, but not at the sacrifice of the dairy animal.

To make dairying profitable you must aim at even production. Keep only profitable animals, take good care of them, see that they are well housed in clean, well ventilated stables. There are many other points that could be spoken of but I will not mention them as they are to be taken up by others who can handle them far better than myself.

You have the market, the way to reach it, and possibilities for the maintenance of a profitable dairy. Now, Mr. Dairyman, *you* have an important part to perform, and that is to get out of the land and cows all that there is in them, and to do this requires study and work. I place study before work, as you should study your problems, then work them out *on your own farms,* not in Wisconsin or Canada or way off somewhere else.

Had those men mentioned in the illustrations given, applied their knowledge at home, on their own farms, they might have become successful where they were instead of going away and being among the unknown.

But some of you are now saying to yourselves: "I have no time for the study you speak of." I say you should make as much of a study of your farm and dairy problems as a banker, manufacturer or merchant does of his business. They study all the time so as to get the most out of their respective business; so I say to you, you must study.

Our State Agricultural College and Department of Agriculture are working out problems each year and publishing the results, which are worth thousands of dollars to you if you will only take advantage of them, for Mr. Dairyman, if you are to make a success of this opportunity the State of Maine offers you, you must study the *soil,* for the whole organization of agriculture rests upon animal and plant production which is dependent almost wholly upon the character of the soil and treatment you give it.

You must study and test the seed you are to plant. You must study your individual animals, in fact, make a study of your business. You cannot afford to guess at it, for guess work is one of the most expensive luxuries a man, especially a *dairy* man ever indulged in.

And when you dairymen take advantage of the opportunities that are offered you to help solve difficult problems on your farm, then and not until then, will you grasp, in the fullest measure, the great opportunity there is for profitable dairying in the State of Maine.

HOW I INCREASED MY DAIRY PROFITS BY FEEDING.

By W. G. Hunton, Readfield.

We dairymen realized years ago that there were good cows born and good cows made, and as a practical man, I believe that there are more poor cows made out of good cows born, by insufficient feeding than in any other one way. In other words, I believe that many dairymen have cows today that they have unnecessarily condemned because the fault was with them, in not judiciously feeding and caring for those cows. The majority of us are in the dairy business for the dollars and cents that are in it, and those of us who are in it for that reason recognize two distinct propositions that we must ever hold before us if we are successful in our business. One is to feed our cows so that they will produce well, and the other is to feed them so that their production shall not be too expensive. Incidentally other things contribute to these: whether the feed which we give them is expensive to us, or whether we by our own efforts produce it upon our farms at the least possible expense. But these are the two main propositions. Are we feeding our cows so as to produce the greatest number of pounds of milk or butter from them and does that great number of pounds cost us as little as it is possible for them to cost us?

In feeding cows I believe that you all have had the experience that I have, and that is that we feed differently today from what we did even six years ago. In other words, experience and teaching have led us to believe that we can feed a much wider ration than we thought it was possible to do some few years ago, and this is much to the advantage of the average dairyman for it gives him the opportunity to produce feeds upon his own farm, while if he was bound to the original narrow balanced ration, he would be obliged to purchase much of it from other states.

One other point I wish to emphasize, and that is that we have proven by experience that we must know the individual animal; that it is only by feeding for the individual, whether you have one cow or twenty-five cows, that you can gain the most success. With cows of the same size, cows standing side by side, as near alike as outward conditions could possibly make them, we may vary the feed and obtain the best results. And the only way to know what these results are is to go right back to the teachings that have been presented by every practical speaker and every scientific speaker that has appeared before this meeting, that we must use the same business principles with the cow that every other business man uses in his business,—know what we feed her, what it costs and what she produces. By using these business principles we are enabled from day to day to obtain the best results. This means much. It means that the average dairyman, when he changes in his barns, as we all do who are living on these New England farms, from one kind of hay to another, must change the grain or whatever else he is feeding that cow, to make her produce the most at the least expense; that we must not change too hastily from one to the other. When we change from silage to dry feed we must be a little careful and when we change to silage we must be a little careful, to keep that cow in the best condition. We must study the individuality of the cow. We must use common sense and never subject her to any sudden change that will throw her system out of balance, for it is too delicately adjusted to conform to sudden changes. It is astonishing to note what a difference even a thunder shower coming up in the afternoon will make in the amount of milk which the cow will give at night. It has astonished us many times to find, when a cold windy day would come, that many of our cows had fallen off one or two pounds on account of the sudden change of temperature. We dairymen who have been through a winter or two such as this winter promises to be when the cows have to drink under different conditions from what they are accustomed to, know how it curtails our business. Four years ago this winter I was obliged to drive my cows half a mile through December to give them water. They had never stepped on the snow before, and it made a difference of over $60 in the product of those cows for thirty days. These things show conclusively that only by individual attention, only by a thorough knowledge of their wants and supplying those wants in the minutest detail are we able to obtain the best results. Therefore the feeding is something that requires attention each day, and twice or three times a day, as our rule may be. It goes without saying that there is no part of our work which is of such vital importance as the feeding proposition. To my mind it has reduced itself to this: Raise everything you can on your own farm for the cow, store it in the most palatable condition possible, and when you are feeding what you have raised on your own farm purchase only that which is necessary to furnish the cow with the amount of protein she shows that she requires by the scales on which the milk is weighed.

HOW I INCREASED MY DAIRY PROFITS BY WEEDING.

By RUTILLUS ALDEN, Winthrop.

When I commenced to have my cows tested in the Cow Testing Association in 1908, I very soon became convinced that I had been conducting my dairying in a very unbusiness-like way, and had not been applying business principles to this branch of my farming.

I had never kept individual accounts with my cows to know whether I was keeping them at a profit or loss. Now, it looks to me as though I had been keeping some of them for the royal blood they were supposed to have in their veins or for some amiable disposition I thought they possessed which had been handed down to them from some old ancestor.

The Cow Testing Associations of this State are doing more to educate our dairymen to put their dairies on to a paying basis than any other thing that has happened to them in the last fifty years. It has turned the searchlights on our dairy business, revealing what each cow in every association in this State is doing, and it has made it clear as noonday that we all have cows that are making us handsome profits, and we all have cows that we had better weed out and dispose of. It decides what I have advocated for years, that our hay will pay more if fed to good cows than it will if sold off the farm, thereby running out our farms and reducing our income.

I have great faith in Maine as a dairy State and I believe that after my brother farmers have tried raising potatoes and everything else to get rid of milking they will settle down to dairying and orcharding, realizing that from these two branches of farming they can make a good living on a State of Maine farm. Now, let us consider what bookkeeping revealed in my herd of cows.

We found that one of my cows in one year ran me in debt $5.35, and one cow paid a profit of $2.17 above the cost of keeping, and another one paid a profit of $2.76. These cows were fed the same and had the same care as other cows that paid me a profit of from $40.00 to $50.00 each. The result was the boarders had to go, their royal blood could save them no longer and their places were filled with heifers I raised on the farm and cows I purchased.

At the end of the first year I was in the Cow Testing Association my herd averaged 305 lbs. of butter each and at the close of the second year they averaged 372 lbs. of butter per cow, making a gain of 67 lbs. of butter per cow in my herd in one year.

The average profit from each cow in 1908 was $27.54 and the average profit per cow in 1909 was $50.77, making a gain per cow of $23.23. The milk from my herd sold in 1908 for $2,200 and in 1909 for $2,687.48, a gain of $487.48.

The price of butter fat in 1908 was 31 9-10 cents per pound and in 1909 was 35 1-3 cents per pound, but by reckoning butter fat at the same price for both years I actually received $300 more from my herd in 1909 than I did in 1908.

In ten months this year I have received for milk $2,492.48 and am confident my herd will pay me $3,000 for the whole year, which means an average of $100 per cow gross income for the year.

I have two cows that have each tested better than 500 lbs. of butter per year and I hope to have my entire herd average 400 lbs. of butter per cow. I do not intend to keep a cow that will not test better than 300 lbs. of butter per year.

This increase of income from my herd is largely due to selecting or weeding out those cows which did not come up to my standard and filling their places with those that did.

If we would all adopt these principles and continue the work started by our able dairy instructors I believe that the profits from our dairy industry would be constantly increased.

HOW I INCREASED MY DAIRY PROFITS BY BREEDING.

By C. L. JONES, Corinna.

We have listened to addresses on the feeding and the weeding of the cows after they have been bred, which illustrates to you that the most important points in this matter are the feeding and weeding processes which must always be carried on under the most intelligent breeding, to secure animals which will pay a profit in the dairy. Probably one of the greatest mistakes that the average dairyman makes in his breeding operations is in relying so largely upon his individual cows for the improvement of the dairy qualities, when in my judgment he should rely almost wholly upon the head of his herd, the sire, because he imparts his qualities, whatever they may be, good or bad, to every calf which is born in the herd every year. How to secure this individual sire which will impart the desirable qualities is a problem which the breeder is up against and which the dairyman is up against. Unfortunately we have but very few breeders of cattle. Somehow the idea seems to prevail in the minds of nearly all dairymen, as well as breeders, that he who mates pure bred animals of like breed is breeding cattle. This to my mind is a wrong impression and the sooner we get away from that idea the better it will be for us who are breeding stock, in the matter of dollars and cents. I believe it was Mr. Hunton who spoke to you of the desirability of wider rations because they cheapen the cost of production. He emphasized the study of individual animals, because by the study of individuals we can cater to the wants of the individual cow and thus secure better results from that cow. Other things must be taken into consideration, such as the capacity of the animal to take and handle these foods, as well as the years of usefulness,—the longevity you may call it, the length of time that she will serve you in the capacity of a milk producer. These must come about wholly by breeding. You as dairymen, are too busy men to study as closely as you ought the individuality of the cow and cater to her wants. You have other things to do, and if you can secure herds so uniform that what is good for one is good for the others in the line of a ration, if you can have them of such capacity that they will consume about equal quantities of those things, it is a desirable thing for you; and I believe, gentlemen, it can be done by breeding, but if you secure these results you must breed in a certain line, practice what perhaps is known as line breeding and not mate an animal which has no particular line breeding but is simply a herd book animal, with your females in the same breed. In the latter case you have not intensified the desirable characteristics you have. How to secure these desirable characteristics I realize is a question that requires a great deal of study. I am well aware that every farmer has not the time, if he would, to solve these questions as they ought to be solved; but to those who do study them and reap results in this direction I would say that you ought, at least, to have respect enough for this work so that when you go into the herds of this State or any other state, you will recognize the time and the effort which it requires to bring about these results. And when you want to put an animal at the head of your herd, do not be so afraid as the majority of the farmers of Maine are, of paying a price that will give you results of which you will feel proud, in the animals which you will raise from that representative of your herd. I have been a breeder of cattle for 30 years and a breeder of thoroughbred cattle for 20 years, but I am not talking because I want to sell, because I do not own any pure bred cattle today; but I want to say that my experience in the breeding of cattle teaches me that too much stress is laid upon color markings and not enough upon the desirable qualities which we as dairymen want our cows to have,—constitution, capacity, longevity and production.

HOW I GROW GRASS.

By L. E. McINTIRE, Waterford.

In the first place I want to tell you a little something of the land I try to grow grass on. I would like to explain to you as far as possible the nature of the soil, its location to the frost line, and other conditions I have to consider in connection with my other farm work.

I am a strong believer in crop rotation as far as practicable, but I have one section that is what is called brook intervale. This piece of land grew grass for thirty-five years before it was plowed or fertilized in any way. This section is below the frost line, and one year with another is not a safe place to plant corn or potatoes. We will call this section number one. From this piece we come to a ridge of land sloping gradually to the south. This soil is composed of a gravelly loam and is natural corn land. We will call this ridge section number two or home farm. In connection with this, my home farm, I have twenty acres more of good land well adapted for growing grass, grain or potatoes, but with this disadvantage, it is one mile from home and all up hill, so you can readily see that it is not profitable to haul barnyard dressing up this hill. This last section is number three.

These three sections comprise the farm I have had to contend with for a number of years. I always liked to see a good piece of grass growing; in fact I like to see any good crop or well tilled field; it seems to bring us nearer in touch with nature than almost any other occupation.

However, I think it was some hungry Holstein cattle that stimulated me more than anything else to grow grass for hay, in order to feed them through our long cold winters, and have them come out in good condition in the spring. I started to increase my hay crop in the section we called the hill farm, or number three, by the use of ashes. I had no trouble to grow a good crop of grass for hay, but the ashes were heavy and the expense of hauling ten miles was great, so I began to investigate and experiment with chemicals, and soon found I could haul more value with a pair of horses in one load of chemicals than five or six of ashes. Consequently I dropped out the ashes and for seven years have been using chemicals.

Now in regard to treating this land for a crop of grass. I have told you the land was adapted for growing grass, grain or potatoes, but as I am a breeder of Holstein cattle and not a potato grower, I grow grain and grass to use at home on the farm. And I would like to state right here that years ago I learned that in order to live from a farm, one must produce something to turn into money, for money we must have to pay the bills. The nearer a finished product we can sell from the farm, the greater the profit.

I break up a section of this land in the fall, removing all the loose stones. In the spring I thoroughly pulverize it, using about five hundred pounds of chemicals to the acre, and sow it to oats. After the oats are off in the fall I plow again. In the spring I pulverize the piece until it is like a garden spot, this time using from eight to ten hundred pounds of chemicals to the acre, sowing oats and grass seed. As I am a great believer in clover, I sow quite a per cent of clover seed, and have never failed to get a good stand of clover. By using three hundred pounds of chemicals to the acre the second spring, I get as much hay the second year as the first.

My home farm, section number two, is where I raise my corn and practice a four-year rotation; corn, oats and grass. The manner in which this land is treated is this: The first year for corn I break up a section in the fall, turning under a fair amount of barn-yard dressing. In the spring I go over this section with another light coat of dressing, and thoroughly pulverize it until I am ready to plant corn, using a small amount of fertilizer drilled in at time of planting. I want to impress on your minds that this field of corn has thorough cultivation. After the corn is taken off in the fall I plow this land and let it lie until spring, then it is pulverized and sowed to oats and grass seed, and about five hundred pounds of chemicals used to the acre. From land treated in this way, I do not have any trouble to get two crops of hay the first year, and with three hundred pounds of chemicals used as a top dressing the second spring I get two crops the second year.

The section called number one, or the intervale, is kept in grass practically all the time by top dressing with barn-yard manure or chemicals. If any part of this section is winter-killed or foul grass works in, I plow it up thoroughly, pulverize and seed in the fall, using chemicals with only a small amount of nitrate of soda. At this time I use only redtop and timothy for seed, and plan to get the work done by the last week in August. Usually I sow some clover seed the following spring, about the time the snow goes off. I have had to learn that the grass plant is very small, and must have a perfect seed bed to do its best. I have also learned that a thick even stand, with the chemicals to give it the quick start, practically insures the crop against drought.

In connection with my grass crop I plan to sow ten or twelve acres of oats. Then if any of my grass land winter-kills, or through any other cause I have a shortage of hay, I cut these oats and make them into hay; other years I let them ripen for grain.

In conclusion I would add that in order to grow a good crop of grass, or in fact to grow a good crop of any kind, I have learned this lesson: Do the right thing at the right time, and in the right place, and do it thoroughly.

Ques. I would like to inquire what you use for chemicals?

Ans. I will tell you what I am using on my land, but I do not claim that it is the proper proportion for your land. For grass and grain I use 350 pounds nitrate of soda, 450 pounds muriate of potash, 600 pounds tankage or fine ground bone, and 600 pounds of acid phosphate. Where I sow oats alone I use more of the tankage. Where I seed down I use the ground bone as I think it lasts longer in the soil though it is not available quite as quickly.

Ques. Do you sow oats with your grass seed?

Ans. Yes, sir.

Ques. How much?

Ans. The quantity varies some. I sow about two bushels or more to the acre. Some would call that a heavy seeding, with grass seed, but I get a good stand of grass.

REMARKS.

By Hon. Z. A. Gilbert, North Greene.

I wish that I might have prepared something to give you, from my own work, but I have not the facts and figures before me at this time. I would endorse much that has been said in connection with the exercises of the afternoon. It has been the pleasure of my life to establish some factors in these lines and put them into my own work. And it has been a great surprise and a great pleasure as well to note the results that I have received from this kind of work. Allusion has been made this afternoon to feeding and breeding and the results that may be accomplished through correct processes in those lines of work. I have been a breeder for a good many years, and in that time I have fed the stock with my own hands and never have I fed a line of stock in my barn without carrying with it the thought of what I was trying to do, what I wanted to accomplish. The thought of the future should go with this kind of work. I hardly see how it is possible for any one to carry on farm work without putting the intellect into it in full measure,—learning these facts and fixing them in the mind, and, Mr. President, it is that kind of work that makes successful farming,—intelligent thought as you are carrying on the farm. If I were to name the points which will bring you success in your business, I should say, first, that thorough work will bring you successful results. There is no reason why you should be satisfied with indifferent results in connection with your farm crops. You should have bountiful crops and use them in your own line of work. This idea of going to the West for crops to feed to your cows is all wrong. The soil that you are handling from week to week, from month to month and from year to year, will give you all that is necessary for successful work in carrying on your farm. It has been my aim in life to grow from the soil that I own what I need for carrying it on, to make the farm self-supporting and measurably profitable in its results. This has largely been accomplished. It is what we all want and what we all can receive when we put ourselves into the work in full measure. I wish I could enforce upon the mind of every young man the necessity of thorough work in connection with this kind of business. The young man may purchase his feeds and get something out of the business, but he can grow those feeds on his own land at less cost than he can buy them. It is not necessary to secure any particular breed; there are good cows in all breeds. It is desirable, many times, for the individual to breed the line of stock that he enjoys best, but more is derived out of the enjoyment than out of any other feature in connection with it. Breed the stock you like the best, handle it as it should be handled, as your highest intelligence dictates to you to handle it, and then see what results you are securing. You are not confined to any one direction in this matter. There are possibilities in many directions when your work is done thoroughly and well. I do not know as I have any better word than this to leave with this meeting.

TO MR. GILBERT.

RUTILLUS ALDEN. When you were a young man you realized the importance and magniture of agriculture. You devoted your early days to its interests. You have helped to organize and build up our different agricultural societies. You have been the means of putting on record many of our best laws for the protection of agriculture. You have in your wisdom taken hold of the fruit interest of the State. You have built up the fruit industry, you have been persistent in your efforts and many of us are reaping the benefits of your work. Later on you and I worked together to see if it was possible to have a Professor of Agriculture at our State College, when we were trustees, and sometimes we felt that we were ignored, but thank God, today our State College is graduating some of our best men and doing a wonderfully good work, of which you and I have reason to be proud. Later on you helped us to organize our Dairymen's Association; you have taken hold and lent your aid, and have been to nearly every meeting, notwithstanding your age, and a few of your friends thought it would be nice to give you a slight token of appreciation of what you have done for us. If your friends all over the State of Maine could have known about it and been allowed to contribute, instead of giving you a gold headed cane, Brother Gilbert, they would have given you a solid gold cane.

MR. GILBERT: This is a surprise to me; I appreciate it. It was entirely unlooked for, unthought of, undreamed of. It is a gratification to me to receive this endorsement of the work that I have been engaged in during my life, and that I have prosecuted to the best of my ability, in the several directions in which I have labored; and to know that at this time, after I have laid down those labors I have received this expression on your part of the confidence in the efforts that I have put forth. I hope that those labors have been fruitful in some measure of results. They have been put forth honestly, truly, uprightly, and for the sole purpose of benefiting the State of Maine.

REMARKS

By J. D. McEdwards.

I have attended all these dairy meetings since the first, twelve years ago. I have been a member of the association and have left my business and come here to learn the things about which we are talking. It is very interesting to me. I never come to one of these meetings but I go home benefited and amply repaid for the sacrifice that I have made. I see a great change since I came to the State in 1895. Then the creameries were taking cream by the old inch system. I remember the last month that we ran on the inch system. We were running one little factory and we ran behind $300. We saw that we could not do business in that way so we introduced the Babcock test. Then there was a great howl. Nobody knew anything about the Babcock test. The patrons said it wasn't any good, anyway, and the man who ran it did not know his business. We had all those things to contend with, but we found it was the proper way to pay for cream. We went from the inch system, the spacing, to the weighing of the cream, and I am proud to say that I helped to formulate the bill presented to the legislature with regard to weighing the cream instead of spacing it. We had another time with our patrons but we found out that that was the proper way to do, to weigh the cream and test it and test our samples by weight. We find that we are progressing as creamerymen and also as dairymen. We try to keep the confidence of our patrons by loaning them small testers. We always have from two to a dozen testers around among our patrons, because we found that if they sent a sample to a competing creamery sometimes the sample was not the same as the one we had taken, and confusion resulted. We also asked them to send a sample to the State College. We find that the clearer we can get the farmers to understand how our business is conducted the more successful we can be. We have confidence in them and try to keep their confidence. When I first started in the business, 22 years ago, we thought the less the farmers knew about the business the better we got along, but we have found out since that that was a wrong idea. I have seen the small factory I have been connected with grow from 120 to over 500 patrons in this time. I think a great deal of our success was due to this very thing,—that we got the patrons to have confidence in the business, in the manager and in the way the cream was tested and paid for. Sometimes we do not pay as much as our competitors but we have had but very little trouble on that score, as long as our patrons thought we were paying all we could afford.

I am sorry there are not more dairymen here. I want to offer one suggestion,—that the papers that are being read here should be sent to the associated press of the State, and the agricultural papers, so that instead of reaching two or three hundred people they will reach thousands all over the State. I think it would bring these things more to the attention of the people.

JOHN M. DEERING: I was not upon the program to speak and it may seem out of place for me to ask for your attention at this time but I wish to speak of some matters in connection with the man who first discovered that a dairy organization was necessary in this State. I well remember, some fourteen or fifteen years ago, of receiving a letter from Hon. Rutillus Alden of Winthrop stating that there was to be a meeting held at Lewiston at a certain date for the dairymen, for the purpose of organizing a dairy association if possible, and asking me to attend. I attended that meeting, with others, and Mr. Alden set forth the reasons why he thought it was necessary to have a dairy association in the State. He said that he thought he could see a gleaming light in the future which if the dairymen would follow it, would not only be of great benefit to them but to all other agricultural interests of the State. He could see that the conditions of Maine were such that without a prosperous live stock interest it would be impossible to have a prosperous agriculture. He could see that if the live stock interests of the State deteriorated all other lines of agriculture would deteriorate in the same proportion. He could see that dairying was the most reliable of any line of agriculture because when other lines failed dairying would always furnish the money to pay the taxes and provide food and clothing for the children. These were Mr. Alden's sentiments at that time, and there were some at that meeting who felt that Mr. Alden was right in his premises. There were others present who thought the light was too far in the distance and discouraged the enterprise and nothing was done at that time. But by the persistent efforts of Mr. Alden some two or three years later the Maine Dairymen's Association was organized with Rutillus Alden as its president. It was, to be sure a puny, weak little child, but it was born of good parents and it had good blood; and in twelve years it has grown to be a healthy, strong boy, and not only that, it is one of the most important agricultural organizations in the State. Now this is old history, and my mind seems to be filled with a newer history, a more modern one, and it would read like this: For three score years and ten in Winthrop he staid, and never, not even once, from his home has he strayed; through all his prosperity, his adversities and woe, he still loves dairying and his State also. He sees here before him a class of young men, who from the cradle to manhood have grown since then; who are out for a living with fame to win, and have taken the places of those that have gone in. He sees here before him men whose heads are silvered with gray, who have stood by him shoulder to shoulder in his efforts for the dairy interests by night and by day; they have always found him square and honest in his business relations, in prosecuting the business of the Maine Dairymen's Association. The new dairymen are here, right under his eye; and it would not be him to pass them by. They are his neighbors and friends, and the owners of land, and for the dairy interests they are doing what they can. Oh, I know him so well I know that is his kind of a man, whether he is a Democrat or a Republican. Yes, he has been faithful and loyal to the dairy interests of Maine we know; he is a man of few words but he is not very slow. His intellect is clear and his eye is well trained, upon that man who acts detrimental to the dairy interests of Maine.

Now, Brother Alden, I have been requested by the old guard of the dairymen of Maine, to present to you that beautiful cane. Take it, old Comrade and use it in your declining years, and be of good cheer; it is their appreciation for the good work done year by year. We bid you success, good health and God speed.

MR. ALDEN: My brother, you have given me a great surprise. I did not have the first idea that any of you had it in your hearts to remember me for the work I have attempted to do for the dairy interests. It has all been done for the benefit of the State of Maine. I can tell you that I went into the dairy business after I found that I could make money in it, more to illustrate to my own townsmen and the people who were acquainted with me that there was some money in the dairy business than for any other one thing. I was born on a farm, I live on a farm and I love agriculture. If there is anything I can do to help my brother man, to make it easier for him, it is the easiest and the best thing I can do. I thank you.

ANNUAL BANQUET.

The annual banquet, held at the vestry of the Winthrop Street Universalist Church, Augusta, on Thursday evening, December 8, was thoroughly enjoyed by the large number of members of the Dairymen's Association and others who were present. In addition to the excellent menu and the fine music provided, the following instructive and entertaining literary program was given:

Recitation, Mrs. E. C. Carll

All Men Love Apples—the Forbidden Fruit—Why?
Prof. E. F. Hitchings

The Guardians of Maine's Greatest Treasure,
Dr. R. J. Aley

What Will the Grange of the Future do with its Sisters?
C. S. Stetson

What is the Most Important Question in Maine Today?
Dr. L. S. Merrill

Are My Recollections of the Dairy Cow Pleasant?
F. S. Adams

If Law is Justice, What is Justice? Hon. H. M. Heath

Must We Believe All that We Read, Dr. G. M. Twitchell

FRIDAY, DECEMBER 9—CLOSING BUSINESS SESSION.

REPORT OF THE COMMITTEE ON RESOLUTIONS.

To the Maine Dairymen's Association:

Your committee on resolutions, to whom was referred the recommendations made by the secretary, have given the matter careful consideration and beg leave to submit the following resolutions:

Resolved, that the live stock and dairy interests of the State are of sufficient importance to demand a revision of the classification and premium lists offered by the several agricultural fairs in the State and that the revision of the classification and premium lists should receive the approval of the Commissioner of Agriculture.

Resolved, that the agricultural interests in the State of Maine can be best served by the closest co-operation of the various agricultural societies in the State and that the director of extension work at the Universiy of Maine be asked to call a conference of the same.

Resolved, that there is a need of demonstration work on farms in the various agricultural communities and that the College of Agriculture at the University of Maine be asked to establish this as one form of extension work.

Resolved, that the Dairy Institutes held in different counties in the State were a great source of benefit to the dairy interests and that they be continued during the coming year.

Resolved, that the judging contests of live stock and farm products at the various agricultural fairs in the State are of educational value and should constitute a part of the annual program of each fair.

Resolved, that the Dairymen's Association re-affirms its endorsement of the present work being done in our State by the Cow Test Associations and the local Co-operative Breeders' Associations. We recommend that this work should be extended as fast as possible.

Resolved, that this association heartily and most emphatically endorses the work of the Extension Department at the State University. We recognize the importance and value of extension work; that it means the carrying of information directly to the farmers of the State. It is a work that is filling a long felt want and we recommend that the scope of the present work be enlarged as fast as possible.

Resolved, that for the stimulation of the minds of the boys and girls engaged in agricultural and animal husbandry, a suitable prize, or prizes, be awarded for the best essays written on these and like subjects.

Resolved, that the slaughter of tuberculous animals at the Maine State Fair was of decided educational value and that other similar demonstrations be held the coming year.

Resolved, that we indorse the action of the State Live Stock Breeders' Association relative to the formation of laws for the eradication of bovine tuberculosis and other contagious and infectious diseases of our domestic animals in the State and that this association appoint a committee to act in conjunction with their committee; this committee shall constitute a legislative committee to act on all matters involved in the present resolution.

Resolved, that the special committees on oleomargarine legislation and on the revision of the tariff on sweet cream be continued another year.

Resolved, that this organization heartily recommends the completion and installation of minor agricultural courses in our various secondary schools in the State of Maine.

Resolved, that this organization endorses the splendid work that has been done by the Maine Department of Agriculture during the past year for the dairy interests of Maine.

Resolved, that the Maine Dairymen's Association desires to express its appreciation of the cordial welcome and hospitality with which they have been received by the business and agricultural interests of the City of Augusta. To Hon. Frederick W. Plaisted, Mayor of Augusta, we express our sincerest thanks for the very many courtesies extended and for the use of the City Building, for the purposes of the association throughout the week; neither would we forget the various railroads of the State who have each year given to the members of this association reduced passenger rates. For all these favors we have the keenest appreciation.

F. S. ADAMS,
P. A. CAMPBELL,
B. A. BAILEY,
C. R. MILLETT,
W. K. HAMLIN,
Com. on Resolutions.

A committee to act in conjunction with the committee appointed by the State Live Stock Breeders' Association in the matter of securing legislation for the eradication of bovine tuberculosis and other contagious and infectious diseases of our domestic animals, was appointed by the Chair as follows: L. E. McIntire, Dr. B. A. Bailey, L. S. Merrill.

The report of the treasurer was presented as follows:

Dec. 4, 1909, amount on hand	$132 52	
Dec. 7, 1910, received of L. S. Merrill, secretary	78 00	210 52
Dec., 1909, paid bill of Mr. Towne of Skowhegan for orchestra	$10 00	
Dec., 1909, paid Somerset Traction Company, special cars for orchestra	6 00	
Dec., 1909, paid Independent Reporter for printing	4 90	
" " " L. S. Merrill for postage	8 00	28 90
Balance in treasury		$181 62

R. ALDEN, Treasurer.

ANNUAL MEETING OF THE MAINE SEED IMPROVEMENT ASSOCIATION.

City Hall, Augusta, December 9 and 10, 1910.

The annual meeting of the Maine Seed Improvement Association, held at Augusta, Dec. 9 and 10, was opened on Friday morning, December 9, at 10 o'clock, by President W. G. Hunton, who gave the following address.

ANNUAL ADDRESS OF THE PRESIDENT.

When the call for all interested in raising better and purer seed was issued by Dr. L. S. Merrill last February; when that little band of progressive farmers in response to that call assembled at Waterville on January 25, 1910, and formed the Maine Seed Improvement Association, they struck the key-note of a long-felt want among the farmers of Maine. It is true that many had for years practiced crude forms of selection for seed purpose, and had waged war with impurity; but the general appearance of the seed had principally governed their selection, and those other and more vital principles of seed selection had been an essential only to the extent that showed by its external appearance. An appropriation of $3000, made by the Legislature of 1909, had made it possible for the introductory work of this association to be supervised.

The evidence of the sincerity of the members, and those chosen to assist in having the foundations of the future work properly and practically laid, are on exhibition at this meeting, and speak louder than any spoken or written words of ours. The encouragement offered the boys of Maine by Dr. Twitchell and Mr. Tripp are before you in the results of their first year's work, and from your own observation of those results you can draw your own conclusions. Through the work begun by this association we were able to make at the New England Corn Show an exhibition of which every citizen of Maine who saw it was justly proud. Hundreds of business and professional men from other states at that show told me personally that they were astonished, and that the exhibit would be worth thousands of dollars to the State of Maine as an advertisement; for they were all desirous of Maine seed if they were sure it was good. And it seems to me that the work at this meeting should demand our best efforts, and most conservative consideration that we make no false move. I am so sure that the members are awake to the importance of this fact that I have no fears of the result, but rather that we shall be astonished at what we shall accomplish in the year to come; especially at what we shall do in the practical experiments on our farms.

Remember that this meeting is not for two days at some central point in our State, but continues for the entire year in the work on our farms that we undertake as a part of this meeting.

REPORT OF THE SECRETARY.

It is with pleasure that the secretary submits his report at the first annual meeting of the Maine Seed Improvement Association. It is a pleasure, first, because the movement for improving the crops of the State has met with such generous and enthusiastic support; second, because the work already accomplished promises much for the future and gives us encouragement to organize the work for the coming year on a more permanent and safe basis.

The members have paid their dues for the year 1910 and several of them for 1911. The total receipts have been $69.50. This amount has been paid to the treasurer and the secretary holds his receipt for the same.

Early in the year the executive committee prepared, under advice from the Experiment Station, the College of Agriculture and Department of Agriculture, a series of report blanks for different farm crops and also seed breeding work in corn and potatoes. The Department of Agriculture also very kindly sent out to such members as desired to undertake the ear row test, ten ears of selected corn. It is still too early to have the reports, which are now coming in from the members, tabulated in proper form. Later this will be done and will furnish some very interesting data on which to shape up and plan future work. It is with considerable pride that the secretary brings to the attention of the association the success of the exhibit made by the association at the New England Corn Show held at Worcester, November 7-12 inclusive. That exhibit was contributed to by forty-five of our members and included 214 samples, made up as follows:

Corn,	8 rowed flint,	ten ear lots,	48	
"	8 " "	single ear lots,	7	
"	12 " "	ten ear lots,	9	
"	12 " "	single ear lots,	18	
"	dent,	ten ear lots,	5	
"	"	single ear lots,	3	
"	sweet yellow-white (hybrid)	ten ear lots,	1	
"	" early	ten ear lots,	1	
"	" Early Crosby	ten ear lots,	2	
"	pop corn	ten ear lots,	1	95
Oats of all varieties,				45

Beans, yellow eye,	19	
" no name,	6	
" Sulphur	4	
" Snow Flake Pea	1	30
Sheaves, Wheat		10
Speltz		1
Oats		3
Barley		4
Turnip Seed		1
Four ear stock, corn		1
Potatoes, Carmine	1	
Snow	1	
Early Choice	1	
Irish Cobbler	1	
Improved Cuban Multiplier	1	
Delaware	2	
Norcross	1	
Clyde	2	
Early Fortune	1	
State of Maine	1	
Gold Coin	1	
Green Mountain	5	
Lowell Green Mountain	5	23
Total		213

The exhibit at Worcester attracted a great deal of attention. It was unique in one respect, in that so far as the secretary knows, it was the first time in the history of the country that a co-operative organization of farmers made an educational exhibit of special farm products in the same room with the educational exhibits made by Agricultural Colleges.

Several thousand people visited the booth of the association and expressed their appreciation of the samples displayed there and of the work being planned and carried out. The secretary is also very much pleased to report that an invitation was received early in the spring from Honorable C. S. Stetson, Master of the Maine State Grange, to hold over the competitive exhibit made at the annual meeting for the annual session of the State Grange. After consulting with the executive committee, the secretary informed him that the association would be glad to accept his invitation.

We are now progressed far enough so that we know that the success of the association is secure, providing we continue our work on safe lines. The secretary is, however, convinced that so far as the breeding of seed and its sale for seed purposes is concerned, the direction of such work as that ought to be placed with a permanent committee so that the policy of the association, so far as it relates to such members as engage in the business of breeding and selling seeds of various kinds, would not be liable to change from year to year. There most certainly should be some plan devised whereby the member who desires to engage in the business of breeding and selling seed should register as a seed breeder with the secretary of the association and that his farm operations should be under the supervision of some person appointed by the association so that the association would be in a position to guarantee the seed produced by each member.

We must not gain the idea that all of the seed grown by the members of this association is fit for seed purposes or that it should receive the endorsement of the association.

Most of our members would undoubtedly never care to be registered as seed growers. They are interested in the proposition of improving the per acre yield of the crops upon their own farms. Perhaps they desire to obtain superior strains of seed but would not care to enter into the growing of seed as a commercial proposition.

Therefore, the secretary favors an amendment to the constitution of the association that will provide for the appointment of a permanent committee, which shall be made up of men who have been trained in the science of seed breeding, and to whom shall be given the entire direction of the seed breeding work of the association. The secretary does not understand that this would preclude the carrying on of demonstration plots, same as has been done during the past year. The directions or the requirements which the seed breeder would be obliged to meet of course, in order to be registered with the association, would necessarily be established by this committee. Such a plan would only be in line with that already adopted by some of the great seed breeding associations and centers.

Reference to the work done by the Wisconsin Experimental Association, the one from which the form of organization of our own association was copied very largely, reveals the fact that they have had, during the past several years, serious complaints from purchasers of seed, that some at least of their members were distributing seed of inferior quality, and at the last annual meeting of that association a trial committee was appointed to investigate the complaints and to recommend action to the association.

It appears to your secretary that at the present moment, before we have carried the work to such a point as to be selling pedigree seed, is the time to settle just how such matters shall be handled in the future.

A great deal of correspondence has devolved upon the secretary during the past year, but it has been carried on with a great deal of pleasure.

The secretary believes implicitly in the purpose of our association and its ultimate success.

In addition to the recommendations contained in the forepart of this report, the secretary desires to add the following:

1st. That in view of the increased interest taken in the association work and of the splendid exhibit of farm products made at this meeting, and of the expense involved in the arrangements for the meeting including the furnishing of speakers, I would recommend that the association present to the next Legislature its needs in this respect and ask for a suitable appropriation.

2nd. That the association favors a conference of representatives of the different agricultural organizations in the State, said conference to be held during the early days of January.

3rd. That the association continue the work in corn and potatoes during the coming year and that its efforts be concentrated on a comparatively few of the farm crops. This would not necessarily mean that demonstration work would not be continued in many directions and in a large number of crops, but that the actual seed breeding work would be limited to a few. Later the efforts of the association would naturally broaden.

With the exception of the above recommendations, the secretary has no further suggestions to make.

Respectfully submitted,

LEON S. MERRILL,

Secretary of the Association.

The report of the secretary was accepted and the recommendations contained therein referred to a committee on resolutions appointed as follows: Chas. S. Pope, A. L. Sanderson, Charles M. White.

The report of the treasurer, Mr. C. M. White, Bowdoinham, was given as follows:

Received from the secretary, 1910 dues	$67 00
Received from the secretary, 1911 dues	2 50
Total	$69 50
Paid bill of L. S. Merrill for ledger, record book and postage	7 15
Balance in treasury December, 1910	$62 35

This report was accepted.

Dr. G. M. Twitchell—I believe the time has come in the State of Maine when if we are to begin a decided forward movement in this matter of seed improvement we should avail ourselves of the work already done by this association and help put it in line to continue the work in the future in the most effective manner. This association is the organization through which we want to commence some systematic work in corn improvement, and I have this to propose,—that I will put into the hands of the association a couple of bushels of seed, the best that I have, that I have been trying to improve for the last few years, to be distributed by them under such conditions as they think best, asking only that it be put into the hands of careful, critical growers, men who will give it a fair chance; the only condition to be imposed on the grower to be that he shall return to the association twice as much seed as he gets. If he has seed enough for 8 acres, he shall return enough to the association for 16 acres. Mr. Tripp said at once that he would be very glad to join hands in this movement. I have talked with J. Henry Rines and he wished to be counted in also. Dr. Moulton is not here but I am satisfied that he will join us and that we can put into the hands of the officers from 12 to 20 bushels of corn grown by different parties in the State, representing different types, perhaps, and varieties which have more or less merit in them, and that the association can put that seed into the hands of men who will keep it distinct and will seek for further improvement.

Another little matter, it seems to me that there is an element of injustice in our system of judging and that another year the association should indicate to its officers the desire that there be some modification. Dr. Bailey comes up here from Wiscasset, with corn grown down on the coast; Mr. Guptil comes here from York county, with corn grown on the sandy, light soils of Berwick; Mr. Tripp comes here from Ripley with corn grown up in that northern latitude, and those three men must come in competition with each other, while the climatic conditions under which the corn is grown are altogether different in each case. There is an element of injustice in this. Mr. Tripp cannot grow corn under the same conditions that Dr. Moulton of Cumberland or Mr. Guptill can grow it. They have a longer season, a different soil; all the conditions are different. If you go up into Franklin county you strike one of the ideal spots for growing corn in the State of Maine. Put the man who grows corn in Franklin county with the man who grows it in northern Penobscot and there is a little injustice. It seems to me the time has come when we ought to divide the State of Maine, as New England was divided, by zones which shall, so far as possible, enable men living in the different sections to compete against each other.

DR. PEARL—I wish to endorse very strongly the recommendation that Dr. Twitchell has made. I would be inclined to go a little further, in that. It seems to me that by doing this we are taking an important step in the improvement of Maine corn in general, for the reason that it will help us to take steps in the direction of breeding locally adapted varieties. I am inclined to think that if this work in corn breeding has shown anything to be certain, it is that the factor of local adjustment is an exceedingly important one. Seed which is very fine in one locality will not do well in another not very far distant, where the conditions affecting growth are different. It seems to me that some such proposition as Dr. Twitchell has suggested is very desirable.

Amendments to the constitution of the association, presented by the secretary on behalf of the executive committee, were adopted as follows:

Resolved, That section one of Article three be amended by inserting after the words "shall be entitled to become" the word "active," so that said section shall read:

Section 1. Any person engaged in the practice of agriculture, in any of its various phases, instructors of the Maine Agricultural College, Experiment Station and Department of Agriculture, shall be entitled to become active members of the association.

That section two be amended by striking out the section entire and substituting therefor the following:

Section 2. There shall be two classes of active members. These classes shall be

(A) Those members engaged in the breeding and sale of improved seed, entitled as hereinafter provided for, to bear the *Tag of Purity and Merit* of the Maine Seed Improvement Association, and

(B) Those members not engaged in the breeding and sale of seed bearing the tag.

That a section be added as follows, to be known as section 3:

Section 3. Any active member may be registered in Class A upon fulfilling the requirements for admission to this class, which are as follows:

The prospective Class A member shall

1. Open his entire farm to inspection at any time by any person duly authorized and delegated by the committee on seed breeding.

2. Agree to follow exactly, so far as is possible, all directions as to the culture and breeding of the crops from which he proposes to sell seed bearing the *Tag of Purity and Merit,* which may be given him by the committee on seed breeding.

3. Agree to sell no seed which does not contain a statement of the percentage of purity, and germinating test.

4. Agree to submit annually to the secretary of the association

(a) A report of his operations for the year past, including the amount and kinds of seed he proposes to sell.

(b) A representative sample of every kind of seed which he proposes to sell.

That a section be added as follows to be known as section 4:

Section 4. Associate members. Any person interested in advancing agriculture and in sympathy with the aims and purposes of the association may be admitted to associate membership by vote of the association at any regular or special meeting or at any time by a majority vote of the executive committee.

That Article five be amended by adding a section to be known as section 3, as follows:

Section 3. There shall be a permanent committee on seed breeding, which shall consist of three members chosen *ex-officio* as follows:

(1) The Secretary of the Association, (2) the Professor of Agronomy of the University of Maine, and (3) the Biologist of the Maine Agricultural Experiment Station.

That section 5 of Article 6 be amended by striking out the last eight words.

That a new section to be known as section 6 be added as follows:

Section 6. It shall be the duties of the committee on seed breeding to

1. Direct the experimental work of the association.
2. Decide on the eligibility of members for Class A membership.
3. Inspect and pass upon all seed offered for sale under the *Tag of Purity and Merit* of the association.
4. Issue all *Tags of Purity and Merit.*

That Article 7 be amended by making it Article nine and that in place thereof there be enacted the following:

ARTICLE VII.

Tag of Purity and Merit.

Section 1. There shall be issued in the manner hereinbefore provided for, Tags of Purity and Merit to all Class A members of the association, in sufficient numbers so that each parcel of seed sold by a Class A member may bear one of these tags.

Section 2. The tags shall be printed with an appropriate and distinctive device, and shall constitute a guarantee of the purity of the seed in the package bearing the tag. The tag shall further carry an expression of the belief of the committee on seed breeding, as representing the association in this matter, that the seed in any package bearing a tag is of distinct merit.

Section 3. The Tag of Purity and Merit shall be copyrighted in the name of the association.

That a new article to be known as Article 8 be added as follows:

ARTICLE VIII.

Forfeiture of Membership.

Section 1. Any member of Class A who shall, after complaint has been made, be found by the executive committee to have sold any seed in a package bearing the Tag of Purity and Merit, which has not been inspected and approved by the committee on seed breeding, or to have sold under the tag seed not equal in purity and merit to the samples inspected and approved, or to have sold seed under the pretense of its having been inspected and approved by the committee on seed breeding when such approval has not been officially obtained, shall forfeit his membership in the association, and lose thereby all rights and benefits accruing from such membership.

Section 2. Any Class B member of the association who shall in his advertising, correspondence, or in any other way, seek to create the impression that seed which he sells has been inspected, or is guaranteed or in any way vouched for by the Maine Seed Improvement Association, shall thereby forfeit his membership. The executive committee shall hear all complaints and evidence and shall decide such cases.

Voted, that the offers made by Dr. Twitchell and other parties to place a certain amount of seed corn in the hands of the association to be distributed to growers for purposes of improvement, be accepted, and that the thanks of the association be extended to them. A committee for the proper distribution of this seed was appointed as follows: C. S. McIntire, J. P. Buckley, H. G. Bell.

In accordance with the suggestion made by Dr. Twitchell in regard to dividing the State into zones for corn competition and judging purposes, the following committee was appointed to investigate the matter: Dr. Raymond Pearl, Leon S. Merrill, Chas. L. Jones.

DEMONSTRATION IN CORN JUDGING.

By Prof. H. G. BELL.

I heard quite an interesting discussion on the following question: Does show quality actually go with merit in corn? Do show requirements come up to the actual requirements for good yielding corn on the farm? With our present experience we are not prepared to say. We want you farmers to be thinking of that, to be looking to it in your fields of corn; to keep that question before you until next year. I am going to ask you the same question next year. Is it your opinion from your experience that taking out the seed ears from a prize lot of corn like this will give you the best yield for all corn?

We will now take up the points on the score card. Under general appearance, first of all the color must be taken into account. When I speak of color I do not wish you to carry away the idea that it is the actual shade of the corn to which I refer. Here are two distinct colors of flint corn. For me to say that one color is better than the other would be ridiculous. Both of the strains are yielding well and giving good results. It is the brightness, the cheerfulness of the corn to which we refer when we speak of color. General appearance denotes first the color and next the uniformity of the exhibit. Uniformity means that the ears are as near alike in length as is possible, and as near alike in size as possible. To that I have given 15 points out of 100.

The next point I take up is maturity. To this point the farmers should pay a great deal of attention. I have had my students at the college conduct an extensive experiment as to what effect the storage of corn has upon it. The results of that experiment revealed some very interesting things. I had them put samples of mature corn, of equal size, into different places of storage. In testing the vitality of that corn we found that in some cases it had gone down and down, and in other cases it had gone up. Where there was any dampness it was exceedingly bad for the corn. When the corn is perfectly mature, perfectly solid, conditions which are the least bit unfavorable do not affect it as badly as when it is immature. Immature corn may be almost entirely killed if it is exposed by storing in a place where there is considerable moisture, because mould can grow there. Prof. Holton, perhaps one of the greatest corn experts in America, at the Worcester Exposition made this statement to me: "A man that will give the prize to a sample of corn that is not mature does not know his business." I thoroughly agree with him. Corn in December should be perfectly solid. It should be dried out, if it was not perfectly dry when put in, so that the kernels will be solid.

The next point is the ear conformation, and first of all we should consider the length. A while ago the aim would have been to get the largest ear, but size and quality do not always go together; in fact, do not often go together. An ear should be sufficiently long, but not too long. If it is too long the tendency is towards immaturity. One reason for throwing out the tips and butts is that there is more liability to be a lack of vitality in the kernels, because they are poor in shape. Like does not always produce like, but it tends to produce like. If you choose ears for seed that are the proper length you will stand a better chance of raising those that are the proper length. We are living in a State where the growing season for corn is about 100 to 110 days in length, speaking for the State generally. In the southern part it is longer and in the northern part shorter. With sufficient length of ear there should also be sufficient diameter. The rule with most of the dent corn is that the circumference should be about one-half the total length. This will be governed by variety to quite an extent. There should be a regular development from base to tip. We look for regularity of development. With all we should have straightness of rows. Here is a matter which introduces a lot of discussion. Why isn't corn grown in mixed rows just as good as that which grows in straight rows? One of the points that the breeders have established is that the rows should be straight. The kernels are apt to be more uniform. If you shell an ear with uneven rows and try to plant the corn with a mechanical planter, the kernels are not dropped as evenly.

The next point is the space between the rows. This should be closely filled. If there is a large space you will be harvesting a lot of air where you should have harvested a lot of corn.

The last point I wish to take up is the kernel conformation. The following are the general principles of kernel conformation which I think should guide us. The kernel should be more or less wedge shape, with the type of a triangle. It should be so uniform that the kernels will touch all the way down. It should be sufficiently wide at the top, but not too wide, and then taper down. Sometimes we find them too wide and rounded, which means that we have a space between the kernels. We cannot have depth and abnormal width.

The germ is the last thing we will consider and perhaps one of the most important things in the study of the conformation of the kernel. I think the germ should come up pretty well toward the top of the kernel, and it should be fairly wide. It should not spread all over the kernel, and it should not be narrow. It should be bright and free from wrinkles. A wrinkle shows a chance of immaturity. In summing up I would say: for general appearance, the first glimpse we get of the sample, the color of it, the cheerfulness of it, and also the regularity of length and regularity of size. Then comes the maturity which is one of the important points in judging corn. I put great dependence upon maturity, because that is the vital point for the seed corn grower. If we are to grow our own seed corn, we must pay attention to maturity. Then comes the ear conformation, which takes up the regularity of development, the covering of the tip and butt. What we should work for in regard to the tip is to have it regularly rounded over, but we should not place too much dependence on this. I would rather have a little bareness of tip and well rounded kernels than a well filled tip and bare kernels. The kernels should be wedge shape so they will fit in together and the germ of good size.

DR. TWITCHELL—In looking over the first prize ten ears of corn, I find there are a great many irregular kernels. The ears are of good length but there are so many irregular kernels as compared with the second prize lot that the question has been raised as to why it was placed first.

PROF. BELL—I would ask you to take up the ears in the two lots and twist them for maturity. The ears in the lot which secured the first prize are exceptionally well matured. They are sound and solid. I will admit that the second lot has a more regular form of kernels, but it is not as mature, and I place much dependence on maturity. They both look vigorous and I think both are excellent; but on account of its maturity I believe the first lot will come out best in the spring.

DEMONSTRATION IN POTATO JUDGING.

By Prof. Bell.

When I came to Maine last January to have charge of the agronomy work at the University, I learned, of course, that Maine was famous for its potatoes. I thought it would be foolish for me to get out a score card because I knew the practical growers were noted for this crop. What I did was to strike off a score card and send it to about fifty of the most prominent potato growers. I took the suggestions from the replies that I received and balanced them up and this score card is the result.

Under general appearance we should have size, freshness and shape. Size is relative. The potatoes should be uniform in size. You will say that there is a great variation in size. On the score card size refers to the relative size of the potato as compared with other exhibits. Regularity in size refers to regularity in shape, to some extent. The next point is freshness. The potato should be fresh and hard, showing that the vitality is not weakened. It should not show a shriveled condition. The word shape brings up the question of varieties, but the usual shape is oblong.

Next we have trueness to type. Now comes the breed characteristics. If we are raising Green Mountain potatoes we want Green Mountain. We do not want part of one kind and part of another. If we are raising a pure type of potatoes, the same as a pure type of apples or corn, we want them true to type. The Green Mountain potato should be rather wide, with a good even conformation, a little more oval than some varieties, the ends rounded over and not thick. Whatever the variety, you want trueness to type.

The potato should have definite eyes, but we wish to discriminate against deep eyes. The market has no place for deep-eyed potatoes, because in peeling too much of the potato is lost.

Under soundness there are one or two things we wish to consider. First of all, freedom from a hollow center. Big potatoes sometimes are hollow at the center. You can tell by the sound if this is the case. Then there must be toughness of skin. If they are dug before they are ripe, the skin will not be so tough. A good many people dig potatoes while they are green. You save a little time and inconvenience but you hurt yourself, the locality and the State, because as those potatoes go out to the Boston and New York markets the people in those markets get the idea that our potatoes are all alike, and they discriminate against Maine potatoes. There are too many Maine potatoes going to those markets with skins that will peel; too many that are immature.

In scoring for vitality, we consider the eyes, and the frequency of the eyes. The potato should have strong looking eyes,—eyes that are vigorous; not shallow, but not of any great depth; eyes that show that there will be some growth there when the proper time comes. Then, from a study of the laws of heredity I do not think it pays to choose potatoes that have very deep eyes, because they have not the quality of prolixity. I am studying now 450 strains and by this time next year I believe I will have some data which I can present on that question. I think, judging from other crops, that the potato that has a reasonable number of productive ovans, or eyes, is the one that we should choose. Of course you know that this is not the seed but the root. It does not correspond exactly to ovans, but I think the laws of transmission should be the same.

The last point to discuss is the quality for cooking. In our class at the University the other day we had just completed the study of the Green Mountain potato, and in the next period I had fifteen varieties of potatoes and two of each variety had been cooked. I said to the class: "How many of you think there is no difference in taste of different potatoes?" Some of them thought there was not much difference, but at the end of the period they said that never in their lives had they thought there was so much difference in the taste. As a final illustration I took one sample of each potato cooked, and there was all the difference in the shade, in the texture, in trueness to type and in flavor that there is between other products, even different samples of butter. The Green Mountain and the Irish Cobbler were nice, dry, palatable potatoes. There were some others that were very insipid, and some rank and bitter. In choosing our seed I think we should take some of the potatoes and cook them and see how they taste, because I am convinced that taste is an heredity quality just the same as the character and growth of stock. In judging potatoes, notice whether they are nice, bright and clear, then take up the point of soundness, then regularity and uniformity of size.

HOW I RAISE BEANS AT A PROFIT.

By F. H. Morse, Waterford.

I have been raising beans for 30 years or more, and I have learned that they will not grow without something to eat, any more than any other crop. Another thing, the cheapest time to hoe a crop is before it is planted. We try to prepare our land very thoroughly for the bean crop. It is not a crop that will overcome witchgrass, like corn. Most of our beans are raised as a part of a regular rotation. We are troubled very much with witchgrass, and we plant beans one or two years with corn, until we get the witchgrass subdued. Instead of sowing grain as our neighbors do and seeding down in grain, we have planted beans and seeded down with beans. That, perhaps, you have never tried, and to tell the truth I have had to give it up, for this year we bought a bean harvester, and that tears the ground all to pieces.

As I said before, we try to give our ground very thorough preparation. We intend to get the witchgrass very thoroughly conquered in the corn. In planting beans we use a two-horse planter. It is very essential when you use a planter that the rows are straight and an even distance apart, so that you can use tools to cultivate them.

On land where the witchgrass and weeds have been thoroughly enough subdued, so that you can use it, I have found nothing equal to the weeder to cultivate the bean crop. It must be used with judgment. It would not do to go out some cool morning and think you could kill the weeds and not kill the beans, for the beans would be brittle and you would break them off. In the heat of the day the beans will stand a good deal. This last summer we lengthened out the regular weeder head, so that it would cover four rows at a time. We cultivated the rows in that way until the plants were three inches high, but found we would not be able to keep the beans clean in that way. The question was: Would it do to use the weeder? We examined that piece of beans, and much to my surprise beans that stood 4 inches high had roots 15 inches long. I found that practically the roots met between the rows.

Then the question came up: How could we keep the weeds down and not destroy so many roots as to hurt the beans? If we do not have a tool that will do the work, we make one. We took our weeder and put a piece of plank on ahead, then took the spring teeth from the American cultivator—they are not shaped like the regular spring teeth—and put those on. Our rows were so even we could put them on and run over the rows and not disturb the beans. Instead of using the pointed teeth we turned them down, and they scraped the surface of the ground and turned the witchgrass over, and the little teeth coming on behind, made it look smooth and light and nice.

We found we could go over three rows at a time, if planted 3½ feet apart, as we plant it. It is slow work going over one row at a time. The way we had this arranged, the weeder teeth were held up somewhat behind, and they barely scraped the surface without going to any depth.

Most of you who ever raised any beans know that it is a back-aching job to pull them. We always did that by hand until this year. I have talked with a number of men about the question, and a man who came from Michigan this summer said he thought a bean harvester would work well here. We have a good many cobblestones, and I supposed a harvester had to be sharp enough to cut the beans off. We finally ordered a harvester, and it did very good work indeed. We took our horses, and pulled two rows at a time. As we had several acres it was quite a saving. This machine is made with two plates that run outside the rows and cut them and draw them together between the rows. Of course, there are more or less stones mixed with them, but we had two men following behind the machine who pulled two rows in toward two more; we did not pull them quite together in the first place, but after they were dry enough to turn over we put four rows in one windrow. That gave us a chance to drive between the windrows and pitch them on to the wagon.

If you plant the yellow-eyed beans there will be white and black beans. With a little practice you can tell them by the growth. I go ahead of the pullers and pull out all the black and white beans. This year we threshed between 30 and 40 bushels before I found a black bean. I find in doing that, and selecting the seed carefully, I reduce the number of black and white beans. The yellow-eyed beans usually stand upright. The black and white beans that grow from the yellow eyes, tip over, and the pods that have the black and white beans in them have a reddish color, striped with black. The white beans are very much more prolific than the yellow eyes. If you keep planting the seed of the beans as they grow, in a few years they will go back to the black and white beans, because they are so much more prolific. I cannot tell you the percentage of black and white beans we get now, but it is very small. I think I have selected seed in that way three years. It is very encouraging to me to see so much improvement in the crop with that little bit of labor.

We let the beans stand until the leaves are about half off, when we cut them. In that way they will dry off, and most of the leaves will be off by the time they are put in the barn. If you have a mow fairly well ventilated you can pitch them into the mow without trouble, only do not tread them; do not stand on them to pitch them back; have something to stand on so that they will not be trodden down. One year we had quite a large lot. I stood on them as I would a mow of hay, and when we came to thresh them the beans had settled down and we lost a lot of them by mildew and mold.

Three years ago this fall we bought a bean-thresher. It is a very nice-working machine, but I got too small a size, and it does the work slowly. It will thresh them nicely and clean them up, so that if you bought a barrel of the beans you would say they were ready for market. But we hand-pick them all. If anyone is going into the raising of beans to any extent, the thing to do would be for two or three to join together and buy a machine of some size. With this one of ours, with beans well filled, we can thresh three or four bushels an hour. Last year I could do that myself without any help, but usually it takes two. This year we have more vines and find it pretty hard work for two to thresh more than that. It is a small machine, run by gasolene. It leaves the fodder in fine shape. We find the fodder is quite an item in our dairy work. It is not only a good feed, but I think it has a medicinal effect on the cows. For two years our bean crop was a failure, and we had more trouble with our cows in the two years, from garget and other troubles, than for 20 years altogether. I think this shows that the beans have a good effect.

I have met some people since I have been here who say that their cows will not eat bean pods, but ours do. We feed them the first thing in the morning, and those cows are just as anxious, and will make just as much demonstration for those pods as for ensilage. Cows will almost always leave their grain to eat ensilage, and they will do that to eat bean pods.

As to the variety of beans to raise, what might be best for me, may not be the best variety for you. The last few years we have raised the old fashioned yellow eyes, and have a special market for a certain amount. I have one customer who takes 100 bushels a year. At the present we get double the quotations in Boston. I do not mean that we get double what they are quoted, but double what the net results would be to us.

We have found, one year with another, that the bean crop has been a profitable one with us, more profitable than sweet corn. I think our land is sweet corn sick. We have raised it so long that the land does not respond. I really think that beans improve the land. I suppose it is on the same principle that alfalfa and some other crops improve the land. When we pulled the beans this year the roots were covered with those little nitrogen gathering nodules. We have grown them because we thought we were planting something that would not sap the ground, and they have partially helped the soil. It seems to me that the bean crop prepares the ground for corn perhaps as well as to sow it to clover.

Ques. What is your rotation?

Ans. Up our way, two years ago, the winter and the dry summer following killed the clover. The rotation we followed up to that time had been corn one or two years, according to the land we planted it on, then beans, seeding with clover in the beans. Then we cut two crops of clover the first year, one the second year, and plowed in the second crop and planted to corn the following year. In using the bean harvester we cannot seed down in the beans, so I do not know what we shall do next. We have a piece that we raised beans on this year, and it is all ready for seed, and I shall sow it next spring as soon as the snow goes off, and apply a little chemical fertilizer with nitrate of soda, and see if I cannot get a hay crop next year. If that works well that is the plan we shall follow.

Q. With the old fashioned yellow eyes what do you find the yield per acre to be?

A. I do not think you could raise as many as you could of the improved. We call 25 bushels per acre a good yield with the old fashioned variety. We cannot raise that every year. Two years ago we averaged that on six acres; last year we got a little over 20 bushels. This year I doubt if they average any more, although on the first setting of the pods they never looked so well, but the blight struck them.

Q. What do you use for fertilizer?

A. Mostly we mix our own chemicals. Three years ago we bought the ready mixed goods, but for three years we have mixed our own chemicals. The formula used for the last two years is: Nitrate of soda, 100 pounds; tankage, 500 pounds; bone, 400 pounds; acid phosphate, 600 pounds, and potash, 400 pounds.

Q. What kind of land do you get the best bean crop on?

A. I think the bean crop with us has been very good about adapting itself to the soil, except for two years when we had some light land in pasture that we broke up, and they did not seem to pod very well there. As they got ready to fill, the dry weather came on and upset the filling. I think we only got about 10 bushels to the acre.

Q. Which would be the better, a sandy or clay loam?

A. If the sandy loam was not the kind affected by drouth, I think that would be better. Ours is what we call gravelly loam.

Q. How heavily do you seed?

A. With the old fashioned yellow-eyes it takes about three pecks to the acre.

Q. What did the machinery cost?

A. Our little thresher at that time cost $42.50 cash in Minneapolis. The harvester we used is an attachment to the American cultivator. That cost $10 delivered at our station.

OPPORTUNITIES FOR CORN BREEDING IN MAINE.

By Dr. Raymond Pearl, Orono.

The time has come in American agriculture when the practice of intensive methods must be seriously undertaken. In the history of the country up to the past decade we have been able to employ the most wasteful agricultural methods in the world without particularly feeling the evil effects of such practice. This ability temporarily to escape the consequences of a careless and wasteful agriculture has been due to different circumstances in different parts of the country. In the West there were always new and virgin lands to migrate to when the yields got low on the old ones. In New England when the farm ceased to pay by the "good" old methods one could work at day wages on the river, or in the shop, or teaming, or as a last resort take summer boarders. All these things, however, are but makeshift solutions of the economic problem confronting the farmer. The virgin lands are now all gone in this country, or very nearly so, and with increasing immigration and increased efficiency in the organization of labor, both from the laborer's and the employer's standpoint, the odd job laborer, part farmer and part something else, is finding himself in a worse position all the time. The summer boarder is at best an uncertain crop, expensive and difficult to cultivate.

The true solution of the problem, and the one which far-sighted farmers who form seed improvement associations have grasped the import of, is the practice of a *more intensive agriculture*. By intensive agriculture one only means farming in such a way as to get the maximum return off a given area of land. This means as primary factors, improved seed, and right methods of culture. Here lies the reason why we must practice seed breeding, and the reason why this association has a work to do.

Now all this which has been said is very well in its way perhaps, but after all pretty general. To get down to the ground, just what does corn breeding offer the Maine farmer? What are the opportunities in this direction in this State? Such opportunities, it seems to me, lie open in two general directions. These are:

1. *The improvement of corn as a farm crop to be used on the farm.*

2. *The production of seed corn, both yellow and sweet, to sell not only in the State but elsewhere as well.*

Let us consider each of these propositions separately.

The first proposition obviously refers to yellow corn. It involves two questions.

(a) Is it profitable to grow corn as a grain crop in Maine?

(b) Granting that it is, what profit may be expected to result from special breeding of the crop?

In answer to these questions let me present some figures. To answer the first question it is necessary to know on the one hand what it costs to grow a bushel of corn in Maine, and on the other hand what it costs to buy a bushel of corn in Maine. The difference will answer the question.

Unfortunately there are no detailed figures in regard to the cost of growing corn in Maine. So then, what we shall have to do is to get some basic figures from other states and then make an estimate for Maine on the basis of these and general observations. Fortunately I have been able to get some figures which will, I think, serve to establish an upper and a lower limit for the cost of growing corn, somewhere between which the cost in Maine may be considered to lie.

First let us examine some data on the cost of growing corn in New Hampshire, a neighboring state, where general conditions are in many ways similar to our own. The following figures represent the cost to Mr. Joseph B. Cram of Hampton Falls, N. H., of growing an acre of corn.

Plowing	$3.00
Harrowing	2.00
Seed	.25
Planting (hand)	2.50
Twice over with weeder	.50
Cultivating both ways four times	2.40
Hoeing once	2.00
Harvesting ears	1.25
Cutting and shocking fodder	2.50
Hauling and husking ears	3.00
Hauling fodder	3.00
Total	$22.40

The figures allow nothing for manure or fertilizer, nor for rental of land, but they are considerably in excess of the average on some other points. The land was plowed twice to kill witch grass; the hand planting was too expensive.

The yield from this acre was 80 bushels of shelled corn. This makes the cost per bushel 28 cents.

More accurate figures, but from quite different conditions, are the following taken from Bulletin 117 of the Minnesota Experiment Station. They represent the results of a very careful investigation on cost of production:

Cost of Producing in Two Minnesota Localities When the Ears are Husked from the Standing Stalks, and the Stover not Harvested.

	Rice Co.	Lyon Co.
Seed	.226	.190
Shelling seed	.026	.025
Plowing	1.311	1.171
Dragging	.544	.439
Planting (horse planter)	.240	.255
Cultivating	1.806	1.453
Weeding	——	.119
Husking	3.456	2.473
Machinery cost	.549	.537
Land rental	3.500	3.000
Total	11.658	9.662
Yield	37.90 bu.	46.24 bu.
Cost per bushel	.31	.21

Cost of Producing Corn in Minnesota, When it is Shocked and Hauled in from the Field.

	Lyon Co.
Seed	.190
Shelling seed	.025
Plowing	1.171
Dragging	.439
Planting (horse planter)	.255
Cultivating	1.453
Cutting (corn binder)	.687

Shocking and binding	.292
Twine	.302
Hauling	1.003
Machinery cost	1.448
Land rental	3.000
Total	10.265

None of these Minnesota figures allow anything for manure. This is made a general charge against the farm and not against the special crops. Commercial fertilizer is little used in growing corn in the West, and hence does not enter into the account. Here lies one of the chief reasons why they can grow corn cheaper than we can.

None of these figures as they stand are directly applicable to average Maine conditions. The western figures are too low and the New Hampshire ones, in some respects too high.

In the following figures I have attempted to make an estimate, on the basis of these figures, and of what I have observed of conditions regarding corn culture in the State, as to what it costs to grow corn in Maine. It is my belief that the result given is a minimum. That is, I doubt if corn can in general or on the average be grown for much *less* than the amount given. Of course, in individual cases some farmer may grow, or think he grows, corn cheaper than this, but these are meant to be average figures.

Estimated Minimum Cost of Growing Corn in Maine.

Seed and shelling	$.25
Manure and fertilizer	6.00*
Plowing	1.75
Harrowing	.50
Planting	.75
Cultivating and hoeing	4.00
Harvesting corn and stover	2.50
Hauling and husking	2.25
Land rental	4.00
Total	$22.00

* In deciding on this figure, allowance is made for the value of the fertilizing materials left in the soil for the benefit of the subsequent crops. It is doubtful if any farmer in Maine attempts to grow corn with an *actual outlay* of as little as $6.00 to the acre in manure and fertilizer. If he does his yield is pretty meager.

This represents a cost close to the minimum. If we add to the New Hampshire figures the same land rental charge, $4.00, and the same fertilizer charge, $6.00, we shall have a total of $32.40. This will represent something close to a maximum of what it *ought* to cost to grow an acre of corn in Maine. Of course it can be made to cost more, but ordinary average farming ought to do it for this sum.

Now an acre of corn cannot be expected to yield more than 1½ tons of dry stover. Reckoning the feeding value of this as $3.00 per ton (some authorities calculate it at never over $2.85) we have as the value of the stover $4.50. Deducting this from the totals we have, as the net cost of producing an acre of corn in Maine something between $17.50 and $27.90.

The following table shows the importance of breeding and the use of improved seed:

Cost of Production of a Bushel of Shelled Corn at the Indicated Yields in Bushels per Acre.

If the corn yields at the rate per acre of	The net cost per bushel of shelled corn will be between
40 bushels shelled corn	44c and 70c
50 bushels shelled corn	35c and 56c
60 bushels shelled corn	29c and 47c
70 bushels shelled corn	25c and 40c
80 bushels shelled corn	22c and 35c
90 bushels shelled corn	19c and 31c
100 bushels shelled corn	17½c and 28c

It is clear enough from these figures what a great advantage it is to use improved seed corn. At the current market price of corn this fall, say 60 to 65 cents a bushel in Boston, there is not a great profit in corn growing for the man in Maine who raises only 40 bushels of shelled corn to the acre, no matter how economical his cultural methods. But if he uses improved seed from which he can get a yield of 60 to 70 bushels to the acre his corn is costing him only one-half what he has to pay the grain man for it. Here then lies one opportunity for corn breeding in Maine.

Let us turn to the second opportunity, the production of seed. While I have not at hand the figures for the present year's pack we are safe in assuming that Maine stands at least third in the amount of sweet corn packed, among all the states in the country. This industry creates a great demand for seed. Now one of the most important principles brought out by recent scientific studies on corn breeding is the great importance of what is called *local adjustment* in seed corn. What this means is that on the average and in the long run corn planted from seed grown in the same locality and acclimated or adjusted to the conditions of that locality will yield more ears, larger ears and finer ears than will corn grown from seed brought in from somewhere else. This principle has been shown to hold true for yellow corn, and the work of the Station during the past four years with sweet corn shows beyond the shadow of a doubt that it applies to this crop as well. *On the average the best sweet corn grown in Maine today is produced from Maine grown seed.* Many of the packers have known this for a long time, but would not say so *because they have not been able, try as they would, to get anything like enough Maine grown seed of high quality to plant their acreage.* Does not this mean an opportunity for corn breeding in Maine? For high quality sweet corn seed the grower can get $4.00 per bushel at any time. The only extra cost of producing this is involved in two items:

1. The extra *brain work* which goes into *breeding* a high grade product, rather than merely *growing* an ordinary one. This you can capitalize at what you will.
2. The extra cost of curing, plus the shrinkage in value of the stover if it stands in the field till the ears are matured for seed.

A similar opportunity lies open in the breeding of yellow corn for seed. That the native flint corn of New England has deteriorated during the last 75 years owing to lack of attention to its breeding no one doubts who has taken pains to acqaint himself with the facts. At the beginning of last century agricultural fairs in New England were such in fact as well as in theory, and did much to stimulate the farmer to improve his crops. A regular feature of the fairs in those days was competition as to yields of crops, the land being measured and the yields determined by disinterested judges. If one will take the trouble to read the prize awards of New England fairs along about 1800 to 1825 he will quickly find that in order to stand any chance at all in the corn competitions one had to get a yield of 100 or more bushels of shelled corn to the measured acre. This was with flint corn. How much of it will do that today?

The general report from the recent corn show in Worcester was to the effect that the flint corn shown was seriously lacking in *breeding*. With the reawakening of interest in corn growing in New England there is already a great demand for improved, acclimated seed. This demand will increase markedly in the next few years. Does not the breeding of seed to supply this demand offer an opportunity to the Maine farmer?

I hope that what I have said will serve in some small measure to indicate that it is worth the while of the members of this association first to grow corn, and second to breed corn. The first great requisite of successful agriculture is to *feed* crops well. The second, and not less important, is to *breed* them well, so as to have something that it is both a pleasure and a profit to feed.

Discussion.

Ques. What about false rows, how can you breed them out?

Ans. Well, I would take that to mean that the original sample of seed that you started with was not the best thing to start with, and I would start again.

Q. There was one ear of an 8-rowed variety sent me that had ten rows at the butt. I put that where I knew where it was, but ought that to spread through the other rows?

A. Yes, I think it would. This ten-row character might be spread by pollen of that row and could show in every other row in the piece.

Q. Then it would have been better to have planted but nine rows, and left the other out?

A. Yes, in view of the outcome.

Q. They did not tip out good. The ears sent me were well formed as to tipping out, but there would be little snouts on mine?

A. That matter of tipping out is influenced by the conditions at the time of pollenation. With the best corn in the world, if the conditions are right (or wrong, as you may say) just at the time of the pollenation of the ears, you will get bad tips.

Q. What do you call right conditions?

A. The conditions should be such that when the pollen is being shed, for a period of about a week you would have warm, sunshiny days, dry weather, and not too hot, so as to dry up the silk prematurely. Corn does not fill out on the tip for two main causes: On the one hand, there may not be enough pollen for all the silks, or, on the other hand, the silks may either not develop properly, or die before the pollen reaches them. If a piece of corn develops unevenly, so that you get an uneven distribution of pollen in respect to time, you are apt to get a good many badly tipped ears.

Q. Would you advise detasseling,—taking off the tops?

A. That is a question in corn breeding. If you talk with a cattle breeder, as I happened to do this morning, and the talk turns on corn breeding, it seems, to the cattle breeder, to be the most ill-guided, ill-conducted thing in the world. On the ordinary plan of corn breeding you are controlling only the female line. The question has been considered a good deal by the plant breeders, and various schemes devised to control the male line or the sire in corn breeding. Perhaps the best method so far worked out for dealing with this problem is that which uses only one sire ear in the seed breeding plot. This sire ear is chosen because of its supposed ability to transmit good qualities, as indicated in several years of ordinary ear-to-row testing. The practice of persons following this method is as follows:

If they find a pedigree strain or row of corn, planted on the ear-to-row method, that for two or more consecutive years yields considerably higher than the other rows, they come to the conclusion it has some good in it, and one or more ears are taken from it to serve as sire plants for the next year's seed plat. A square plat is planted for seed. In the center of that plat are planted the ears (or ear) which have been chosen to furnish the pollen, that is to be the sire plants. Then just as soon as the tassels are out and before the silks appear all the plants in the plat except these sire plants in the center are detasseled. The ears from the detasseled plants are saved for seed. This method corresponds to the practice of grading up cattle with a purebred male. By this means you can control the male parent in corn. It has been shown that if you bring together in corn two unrelated strains you can get an increase in the yield. There have been figures published that give a very great increase. For example, where two strains were crossed, each yielding in the neighborhood of 65 bushels, the resulting yield the first cross-bred generation was over 100 bushels to the acre. People who have done this work give much higher figures even than these.

Q. Suppose you take that cross-bred seed and breed it again, what would you get?

A. That is not to be done. Anybody who takes up this plan must be prepared to run on his farm all the time at least three corn plats so far apart that they will not mix. Understand I am not advising this plan as a practical thing, but bring it out as having a bearing on the question raised in regard to detasseling.

Q. I would like to know about husking corn. In my experience with the corn I have raised the husking costs as much as the rest of the crop?

A. You will realize that my estimates are minimum ones. I deliberately put the price very low on husking. I agree with you that husking probably often costs more, and would like to have your opinion. In that estimate the charge for husking is $3. What do you think it costs you?

Q. Well it costs me pretty close to $9. My corn crop cost me about 47 cents per bushel.

PROF. HITCHINGS: Don't you think that it makes quite a difference in the value of the land used? If one farm is worth $20 an acre, and another man is using land worth $100 per acre, there is quite an item to be considered.

DR. PEARL: Yes, of course, that figures on the land rental charge, but I endeavored to make a fair average charge, considering the land in Maine that is used for corn growing.

Q. How long can we continue to get an improvement in the yield of our corn?

A. That is a hard question to answer. It seems to me that the question of the improvement of corn by breeding, in the last analysis, comes to the same basis as the improvement of anything else by breeding. We have to discover the ear, in the case of corn, which comes from a plant which has the ability to *transmit* its qualities. We must have the *transmission* of good qualities. With ear-to-row tests you get in the first generation such results as those shown down stairs; some rows that yield 80 bushels to the acre, and some that yield at the rate of five bushels. The common assumption is that by planting seed from the 80-bushel row next year you will *surely* get a considerably higher yield than the average of the year before. But all the actual figures, so far as I know, of the ear-to-row method of breeding, do not justify that assumption, so far at least as concerns the character yield.

What we have to do is to find that ear which will produce a high-yielding row, and the *next year* produce a high-yielding row again, and so on indefinitely. In other words, we must find the *prepotent* individual. We have tested in the Station work hundreds of ears and their progeny rows, and out of the hundreds we have found just one row that seems to transmit with certainty high yielding qualities. There were other ears that seemed in the first generation as good as that, but they lacked the ability to dominate, as it were, all the inferior strains that mixed with them in fertilization, and keep up the yield. I think the occurrence of such a prepotent corn plant probably happens only about as often as you get a great sire in trotting horses, for example, and the occurrence of such prepotent individuals quite certainly is something that with our present knowledge man cannot control. When such a favorable variation is sent along by Nature what we want to do is to know how to take advantage of it and know how to perpetuate and not lose it.

The practical question is: What method shall we follow in breeding corn? and today there seems to be nothing better than to practise the ear-to-row method. Anyone doing that, however, must not be disappointed if he does not get the results expected right off. Do not be disappointed if when you plant the 80-bushel row it does not yield higher than the 5-bushel row.

The next point to be considered, although I am not yet ready to give any positive advice on it, is the question of detasseling. Personally, I am in favor of detasseling alternate rows and taking the seed only from stalks that have had the tassel removed, thus preventing any self-fertilization. I am not guaranteeing to you that this is going to raise your yield greatly, but I think it is a good thing to practise in connection with our ear-to-row method. It is, I believe, good practise to detassel barren stalks and suckers in the breeding plot.

Q. Why not remove the stalk?

A. You can, but detasseling is easier and you save the fodder.

SMALL GRAIN GROWING IN MAINE.

By Prof. H. G. Bell, Orono.

From the close of the Civil War to the early 80's New England was famed for her production of small cereals. Wheat fields were found on nearly every farm and busy mills supplied the demands of the people with flour made from locally grown grain. But all this is changed. In the 80's and 90's the opening up of fertile areas in the West made it possible for the western sons to lay down grain on eastern markets at a lower price than that for which their fathers could produce this commodity on the home farms. Hence, it was natural that the grain field should give place to the pasture or meadow, and even to the abandoned farm. But the pendulum is swinging back to the other side of the arc. Rise in land values, increase in the demands of a growing populace, and high freight rates have forced the price of corn, oats, and wheat up to a height that is almost prohibitive to the easterner. The time has come when he can again compete with profit in the raising of these much needed cereals.

The climate of Maine is indeed somewhat severe for the growth of corn, but great hopes are entertained for the breeding of a corn that will mature in 90 to 110 days, which is about the limit of the average corn growing season of many of the fertile districts of this State. Small grains such as oats, wheat and barley, coming from the more rigorous climates of Europe and Asia, thrive under the conditions which prevail in Maine. Probably no state in this great Union has a more propitious climate for oat growing than has our own Pine Tree Commonwealth. Moderately cool temperature, accompanied by abundant rainfall, are conditions that make good oats. These three cereals, moreover, prefer a medium clay to sandy loam soil in preference to soils rich in humus. Undoubtedly such soils which prevail in Maine are capable of producing good small grains if they are properly drained, and the crops handled in judicious rotations upon them. A clover crop should be grown and plowed under once in 3 or 4 years, on most of our fields. More cattle could be kept if more feed was grown and as a result manure could be applied to the soil in greater quantities. Drainage, crop rotation, and application of barn dressing, and a limited amount of commercial fertilizer are keys to success in general farming in Maine.

Great advancement has been made in the knowledge of grain growing since the time that Maine was famed as a cereal-producing state. As a consequence her farmers, who wish to undertake this commendable and profitable phase of farming at the present time, have not to take all the arduous steps that found place in the period between the grain-growing days of our forefathers and those of the present. Much has been learned about soil preparation and fertility maintenance. Still more has been learned about the varieties themselves. A glance at the accompanying chart (see table No. 1) will show new

Table I.—Valuable Varieties of Oats, Wheat and Barley.

Number of station tests.	Class.	Name of Variety.	Yield per acre in bushels.	Weight per bushel —pounds.	Per cent hull of oats.
3	Early 90-100 days.	Kherson	61.3	30.0	26.5
2		Early Champion	34.8	29.5	30.5
1		Daubeney	62.8	34.0	25.5
3		Silvermine	41.2	28.5	28.0
3	Late 110-120 days.	Siberian	86.9	31.5	27.5
5		Swedish select	79.4	32.7	28.0
2		Joanette	68.7	34.3	22.0
		WHEAT.			
4	Winter.	Turkey Red	33.5	54.8	Hard.
2		Dawson's Golden Chaff	33.2	57.8	Soft.
1	Spring.	Red Fife	34.9	60.0	Hard.
1		Minn. No. 163	35.3	59.9	Hard.
		BARLEY.			
3	Hulled.	Mandscheuri	59.7	50.9	
2	Hulled.	Mensury	49.1	52.1	
3	Hulless.	Guy Mayle	50.7	60.3	

named wheat, oats, and barleys which yield more grain of better quality than was generally possible in former times. Variety does count for a great deal in plant life just as breed and strain within the breed counts for so much in live stock. The tests of oats recorded in the chart, tests which were carried on by some of our leading American experiment stations, show a difference of many bushels in yield per acre. Similar differences are evident in the yields of wheats and barleys. All of these varieties of small grains have proven themselves to be of superior quality in actual tests. Any one of each type of grain is recommended for use on Maine farms. However, a more interesting test has been carried on at our own Experiment Station on its Highmoor Farm. This test has proven the Swedish Select oat to be an excellent late oat for Maine. One of the interesting studies in oats and one which means a great deal to Maine farmers is the study of the per cent of hull of the oats grown. A glance at the figures of the per cent of hull of the oats grown by the Experiment Station, those grown by the Department of Agronomy and those grown on the individual farms of many of the members of this association, will bring out the importance of such a study. On the demonstration plots of the Department of Agronomy ten plots of oats were grown, varying in hull from 22 to 40%. Almost equal differences are noted in oats grown by the members of the Seed Improvement Association. What does such a difference mean to the farmer? Farmer A grows 1000 bushels of the variety of oats which has 22% hull. Farmer B grows 1000 bushels of the variety that has 41% hull. Farmer A has as a result over 3 tons more feeding material in the shape of oat kernel than has Farmer B in his 1000 bushels. Three tons of feed are worth looking after! It is important to note that over 80% of the members of the association are growing oats that test over 30% hull. There is room for great improvement yet. Equally important differences in varieties of wheat and barley could be pointed out, but we will leave this to another occasion.

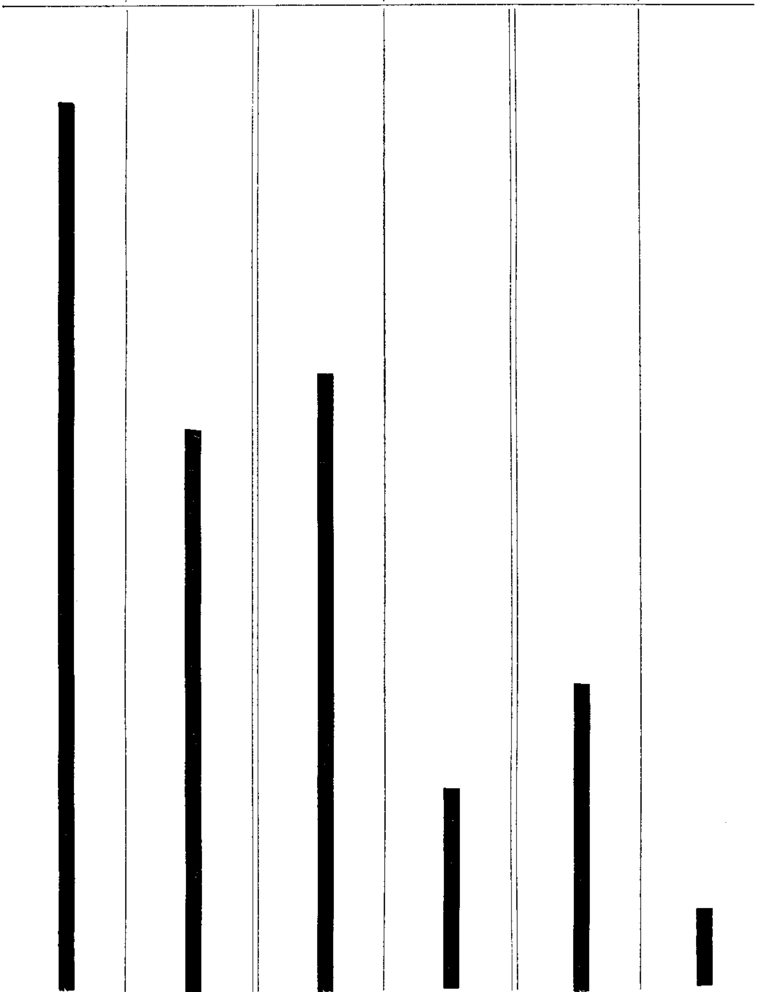
Can we raise winter wheat in Maine? We believe it is possible if the following things are done: (1) If the land is well prepared by (a) thorough drainage, (b) careful and thorough tillage; (2) if the seed is planted early in the fall or in the late summer—not later than Sept. 1 for most parts of Maine; (3) if only seed of first quality is used.

Now, why should Maine grow small grain? The 49th annual report of the Maine Central Railway records that 271,541 tons of grain—corn, oats, wheat and barley—were brought into the State for distribution in 1910. Beside this 77,405 tons of mill

Table II.—Maine's Demand and Supply of Grain.

(MILLIONS OF BUSHELS.)

OATS.		WHEAT.		CORN.	
Maine needs.	Maine grows.	Maine needs.	Maine grows.	Maine needs.	Maine grows.
7.0	4.5	5.0	.23	2.4	.6



feeds and 67,081 tons of flour were also imported by consumers in Maine. Think of it! Over $5,430,820 going out annually for grain alone! Study the accompanying chart (see table No. 2) and note the quantity of grains our farm stock and poultry consumed in 1910, and how nearly we met the demand by cereals grown on Maine farms.

Most people will be surprised to learn that if the 60,000 farmers of Maine grew 3 acres of wheat, yielding 30 bushels per acre, they would have 400,000 bushels of wheat more than the farm live stock consumed. If each farmer grew 10 acres of oats yielding 50 bushels per acre, Maine would have 20,000,000 bushels of oats to sell!

Not only must quantity be in the minds of the grain growers but quality should play a large part. Thousands of bushels of superior seed oats and feed wheat are being imported by Maine farmers from states 500 to 1000 miles west. We paid 85 cents per bushel for oats last spring to a Wisconsin farmer who had 2000 bushels of selected Swedish oats for sale. We have personal knowledge of this same farmer having sold over 1000 bushels of the same variety of oats in 1908 for 90 cents per bushel. Members of seed improvement associations of certain of our states are making good incomes by paying attention to the quality of the grain they offer for sale as seed. No trick of advertising or cunning of trade mysteries is getting them trade, but good reliable goods, honestly selected, is bringing its merited return. The opportunities for members of this association to make good returns from such work were never brighter. You have heard of the profitable seed grain production of the Swedish people. Why cannot Maine farmers do equally good, careful work?

It is our opinion that a diversified type of farming, except in such cases as where a farmer is located very near to a large city—diversified farming, practicing a good system of rotation of crops, and making a specialty of seed grain raising to a limited extent, would not only build up the fertility of our farms but would build up the pride of our farmers, and augment their finances to an extent that was not deemed possible on the farms of this State. Not only would this be possible, but inducement would be held out for the establishment of manufactories using cereals as raw material, to locate in this part of the country. We have natural power in our waterfalls, intelligent farmers on our lands, upwards of 20 millions of people within a radius of 250 miles.

Let us give more thought to raising grain of quality to supply such demands.

REPORT OF COMMITTEE ON CORN ZONES.

Your committee has met and considered the questions raised by Dr. Twitchell and has come to the conclusion that, in view of the importance of the questions involved and of the desirability in the interests of fairness of reaching as correct a distribution of zones as possible, it is necessary to take more time for the settling of this matter than can be had at the present meeting. It has seemed to the committee that the most feasible way in which to approach this matter is to have prepared a tentative division of the State into not more than three zones. In making these divisions it is believed to be absolutely necessary to take account of soil, climatic and other local conditions. In view of these circumstances it seems necessary to have the divisions something other than straight parallel lines across the State. It is proposed that this tentative plan, after having been drawn up, shall be submitted to a number of representative corn growers in different sections of the State for their suggestions; these suggestions can then be incorporated in the scheme and the final result prepared as a printed map of the State, showing the zone divisions, and a copy of this map placed in the hands of each member of the association in plenty of time for him to get his exhibits in for the next meeting of the association. At that meeting the whole question of the distribution of the zones can be discussed and any desired changes made.

It is recommended, in accordance with these suggestions, that your committee be continued with the view of carrying on these suggestions and reporting at the next meeting of the association.

OUR PART IN IMPROVING MAINE AGRICULTURE.

By C. S. STETSON, Master State Grange.

It certainly affords me pleasure, as a representative of the largest organization in our State, to come before you and say a few words, and to give you as concisely as I can my idea of the position of the Grange in regard to the agricultural development of the State of Maine. I feel that I owe you an apology in that I have not had sufficient time to prepare myself for this evening's program.

This organization of the Order of Patrons of Husbandry from its earliest inception has stood for the promotion of agriculture. Its idea has been from the beginning, and its aim and work, to educate and elevate the American farmer. Now we have a vigorous organization in Maine, consisting of about 60,000 of the people of our State. It occurs to me that in any agricultural development, in any betterment along the lines of agriculture, and perhaps civic improvement, this organization ought to be a leader. It has been said in past years, and with some degree of truth I am willing to admit, that the organization of which I have the honor of being the head at the present time, has been devoting too much of its energies to the social feature or the social end of grange work, as we call it. When I was elected Master of the State Grange, I felt that, having this great organization in our State, having the great amount of money invested in grange property, the time had come when we ought to take account of stock, as it were, when we ought to ask ourselves the question, Does it pay? It occurred to me that the time had come when we ought to make this organization a very potent factor for uplifting along all lines of agricultural endeavor in our State. The criticism that I have mentioned, that we had been devoting too much of our energies and too much of our time in the social feature of grange work, perhaps was justly made; and in visiting the subordinate and the Pomona granges in the State of Maine, in season and out of season, I have had in mind and have given the grange organizations to understand that the cultivation of the social graces and the enjoyment of the social pleasures are to be commended, but any organization composed largely of farmers, as this organization is, that devotes all of its work and all of its time and all of its energy to the cultivation of the social graces cannot long endure. We must do something that will commend our organization to thinking people. Now I believe we have in our State the largest proportion of farmers that is found in the grange of any state. One person in every eleven in Maine at the present time belongs to the grange, and the grange organization in the future must, if it endures, if it maintains its present prestige, if it attains to greater heights, demonstrate that it is to be a leader as it never has been in the past.

Mr. Chairman, it has been said that we are not doing our best in developing agriculture in the State of Maine. I believe it to be true, but by comparison we can look back twenty-five years and see that we have made great strides along the line of agricultural development. Any man who travels over Maine as I do, and who notices as he travels, may see that conditions in Maine are immeasurably better than they were twenty-five years ago, and I believe that we are just at the beginning of our possibilities so far as agriculture is concerned. And this organization, consisting of nearly 60,000 of the best people in the State of Maine, ought to be a leader along future lines of development. It has been said that the fruit industry in our State has been on the wane; it has been said that we are not producing as good fruit or as much fruit as we were ten years ago. Is this true? and if it is true, why is it true? I propose, so far as I can dominate the work, so far as I can formulate the plan of grange work in the future, that we in the capacity of granges shall find out why this is true. We have an organization, we have the grange homes, the grange halls, we have everything at our hand for promulgating this work, and so far as I am concerned and so far as I can formulate the policy of the grange in Maine, I propose that we shall be identified with every other organization in our State that is trying to promote agriculture. I care nothing for any credit which might incidentally come to myself. I believe that all petty jealousies, all rivalries, all envies, if you please, should be laid aside, and each and every organization in Maine shoud work together along a definite line toward a definite object for upbuilding agriculture in our State.

Now, Mr. Chairman, I believe that every one of us believes in Maine. Maine is great in area and it is sparsely settled, and in proportion to the area of the State we have no great wealth like many other states. I believe there is greater room for independent operations, I believe there is greater opportunity for a boy and a girl here upon a farm in the State of Maine, for future development, for getting the most of the good things in life, than there is in any other place to which I have recently been.

I believe a man should have a good word to say for his State, for his county, for the place which he calls his home. In August of 1909, and several times previous to that, I went into Aroostook county and I found that after I had crossed the border between Penobscot and Aroostook counties, I was obliged to talk about Aroostook county and about potatoes. In August, 1910, I went into Aroostook county again, and I registered a solemn vow that after I had got into the county I would not say anything about Aroostook county and potatoes, but I found that I had hardly got ten rods over the county line before I was obliged to talk about Aroostook county and potatoes. Nobody would talk to me about anything else. They even asked me how many potatoes I raised last year and the profit I made on them. I made up my mind that the people of Aroostook county would get up nights, and sit up nights, to shout for their county. That is what has given it prestige all over the State, and has spread its fame as far as the Union extends.

Mr. Chairman, and friends, I want to say to you that I have had in the past, and have now, great faith in good leadership. I have great faith in those men who have made a special study along special lines of farm work and farm endeavor, and my observation teaches me this: that it is not always safe to pin your faith to leaders or to leadership. However well trained a man may be, however much he may know about certain special lines of farm work, it is not always safe to place your faith implicitly upon what he may know, because if my observation teaches me anything it is certainly true that every man is surrounded by certain conditions which surround no other individual man, and you and I who are members of this grange organization, many of us, ought to be in our individual capacity studying the conditions by which we are surrounded and to be able to make the most of them. I believe we can do so, and the grange organization of the future is to be a leader along this line of work.

Do you know, the road problem in the State of Maine is of vital interest to every resident of our State. Seventy per cent of the transportation question in Maine begins at the farmer's front gate and it ends at the railroad station where the products of the farm are shipped away to the consumer. It is a very great problem. There is no one thing which can so promote agricultural conditions as having a better system of roads. And I say to you that I believe the way we settle the road problem in the State of Maine will have a great deal to do with the agricultural betterment of the State. It should be considered first at least, from a commercial standpoint. I doubt the propriety, I doubt the good business feature, of building boulevards for automobiles across the State. I do believe in a better system of road building, and I do believe that this grange organization should be a leader in getting legislation enacted which shall give the farmer a better road over which to haul the products of the farm to the railroad station where they are shipped to the consumer. I believe that the grange should be a leader in conserving the natural resources of the State. How many of us know or realize the graft which has been going on in appropriating through crooked legislation or in some other way the great water powers of our State for the purpose of transmitting outside the State the electrical power for manufacturing processes. We have in our water powers a 60,000 horse power possibility without storage, and more than two million horse power with storage. The grange organization ought to be and I believe will be a leader in conserving the water power of the State of Maine in the future, and thereby developing our agriculture. We believe in Maine; we believe in its possibilities; we believe that, situated as we are, just at the doors of the best markets of the world, our agricultural possibilities are just at their beginning. We believe that they may be developed almost indefinitely, and with a clear assurance that the earnings will keep pace with the development, we believe that we can eliminate those factors which do not pay and develop those which do pay, almost indefinitely. We believe in the future of our State. We want the boys and girls who are here in Maine today to remain in Maine and become the future men and women of our State. We want them to remain upon the farms and take hold of the work where you and I leave it and carry it on and on as the years go by. Farm life and home life must be made more attractive and this grange organization from its inception has stood for better education, better church privileges and for a broader and nobler type of citizenship. It must be a factor, and will be a factor in making home life more attractive to the boy and the girl.

I believe that it is possible in an educational way, for this organization, through its individual membership and the things which it can do in an indivdual capacity, to make the place that is a home in name a home indeed. When that time comes we shall have a new home in which there shall be no parlor or parlor bedroom with its system of cold storage. There will be a place where we can stay and read and stüdy and think, and entertain our congenial friends. And there will be a room where we can eat and be happy. This is all we need, but how we agonize and toil and suffer because we want more. The grange in Maine in the future is to be a leader in making just that kind of home and thereby promoting agricultural development in the good old Pine Tree State. We want the girls and boys to stay with us and if they can see the possibilities that are ahead in agriculture when rightly developed, we believe that many of them will have the inclination to do so. If it were possible I wish that I might say to them tonight that wherever they may be, under whatever conditions they may find themselves, in whatever occupation they may be engaged, whether it be upon the farm, in the shop or factory or mill, whether it be in the manufacturing industries or in the learned professions, however discouraging conditions are, it is always a laudable ambition to try to be worthy, to do something worth while. My desire in coming here tonight was simply to demonstrate that whatever may have been the conditions in the past, in the future this organization is to identify itself with and stand for those things which tend to make Maine a better place in which to live; to stand for and to be identified with all those organizations which are struggling so nobly to develop the grandest occupation that we have in the State of Maine, that of agriculture.

SATURDAY, DECEMBER 10.

FIELD WORK OF THE MAINE SEED IMPROVEMENT ASSOCIATION.

By A. S. Cook, Maine Department of Agriculture.

One of the greatest things upon which the success of the Maine Seed Improvement Association depends is the thoroughness and carefulness which is exercised in doing the field work. At the present time, we have planned a great future for this organization. We want it to mean more to the agriculture of the State, to the people of the State and to ourselves than any other association could mean. If we are to accomplish this, it is necessary to exercise the most thoughtful deliberation in building the foundation upon which we are to grow. It gives me a great feeling of satisfaction to be able to say, after studying the organization that would mean the greatest success for the farmers of America, that I believe we are started right. Now, if we are ever to realize our hopes and ambitions, it will be necessary to grow slowly. We must carefully plan our work and try to determine what the result is going to be before any steps are taken. Many other organizations of this nature have failed to do the work which they were organized to do. If by making a study of these we will be able to avoid such mistakes, it is certainly of advantage to do so. If every member will try to feel his share of the responsibility and govern his work accordingly, our association will be where we want it—at the head of all other such work.

To me, it seems that the most important factor in building up this association is the field work. Its purposes are many. It is through the field work that we are going to establish a closer relation between the farmers and the agricultural institutions that are co-operating with them. Unless there is some means of transmission by which each member can receive the benefit of work done by the other members, and of the thought put into the work by agriculturists, how can we expect to get the best results? Without question, this has been one of the greatest things which has made a success of the dairy testing associations of the State. At the monthly meetings the members discuss their successes and failures, meet and become intimately acquainted with such men as Prof. Campbell of the University of Maine, and all this is of the greatest value. Another important factor of the testing association work is the visits of the testers, who have the experience of thirty dairymen doing business under practically the same conditions, besides a knowledge of their own business.

More definite information regarding care, management and yields of all things related to farm crops must be obtained. This has been one of the most serious handicaps experienced by the agriculturists of our State; until this information is obtained, we can accomplish nothing. It is only through efficient field work that this can be obtained, and I believe you will all realize the importance of this when you have seen some of the data already collected. To gain this information which actually exists, without any extra exertion from the farmers, all that is necessary is to record it. The time required to do this is small and I am sure that every member who realizes the possibilities of the association will keep the records in detail. The benefits financially and educationally will be measured by the thoroughness of this work.

In order to comply with the purposes of the association, it is necessary for each member to be visited by a representative of the association or of one of the institutions co-operating with it.

WORK IN WISCONSIN.

During my vacation I had the opportunity of visiting the Wisconsin Experiment Association. This, as many of you know, is proving to be one of the most efficient associations of its kind in America. It was organized in 1901 and has been growing very rapidly since that time. One of the peculiarities of this association is that its membership is limited to only those men who have taken some course at the State Agricultural College. This proves to be an inducement for young men to attend the college, as the apparent benefits received from association work will be of financial value to them if they can be admitted to the association. Owing to the fact that each member of the association has taken some course of study at the State College of Agriculture, they are much more familiar with plant selection and breeding, and realize to a greater extent the value of pure seed. The greatest proposition before the Wisconsin Association at the time of its organization was one similar to that which faced the Maine Seed Improvement Association. Difficulty was experienced by the farmers of the State in obtaining high-yielding strains of corn and different grains. Great variation was found in yields; uncleaned and impure oats were used for seed, and great difficulty was experienced by the farmers in the State in obtaining varieties of corn that were high-yielding and would mature under their conditions.

There is one special feature to which I desire to call the attention of the members, and this is the work the Wisconsin Experiment Station and Wisconsin College of Agriculture have done in assisting the association. Prior to the time the association was organized, the college had done breeding work with barley for a term of four years. A superior strain was isolated and as soon as the association was organized, samples of this seed were sent to the members. The same thing will apply to their method of improving corn. It was necessary for each member of the association who obtained this pure seed to keep a record of its growth and to keep the variety pure. As a result, great things have been accomplished by the association since 1901. About two-thirds of the acreage of barley raised by members of the association is of that variety with which the Experiment Station was doing breeding work. This is yielding about 20 bushels more per acre than the common local variety.

In talking with Prof. Moore, secretary of the association and the man who organized this work, he said, "This work you have started will mean millions to your State, but you must grow slowly."

Many of the members of the Wisconsin Association are young men just starting in farming for themselves. Prof. Moore tells me that many of the members have been elected to the Legislature for the year 1911. This, you see, will strengthen the association and at present they can get almost anything they ask for from the State of Wisconsin. Prof. Moore received a letter while I was in his office from a seed company in Nebraska, ordering 15,000 bushels of barley. This barley was sold at a price about 100 per cent larger than that of the local market. You will readily see the financial benefits the members are receiving. This was not an unusual occurrence, as the same thing holds in the case of corn and other grains.

The importance of the work in Wisconsin is impressed upon one very forcibly when through a study of the work one discovers the real value this association is proving to the boys of the State. The majority of the membership is made up of young men and includes boys as young as 12 or 14 years of age. Many of these boys have entered into some kind of a business proposition with their fathers for raising seed corn or seed grains. One in particular with whom I talked while there, had cleared $900 in the year of 1909 from sweet corn selected from a field raised by his father. The Wisconsin Experiment Association furnished the seed and the boy made the selection. The seed was then sold through the association.

DETAILS OF FIELD WORK.

The importance of keeping the remainder of the seed ears after using what was required for seed, was not made plain enough last spring, and as a result only two members have these left. This corn is on exhibition in the association exhibit now, and with it, a representative exhibit from each of the ten rows. It is very interesting to note the difference in the way individual ears have reproduced themselves, both in ear conformation and yield per acre. The pedigree which we will have of this corn in a few years from now will be much more comprehensive and instructive if we have the seed ears of each year's planting. In planting their plots by hand, some of the members made the mistake of planting too deep. As a result, some plots planted at the same time as the field crops did not appear above ground until long after the field corn. This proved in many cases to be a serious handicap and it was thought by some members to be due to the quality of the corn instead of the fact that it was planted too deep.

The importance of keeping the experimental plot at a sufficient distance from other corn, to prevent it from mixing, has not been understood during the first year's work as it will be in 1911. The corn used for breeding work during the past season has not been superior to many of the strains of corn raised by members. For this reason, it was not as important to prevent mixing, but the members who make the selections from their best rows of seed for next year's work should be very careful to plant at a sufficient distance from other corn. In isolating a superior strain, it must not be allowed to mix with other field corn.

In general, the experimental work with corn during the past season has been very satisfactory. The plots, as a rule, have been conducted according to the detailed plans sent out for this work.

There is only one more matter to which I believe the attention of the members should be called. This is the filling out of the report blanks as the season progresses. I wish each member might realize the importance of keeping these report blanks in detail and also the importance of recording this information as soon as it can be obtained. When a request is received from a prospective purchaser regarding the seed the association might have for sale, the greatest recommendation that can be given any member is a neat, well kept report blank. This, in addition to a report made by the representative who has visited the members, will certainly be of great value.

RESULTS OF FIELD WORK.

Some reports have been received from the members of the association of the experimental work that has been done during the past season with corn. Each blank that is received seems to show more and more plainly the importance of this work. Much has been said and written by agricultural authorities upon the variation in yields from different strains and individual ears of corn. These facts are all supported by report blanks that have been received from members. In one case you will note that the total yield per acre on row number 1 was 127 bushels, while the yield of corn fit for seed purposes was 82 bushels.

In row No. 4 of the same experimental plot, with a total yield of 120 bushels of corn, there is none fit for seed purposes. Row No. 10 has a total yield of corn exactly the same as Row No. 1, and while No. 1 has 82 bushels of corn fit for seed purposes, No. 10 has only 7 bushels. As you will see by other report blanks, this is not an exception, and the difference in the way individual ears reproduce themselves is certainly very evident. Another very interesting thing regarding this experiment work is the relation of the germination test to the yield of corn. The ear of corn used for planting Row No. 1 germinated 100% in four days, while that of Row Nos. 9 and 10, yielding 5 and 7 bushels of corn fit for seed purposes, required seven and eight days to germinate 100%.

NEW ENGLAND CORN EXPOSITION.

Upon the invitation of the New England Corn Exposition, the Maine Seed Improvement Association made an exhibit at Worcester. This exhibit attracted a great deal of attention, as it was the only organization of farmers that exhibited on the grounds. All of the other exhibits from the different states in New England consisted of experiment station or agricultural college exhibits. These contained no material grown by farmers; nothing except that which was furnished by the institutions themselves. This being the case, it is not to be wondered at that the association's exhibit attracted a great deal of attention. Many of the men from different experiment stations and colleges who were there with exhibits, expressed a great deal of surprise when told that the Seed Improvement Association exhibit was sent in by farmers. This led to many inquiries regarding the plan of work of the association.

Another thing which is of the utmost importance to our members was the prospective purchasers who visited the booth at Worcester. It was a great surprise to me to find that so many seedsmen and farmers of the New England States are desirous and willing to pay seed prices for seed that is as represented. This impressed upon me very forcibly the importance of establishing some system whereby the association could market its product. After giving the matter considerable thought it seems to me that the success of the association depends more upon this matter than any other. I believe all orders for seed should be taken to the association headquarters, in order that a record may be had of all seed sold. This is certainly a case where the minority should have something to say. The honest members, who put material on the market that is just as it is represented, must be protected. This can only be done by enforcing the strictest discipline. The association cannot afford to have members who put inferior seed upon the market. The Wisconsin Association has had some experience on this line, and in their last annual report mention is made of complaints that have come to the organization that inferior seed has been sold. Another organization, doing similar work to this, has sent seed into our own State containing weed seeds and much foreign matter. These things can and must be avoided if the possibilities that are open to us are ever realized.

A great deal of credit is due the members of the Seed Improvement Association for the interest they have taken in the work during the past season. The way in which they have contributed to both the exhibit at the New England Corn Exposition and at the annual meeting, is certainly appreciated by the men who are so vitally interested in the success of the Seed Improvement Association. It proves that we are establishing a foundation upon which the association will grow to mean as much to the agriculture of the State of Maine as we desire it to mean.

FUTURE WORK FOR THE SEED IMPROVEMENT ASSOCIATION.

By A. P. Howes, Palmyra.

I want to say that I believe this Seed Improvement Association is the most wonderful and the most helpful organization that has been established in the State of Maine in the interests of the farmer. Dr. Merrill has opened up to us a vision, or rather he has given us ideals. He has given us certain standards which he thinks the association should live up to. One of the duties of the association is to keep the boys and girls upon the farms of Maine. It is the duty of this association to a large extent to help to do that by giving them some of the best seeds of corn and the various kinds of grain and getting them interested in the growing of these crops. I believe we should commence with our public schools. The boys who are ten or twelve years old, who are going to our common schools, should be interested through the teacher to have little plots of land and grow corn or some other crop, and watch its growth. The father should give the boy time to take care of it and let him have what he can get out of his plot of land, and so increase from year to year.

Another point I would make is that the members of the association should specialize upon one or two crops—not more than two at the outside—and breed up something that is excellent. And if we are general farmers, as I believe most of us are, not making a specialty of any one crop, we can purchase of some members of the association some of their superior strains of seed that we need to carry on our general farming. I would also make this suggestion—that the association should appear before the Legislature this winter and have the law amended so that all seeds brought into this State and all seeds grown in the State and offered for sale should be guaranteed as to vitality. We have a guaranty now as to purity and we need one regarding vitality. For instance, take the grass seed. In a great many instances 25 per cent of the grass seed that is bought from local dealers does not come. I am going to say that in some instances the proportion is greater than that. And what is true of grass seed is undoubtedly true of many other seeds. The association has not as yet taken up anything upon the line of the production of garden seeds, such as cucumbers and pole beans, but I believe there is a great opportunity in that line. We buy a little package of cucumber seeds, and pay four or five cents. There is an opportunity for the farmer to raise the seed that is necessary to make a nice little fortune out of a small piece of land, by raising cucumber seeds true to name and guaranteed as to their vitality.

Undoubtedly the association will take up sooner or later, when we have acquired seed ready for sale, the idea of having seed centers where our seeds may be all put together and there offered for sale. Probably that is not possible at the present time but it will be later, and in connection with this I am inclined to believe that the farmers should have a uniform price on the different kinds of seed.

There is one trouble with the farmers of Maine. They have always told openly what it cost them to produce their farm products. The manufacturer does not tell you how much it costs him to produce a yard of cloth. You could not find out if you wanted to. That is one thing that hampers us as farmers and keeps our prices down. The buyers know absolutely what it costs us to produce our products and they will give us only a small margin above what it costs to produce the articles upon the farm.

I have just one more point to mention, and that is in regard to beans. This matter was quite thoroughly discussed by Mr. Morse yesterday. I believe the association should adopt a type of old fashioned yellow-eyed beans. Possibly it may be advisable to take two or three strains. I believe we have three different types on exhibition here. I got a peck of what was termed old fashioned yellow-eyed beans and planted them. I took everything out so that they were all typical, had the same markings and were of uniform size. When we harvested the crop this fall I found that they had begun to run into another form, with quite a little yellow on the beans; and in addition to that, I found a lot of small white beans. I have a kind of old fashioned yellow-eyed beans that I have raised for the last ten years, and every spring I have picked out all the white beans and all the colored beans, and have got those at the present time so there are but very few white beans and some years no colored beans at all among them; and the white beans that have appeared in those of our own raising are the long kind, not the pea bean as in those that Mr. Hunton gave me. From those which Mr. Hunton sent me I had 24 rows; 16 rows were planted with sweet corn and 8 rows were planted by themselves, side by side, in the same soil, in my young orchard. On the 16 rows planted with the corn there was no rust. The beans in the eight rows planted by themselves had commenced to rust,—not enough to damage the beans but the pods had rusted. I always plant beans with my corn for two reasons: First, I am not sure of the sweet corn crop, and, secondly, I am sure of the bean crop, and they never rust. If this association can breed a variety of beans that will not rust it will be of great assistance to the farmers. I do not know whether it is possible or not, but it is something that ought to be carefully considered by the association and worked out so that the farmers through the State can have the advantage of it.

We should raise the very best seed we can and put it upon the market and stand behind it and have it backed by the Seed Improvement Association. Then we should not be ashamed of the seed and should have something worthy of the State of Maine. Her motto is "Dirigo," I lead, and let us live up to that.

JOHN PEASE—In regard to the future work of the association, my idea is that we should do a few things and do them well, and that we ought to concentrate our efforts, in a certain measure, upon the staple crops because the improvement in them will benefit the largest number of people. These should be corn, potatoes and oats, also beans and perhaps barley or some of the crops that are grown in the northern part of the State and not here. We might also take up some experimental work in the different parts of the State with some of the newer forage crops, like alfalfa and the legumes, because of their great value as fertilizers, enriching the soil by means of their nitrogen-gathering properties. We might also take up some experimental work with wheat. There was a time when we could grow wheat here in Maine. I can remember a time when all of our neighbors grew at least their own bread stuffs—that is, wheat enough to supply them for the year. And I find that there are many poultrymen who, since the price of wheat has been high, have been turning their attention to the growing of this crop for poultry. So far as I know, we have not any standard variety that would be suitable for this part of the State. It seems to me there is a chance for the association to take up a little demonstration work along that line. So we might go on and take up a number of things, but in general it seems to me that the work of the association ought to be concentrated upon staple crops because that will bring the greatest good to the greatest number.

DR. PEARL—I would like to say just a few words about some of the work that the Experiment Station is doing along lines connected with the work of this association. As you know, we have been working for some time with sweet corn. That work was taken up because of a demand from a special class, the sweet corn packers. We have also been carrying on some work with yellow corn but are not ready to say anything about that. We began this year, as many of you know, to experiment with oats. This work consists merely in a variety of testing experiments, the purpose of which is not primarily or solely to test varieties but to furnish the basis of an extended work with oats by selection, with the idea of discovering new and valuable strains which should yield higher and be adapted to our conditions. That is to say, the object of the work is precisely the same as that of the work which Mr. Cook has spoken of in connection with the Oderbrucker barley in Wisconsin. We have selected out of the variety test plots this year about 500 individual oat plants which seem to possess particular merit for one reason or another. Each one of those will be planted separately next year and an account taken of the various characteristics of the resultant plants. We shall probably find a small number that will possess some merit and will be used for carrying on further work. It is impossible to tell in this sort of work when we are going to find out anything, as I tried to bring out yesterday in talking about corn. There is no way that we know of, by which we can force the issue. I merely want to bring to the attention of the association the kind of work the Experiment Station is trying to do. One other line which is to be taken up shortly is in accordance with the suggestion of Mr. Pease, some kind of work with wheat.

L. S. MERRILL—I am glad Dr. Pearl mentioned the work of the Experiment Station, because I want to leave with the association as a last impression the fact that we have in our State now, in connection with this association work, a co-operation between the agricultural organizations and institutions, and we ought to encourage that. You have a statement made by a representative of the Director of the Experiment Station, outlining the work that they have already begun and propose to do, not only for the farmers of Maine but primarily as an aid to the work of this organization. You have had stated to you by Prof. Bell, representing the president of the University in this particular, that he had been authorized to organize some demonstration plot work and carry on check tests with the members of the association. Of course this will be of educational value to the students of the institution, but far and away beyond that will be the interest of the people of the State when they visit the institution and the educational advantages it will be to those visitors, and then the co-operative assistance extended to this association. In addition to this we have the assistance of the Department of Agriculture; and I shall always regard it as one of the greatest privileges I ever had, to present to the agricultural committee of the last Legislature, over which our friend here, Senator Howes, had the honor to preside as chairman, the needs of just such work as this. And I shall always consider it exceedingly fortunate for the agricultural interests of Maine that we had upon that committee such men as our friend here, who appreciated the need of this work and voted to support it, and instructed their chairman to present a bill to the Legislature to secure the funds. Here was one instance in which the agricultural committee of the Legislature was taking the initiative, in presenting to the Legislature measures that will be of practical importance and interest to the people. This money was placed with the Department of Agriculture, and to my mind, as I helped to shape it up at that time, and as I have seen all the way along, each one of these three—the Experiment Station, the College and the Department of Agriculture—has an exceedingly important part to play in the encouragement of this work, if it is to be successful. We want to dispossess ourselves of the idea that in the actual improvement of seed, and the improvement of the crops, we can walk entirely alone. We need the help of everybody, and we want to encourage the idea that this is a state-wide movement and we want all the agricultural forces of the State to stand behind one of the most progressive steps that has ever been taken in the State. We want to eliminate all ideas of jealousy in the work. We want to give to each one his full share of credit, and we do not want to attempt to divert from each one his own special duties, but we want to co-operate. I think Mr. Redman, who is an enthusiastic co-operator, is on the right track. He always has up two or three banners, "Co-operate." You cannot get away from that word. I think we want to keep it in mind all the time, even if it is not placed on the wall. We each have a work to do,—the members, the Station, the College and the Department.

Officers were elected as follows: President, W. G. Hunton, Readfield; vice president, John Pease, Cornish; secretary, L. S. Merrill, Orono; treasurer, C. M. White, Bowdoinham; executive committee, the president and secretary, ex-officio; A. P. Howes, Palmyra; J. H. Cook, Presque Isle; Geo. M. Twitchell, Auburn; Frank Lowell, Farmingdale; C. S. McIntire, East Waterford.

REPORT OF COMMITTEE ON RESOLUTIONS.

In view of the remarkable success of the officers of the Maine Seed Improvement Association in presenting to the public the great need of seed improvement in this State and the work already accomplished in this direction, as demonstrated by the beautiful exhibit at this session, and realizing that the future success of the work will depend largely on the aggressive policy of the association, therefore be it

Resolved, that we recommend that the executive committee present our needs to the next Legislature and use their utmost endeavors to secure an appropriation of not less than $500.00 to forward the work of the association.

Resolved, that the association favors a conference of representatives of the different agricultural organizations of the State and that the President appoint one or more delegates to attend that conference—same to meet as early in 1911 as possible.

Resolved, that the thanks of the association are extended to the City Government and Board of Trade for the interest they have taken in the work of the association, for their generous hospitality in tendering the use of the City Building, and other courtesies.

Resolved, that we hereby express our appreciation to the railroads and hotels for the special rates and privileges which they have given.

Respectfully submitted,

CHARLES S. POPE,
C. M. WHITE,
JOHN PEASE,
Committee on Resolutions.

L. S. MERRILL: I omitted to say to you, in behalf of Director Woods of the Experiment Station and in behalf of the College of Agriculture, when I was speaking of the field work that is going to be done by these institutions, that sometime during next summer we would like to have you, as an association, visit these two institutions, so that you may be there while the field work is on, and while the breeding work at the experiment farm is on. In addition to the field work, the comparative tests of varieties, there will be several hundred actual breeding plots. The present year individuals have been selected out of the demonstration work and next year from those individuals several hundred will be selected; so that if the farmers should have a Field Day they would have an opportunity to see what actual breeding work is, in comparison with growing work. At the University we shall have this plot work which will be just what you men are doing. We want you to come and see what the college is doing. A gentleman from Winthrop came over to Orono a short time ago, with a special committee, and he said to me: "Mr. Merrill, I am amazed at the work that is being done by the College of Agriculture." We are having some splendid men come into the institution at the present time. We want you to come and see what we need to carry this work on. It is a growing institution. It is growing in its possibilities to the young men. Then we want you to come and see this plot work. Here is an opportunity then for two field meetings sometime during the summer. I am sure that most of us hope that the work will go on along the lines which have been followed, and while we are to lose the services of some of the men, I am confident that they will be replaced by others who are enthusiastic and earnest and will do live, progressive work.

Voted to adjourn.

REPORT OF CATTLE COMMISSIONERS.

BALANCE SHEET OF JOHN M. DEERING, SECRETARY, STATE OF MAINE CATTLE COMMISSION.

Cash on hand Dec. 1, 1908	$ 142 97	
Received from State Treasurer, 1908 deficiency	21,823 18	
Received from State Treasurer, 1909 appropriation	50,000 00	
Received from State Treasurer, 1910 appropriation	50,000 00	
Received from the sale of hides, 1909	1,236 29	
Received from the sale of hides, 1910	1,451 37	$124,653 81

Paid out on account of 1908 deficiency	$21,810 68	
Paid State Treasurer, cash on hand Dec. 1, 1907	54 41	
Paid out 1909 appropriation, on vouchers approved by the State Auditor	50,000 00	
Paid out 1910 appropriation on vouchers approved by the State Auditor	50,000 00	
Paid out the balance of the 1908 deficiency	12 50	
Paid the State Treasurer for the sale of hides	2,687 66	$124,565 25

Cash on hand, Dec. 1, 1910	$ 88 56
Regular appropriation for the two years, expended	100,000 00
Balance of the 1908 deficiency, expended	12 50
Amount of deficiency created	45,296 77
Total amount of business for the two years	145,309 27

There have been destroyed during the two years,

Grade Cattle.	Pure Bloods.	Horses.	Sheep	Total.
2,786	146	165	5	3,102

2,786 Grade Cattle, cost	$93,057 73 or	$33 41 each
146 Pure Blood Cattle, cost	5,959 00 or	40 83 each
165 Horses, cost	4,008 00 or	24 29 each
5 Sheep, cost	20 00 or	4 00 each

Commissioners,	F. O. Beal	Services.....	3,240 00
		Expenses ..	1,328 22
	F. S. Adams,	Services.....	2,712 50
		Expenses ...	1,821 81
	J. M. Deering,	Services.....	2,795 00
		Expenses ...	1,257 09
	Veterinarians,	Services.....	19,088 28
		Expenses ...	5,003 04
	Labor for disinfecting		2,121 40
Tuberculin and all other supplies			1,778 00
Postage, stationery and printing			1,119 20
			$145,309 27

During the two years, there have been destroyed at Brighton, Mass., by the Massachusetts authorities, 143 head of cattle costing $4,803.18 or $33.59 each.

Of this number, 30 were destroyed under the old law of 1908 and cost $750.00 or $25.00 each.

The other 113 head were destroyed under the new law of 1909 and cost $4,053.18 or $36.00 each.

All of the 113 head were appraised at $50.00 each, and the salvage under the meat inspection law of Massachusetts amounted to an average of $14.00 each.

Under a similar law in Maine, the salvage on 2,789 head might reasonably be expected to return to the State at least $10 per head or $27,890, which at present has to be buried in the ground for want of a meat inspection law.

It will be noticed that more cattle have been condemned and destroyed in the last two years and more money expended, than in any previous two years' period. One part of the new law that has caused an increase in expenditures is the rise in the valuation of cattle from one-half, under the old law, to a full market value under the new law, at the time of condemnation.

Two thousand seven hundred eighty-six grade cattle under the old law would have cost only $69,650.00, whereas under the new law, the same have cost $23,407.73 more, besides an added stimulus to the business.

The increase in appraisals has caused dairymen all over the State to call upon the Commissioners to investigate their herds. The increase in compensation for condemned cattle has caused the owners to look more closely after the health of their animals and where there was a suspicion of disease the services of the Commissioners have been more freely sought for, for the purposes of investigation and this has brought the Commissioners into new sections of the State; sections where tuberculin had never been used.

This has raised the percentage of diseased cattle over what it would have been had we confined ourselves to the old law and only worked in sections where the dairymen were more acquainted with the use of tuberculin and where cattle to quite an extent had been tested for a number of years and the disease practically cleaned out.

It was shown in the last report that the city of Portland milk and cream supply had been greatly improved by the testing of the herds furnishing the same, for three consecutive years. The first test showed 6% diseased and the third test showed about 2%.

In the testing of the Turner Center Creamery herds, we give Mr. Bradford's statement as follows:

"Three hundred fifty-four of our patrons have had their herds tested, 3,185 cows in all, of which number 101 reacted under the test and were destroyed. This is about three percent., or in other words, an average of one diseased cow for every three herds of eleven cows each. A few of these herds have been tested annually for the second and some for the third time, and no diseased animals have been reported in such cases. This speaks well for the tuberculin test and for the efficiency with which it had been administered by the Cattle Commissioners and their authorized veterinarians."

This seems to us to be fairly conclusive evidence that bovine tuberculosis can be practically stamped out of our dairy herds, by faithful and persistent work.

To show how the matter stands in sections where no testing has been done, we call your attention to the town of Sanford. It has a population of about 11,000 and it requires about 550 cows to furnish its milk and cream supply. These cattle have practically all been tested within the last year. There had been but one herd tested in the town to our knowledge up to the time that the testing commenced in October, 1909, and that herd was practically all condemned. The result of the work done will show the difference in percentage of diseased animals between sections where no work has been done and sections where more or less work has been done by the Commissioners within the last few years.

In the last months of the year 1909, there were 455 head tested and 130 animals reacted, or 28½%. To replace these animals the dairymen bought new cows subject to the test, and no sales could be made without the test. In this way, 356 more cattle were tested and 80 of them reacted, or 22½%.

We do not say that all sections where no work has been done would be as bad as Sanford, but we do say that wherever disease is located, and no effort has been made to suppress it, there will be a very much larger percentage than in sections where owners of cattle have been trying for years to get rid of it.

Continuing this matter of saving to the State, it might be well to say: The labor of disinfecting the barns and tie-ups has under the law of 1909 been paid for by the State. This should be done by the owner at his expense, which would have saved $2,121.40 during the last two years.

The law regarding appraisals might appear to be too liberal in its provisions, yet in New York State, pure blood cattle are appraised at $125.00, grade cattle at $75.00, and horses at $120.00. They are paid for on the basis of clinical and post-mortem appearances. Cattle affected with localized tuberculosis are paid for at 80% of the appraisal; those with generalized tuberculosis are paid for at 50% of the appraisal.

Under such a system it is doubtful if there would be any saving in this State, as the appraised values now fall below these amounts on the average. Yet it would be well to consider whether it is right to pay full value for an animal that has been kept until it is ready to die with the disease. It has done all the harm that it is capable of doing, and the destruction of it can hardly be called "protecting the cattle industry of the State."

Again, under the old law, owners paid for the testing of sound animals in the herd, even where disease was found; but under the new law, if only one diseased animal is found, the State pays the bill for testing the whole herd. This has raised the expense to the State for veterinarians to a large degree.

Recoveries from the sale of hides have not been as large as they should have been, as there has been no provision of law for the same. It has been only through the insistence of the Commission that anything has been saved at all. Under an inspection law, larger amounts can be recovered, as the present system of freighting the animals to a rendering plant eats up nearly all the returns, and unless they are so dealt with there are no returns at all. The killing, skinning and burying on the farm practically uses up all the returns that can be secured.

An inspection law enters into the savings question so closely that it is the basis of the whole question. The expense of inspection is to be borne by the Federal Government, and they are willing to assume it.

The expense to the cities and towns affected will be small compared to the results obtained, and certainly not large in any case, and it is an open question if the disposal of the offal, in most cases, will not pay the running expenses and show a profit.

In Massachusetts, the cattle from Maine that are condemned under the tuberculin test are slaughtered under inspection and those that are fit for food passed, the carcasses sold, and the proceeds deducted from the appraised value. In York and Cumberland counties, there is a modified form of what might be called inspection; that is to say, butchers are their own inspectors and when tuberculosis is found, they notify the Cattle Commission, a post-mortem examination is made, and the carcass is condemned.

This has resulted in a cleaner meat supply. It has resulted in a reduction of tuberculous cattle, because the butcher buys with more confidence what he formerly had fear of and left on the community; a fear not always justified, as results have proved.

In the southern part of York county there has not been much testing done.

Aroostook county is another section where practically no work had been done previous to 1909. During the year 1908 several carloads of dairy cattle were shipped in there from Central Maine, and the people reading and hearing so much about what was being done in the western part of the State, became suspicious that disease was being brought into their county and made a demand upon the Commissioners to have some of these cattle tested, and the result was that out of 471 cattle tested, 71 were found to be diseased during the year 1909 or 15%, which shows that the Aroostook farmer did not commence any too soon.

There has been very little done in Knox, Lincoln, Washington and Hancock counties. The other counties have had more or less done, some more than others.

Forty-four thousand two hundred seventy-four grade cattle have been tested during the two years, and 2,786 condemned, or 6.3%. This includes those in good and bad sections.

Five thousand eight hundred forty-six pure blood animals have been tested during the two years and 146 condemned, or 2½%. This is a decrease of 2½% over the previous two years, and shows the percentage of disease in the State.

The new law requires the testing of all animals that are to be shown at the State Fairs. Also many herds containing part grades and part pure bloods have been tested for the first time, owing to the favorable aspect of the new law as regards compensation for diseased animals and the free test by the State where disease is found. The old law only required a test where the animal was to be transferred.

The law provides that the State shall pay for the testing of cattle where the evidence of disease is such as to satisfy the Commissioners that a test is necessary. Our rule is that whenever a case is found in a herd, it is necessary to test the balance of the herd; that when a herd is found badly diseased and a number condemned, it is necessary to test the herd again, within six months or thereabouts.

In the testing of herds where no disease is found, the owner must pay for the test, to the extent of $10.00, which usually pays the bill; but if the cost exceeds this amount, the State will pay the balance.

The law provides for a free test, where disease or suspicion of disease exists. Dairymen cannot afford to carry disease in their herds when the State pays a fair market valuation for the animal, pays for the test where disease is found, and pays for the disinfection and making the premises safe for sound animals.

Some may say that the Commissioners are condemning too many cattle, and it is a fact that the Commissioners sometimes feel that way themselves; but when we consider that they make no effort to locate or hunt for diseased herds; that the business is absolutely upon the application of the owners of the cattle themselves; that it takes the entire time of the Commissioners to keep up with the work; that it requires the services of 40 veterinarians to do the work of testing and disinfecting premises; and under the law the Commissioners have no way or excuse to curtail the business, it becomes evident that it is the policy of the State under the present law, backed up by public sentiment, that tuberculosis amongst our dairy herds must be eradicated as nearly as possible and that the Commissioners are not responsible for the amount of money being expended, further than the efficient manner in which the work is done and the economical conduct of the business.

There have been 50,120 cattle tested during the two years, costing the State for every expense pertaining to the business, $145,309.27.

After deducting the $2,687.66 paid to the State Treasurer for the sale of hides, the cattle tested cost the State $2.84 each, upon an average, including all expenses.

Of this $2.84 for each animal tested, the owner received $2.09

The Commissioners received for each animal tested,	.22
The veterinarians received for each animal tested,	.48
It cost for disinfecting, postage, stationery and printing,	.05
	$2.84

This would seem to imply that the veterinarian only received 48 cents on the average for testing each animal.

This would not be fair, as the owners paid for testing about	8,000
Commissioner Adams tested about	980
There were tested at Brighton about	11,200
	20,180

This leaves 29,940 which the State paid for, or at the rate of 80½ (eighty and one-half) cents each for testing.

What have the Commissioners accomplished under the law?

Six years ago the Commissioners went before the Agricultural Committee and asked that the law be amended, so that all pure blood animals coming into Maine from another state might be tested within 30 days of arrival under the direction of the Commission; also that all pure blood animals sold within the State be tested before delivery.

At this time the Commissioners were discouraged, knowing by their experience that the disease was rapidly increasing and that unless something was done to check it, what money had been appropriated would be practically thrown away. This was an experiment, and many pure blood breeders were discouraged, and some were going out of the business. They were skeptical and felt that the law would be of great loss to them; but after careful consideration, they soon began to co-operate with the Commissioners and the testing of pure blood herds began. During the first two years there were 909 head tested and 201 condemned, or over 20% found diseased.

During the same period 26 pure blood cattle were shipped into the State and found to be diseased, and were destroyed without compensation to the owner.

These cattle were bulls mostly, purchased for use at the head of grade herds throughout the State. Allowing 10 cattle to each herd, 260 head would have been exposed to the disease through these bulls.

The two following years, the percentage of disease in the pure blood herds dropped to 5% and in the last two years to 2½%.

These facts are proved by the records and this feature is worth more to the State than all of the money appropriated during the whole six years put together. What would have been the result if the State had not taken it in hand six years ago?

The Federal Government has taken the position that it is willing to test at its expense all interstate shipments of cattle (and made arrangements), and Dr. Melvin states that the Government is ready to do the work, provided the owner would pay the traveling expenses and other necessary expenses. This proposition the Commissioners have not as yet accepted, as our law will not allow of it.

In speaking of grade cattle, it is altogether a different proposition; but we do know that keeping the diseased pure blood bulls from being put at the head of sound grade herds is a strong point in the prevention of the spreading of the disease; that by testing some 10,000 dairy cows furnishing milk and cream to the Turner Center Creamery and 3,000 for the Oxford Co. Creamery; and by testing these cattle two and three years in succession, the disease has been practically cleaned out of these sections.

By testing the milk supply of Bangor, Waterville, Portland, Sanford, Oakland, Fairfield, Winslow, and Bath; also to a large extent that of Lewiston and Auburn and other sections in different parts of the State during the last two years, 6.3% were found diseased. If the same sections could be retested during the next two years, reasoning from past experiences there would not be found over 3% diseased. By liberal appropriations and by persistent work, tuberculosis can be practically eradicated from our herds in the next few years. It would be bad policy for the State, after spending so much money and getting such good results, to adopt any method that would check the business, and allow bovine tuberculosis to increase in the State.

There is a stronger sentiment for a sweeping test than there was two years ago, and there is no question but that it would be the most economical in the long run. It is strictly a public health measure.

The law requires that "Such sum as may be deemed necessary, by the Cattle Commissioners, shall be used from their appropriation for the purpose of vaccination of cattle against tuberculosis, under the rules and regulations as shall be made for the control of such work."

Our rule is, that the State will pay for the vaccine, if the owner will agree to pay the veterinarian and conform to the regulations as laid down by the agents of the Vaccine Company.

There are but half a dozen veterinarians in the State that have been doing the work and they are selected by the agent of the company and approved by the Cattle Commission. They are instructed to report to the Commissioners all unfavorable results in the use of the vaccine. During the years 1907-8 there were 50 calves so treated and during 1909-10 there were 145 calves so treated, and so far no unfavorable results have been reported. It has cost slightly under $300.00 to do the work.

The cow population of the State has been reduced during the last few years on account of the short hay crops. Dairymen have been weeding out the unprofitable ones, and while our numbers are less, the quality was never better, and we might add, never higher in price.

The high prices for dairy products make a good young cow worth from $40.00 to $85.00 and even higher.

It will be noticed by the report that the average payment for condemned cattle is $33.41, while the limit of appraisal is $50.00, and in practice every owner is inclined to think that he should be entitled to a full appraisal.

Much time has been spent by the Commissioners in person, in making appraisals, and the cold figures will speak for themselves, as to whether they have succeeded in keeping down the price and still leaving the owner in a satisfied condition of mind.

To the owner also, much credit must be given for the reasonable manner in which he has met the situation; for financially he has been a severe loser. The cost has not been entirely upon the State; it has been a hard situation for everybody; but we believe that the results justify the expenditures. No state in the Union is freer from the disease tuberculosis; no other state, save one, kills every tuberculous cow that it finds. They isolate and quarantine, sterilize the product, brand the diseased cattle, and seek by various means to get along without destroying.

We believe that it is a wrong method and that the percentage of disease increases daily under such a system.

The dairyman is entitled to the protection of the State to assist him in combatting a disease which he cannot combat alone. The consumer is entitled to the protection of the State in assisting him in securing the product of the healthy cow. The wealth and welfare of the State are increased thereby.

STATISTICS OF AGRICULTURAL SOCIETIES.

OFFICERS OF AGRICULTURAL SOCIETIES.

Name of Society.	President.	P. O. Address.	Secretary.	P. O. Address.	Treasurer.	P. O. Address.
Maine State Agricultural	B. J. Libby	Oakland	J. L. Lowell	Auburn	T. F. Callahan	Lewiston.
Eastern Maine Fair Association	F. O. Beal	Bangor	A. S. Field	Bangor	A. S. Field	Bangor.
Central Maine Fair Association	Martin F. Bartlett	Waterville	Geo. R. Fuller	Waterville	Geo. R. Fuller	Waterville.
Maine State Pomological	G. M. Twitchell	Auburn	E. L. White	Bowdoinham	E. L. Lincoln	Wayne.
Maine State Poultry and Pet Stock Association	Silas Bartlett	Lewiston	A. L. Merrill	Auburn	T. H. Sclater	Auburn.
Androscoggin County	A. M. Bumpus	Livermore Falls	W. N. Gilbert	Livermore Falls	Howard P. Berry	Livermore.
Aroostook, Northern Maine Fair Association	O. B. Griffin	Caribou, R. F. D. 5	Ernest T. McGlauflin	Presque Isle	Athill E. Irving	Presque Isle.
Cumberland County	Jos. L. Robinson	South Windham	C. H. Leighton	Cumberland Mills	F. D. Scamman	Gorham.
Cumberland Farmers' Club	Fred E. Burnell	Cumberland Ctr.	Ernest W. Winslow	Woodfords, R. F. D. 2	Willard Wilson	Cumberland Ctr.
Cumberland, New Gloucester and Danville	Manley F. Burnham	Auburn, R. F. D. 7	Charles H. Nelson	New Gloucester	George W. Haskell	New Gloucester.
Cumberland, Freeport Agricultural Society	J. A. Brewster	Freeport	Willis Snow	Freeport	S. H. Fitts	Freeport.
Cumberland, Freeport Poultry Association	V. C. Morton	Freeport	Geo. P. Coffin	Freeport	L. E. Curtis	Freeport.
Franklin County	C. F. Blanchard	Notch	C. F. Smith	Farmington	G. M. Currier	Farmington.
Franklin, North	Elbridge Dill	Phillips	Fremont Scamman	Phillips	Andrew Davenport	Phillips.
Hancock County	F. P. Merrill	Bluehill	C. S. Snowman	Bluehill	M. R. Hinckley	Bluehill.
Hancock, North	Frank E. Mace	Great Pond	Harold M. Kenniston	Amherst	J. G. Dunham	Amherst.
Hancock, Eden	A. S. Bunker	West Eden	F. A. Wood	Salisbury Cove	Ephraim Alley	Salisbury Cove.
Hancock, North Ellsworth Farmers' Club	H. F. Maddocks	Ellsworth	J. Artelle McGown	Ellsworth, R.F.D. 3	James A. McGown	Ellsworth.
Kennebec County	George A. Russell	Readfield	C. G. Freer	Readfield	C. H. Stevens	Readfield.
Kennebec, South	Edwin Bullock	Windsorville	L. H. Ford	Whitefield	J. S. Gray	Windsorville.
Knox, North	E. E. Bowes	Union	H. L. Grinnell	Union	Geo. C. Hawes	So. Union.
Lincoln County	C. E. Peaslee	Alna	Geo. W. Singer	Damariscotta	Harvey E. Winslow	Damariscotta
Lincoln, Bristol	Artell Russell	Bristol	J. Wilbur Hunter	Damariscotta	C. B. Woodward	Damariscotta
Oxford County	W. J. Wheeler	So. Paris	W. O. Frothingham	So. Paris	W. O. Frothingham	So. Paris.
Oxford, West	Wm. Gordon	Fryeburg	B. Walker McKeen	Fryeburg	Alvin W. Merrill	Fryeburg
Oxford, Androscoggin Valley	Wallace W. Rose	Canton	O. M. Richardson	Canton	W. S. Marble	Dixfield.
Oxford, North	Young A. Thurston	Andover	John F. Talbot	Andover	R. A. Grover	Andover.

Oxford, Western Maine Poultry Association	A. E. Shurtleff	South Paris	E. P. Crockett	So. Paris	D. H. Bean	So. Paris.
Penobscot, West	E. M. Atkins	Corinna	E. E. Colbath	Exeter	F. C. Barker	Exeter.
Penobscot, North	S. T. Mallett	Springfield	I. R. Averill	Prentiss	C. M. Lombard	Springfield.
Penobscot, Bangor Poultry and Pet Stock Association	W. A. Brown	Orono	L. A. Clark	Bangor, 759 Union St.	L. A. Clark	Bangor, 759 Union St.
Piscataquis County	C. W. Hayes	Foxcroft	E. C. McKechnie	Foxcroft	A. J. McNaughton	Foxcroft.
Sagadahoc County	Isaiah R. Morrell	Brunswick	John F. Buker	Bowdoinham	L. E. Smith	Brunswick.
Sagadahoc, Richmond Farmers' and Mechanics' Club	Geo. M. Curtis	Richmond	N. H. Skelton	Richmond	Wm. R. Fairclough	Richmond.
Somerset County	Ernest Hilton	Anson	Orlando Walker	Anson	E. H. Athearn	Anson.
Somerset, East	A. W. Miller	Hartland	E. A. Webber	Hartland	R. C. Hamilton	Hartland.
Somerset, Central	Clyde H. Smith	Skowhegan	S. H. Bradbury	Skowhegan	Roland T. Patten	Skowhegan.
Somerset, Embden	J. W. Morin	No. Anson, R.F.D. 1	Grant Witham	North Anson, R. F. D. 1	Geo. O. Moulton	No. Anson, R. F. D. 1.
Waldo County	John B. Darling	Belfast	Orrin J. Dickey	Belfast	Orrin J. Dickey	Belfast.
Waldo and Penobscot	F. M. Nickerson	Frankfort, R.F.D. 1	F. H. Putnam	Monroe, R. F. D. 2.	Franklin Chase	Monroe.
Waldo, Unity Park Association	W. H. Kimball	Burnham	Edwin T. Reynolds	Unity	Edwin T. Reynolds	Unity.
Washington County	Dr. T. W. Pomeroy	Pembroke	J. M. Morgan	West Pembroke	A. E. Lincoln	Dennysville.
Washington, West	A. H. Chandler	Columbia Falls	S. H. Allen	Columbia Falls	R. M. Allen	Columbia Falls.
Washington, Machias Fair Association	E. I. White	Machias	W. H. Phinney	Machias	W. H. Phinney	Machias.
York, Shapleigh and Acton	W. P. Ferguson	Springvale	Fred K. Bodwell	Acton	G. T. Crediford	Shapleigh.
York, Cornish	Wm. H. Pendexter	Cornish	Wm. R. Copp	Cornish	Edwin C. Small	Cornish.

ANALYSIS OF EXHIBITION.

NAME OF SOCIETY.	Number of horses and colts.	Number of thoroughbred bulls and bull calves.	Number of thoroughbred cows, heifers and heifer calves.	Number of grade cows, heifers and heifer calves.	Number of oxen and steers.	Number of animals for beef.	Number of cattle shown in herds.	Total number of neat stock.	Number of sheep.	Number of swine.	Number of poultry (coops).
Maine State Agricultural	128	67	236	65	322	36	-	726	260	56	446
Eastern Maine Fair Association	73	4	15	-	96	-	3	118	-	-	-
Central Maine Fair Association	89	85	254	36	146	83	175	504	167	29	1600
Maine State Poultry and Pet Stock Association	-	-	-	-	-	-	-	-	-	-	2150
Androscoggin County	85	15	45	60	78	25	24	247	20	-	100
Aroostook, Northern Maine Fair Association	136	51	117	45	8	-	65	221	66	17	485
Cumberland County	97	62	94	15	196	10	84	461	21	18	125
Cumberland Farmers' Club	13	9	23	16	38	4	16	106	-	8	110
Cumberland, New Gloucester and Danville	29	3	6	25	16	-	-	50	-	5	51
Cumberland, Freeport Agricultural Society	13	4	7	3	2	-	4	20	-	1	334
Cumberland, Freeport Poultry Association	-	-	-	-	-	-	-	-	-	-	700
Franklin County	115	43	136	114	432	34	98	857	194	6	47
Franklin, North	75	5	15	36	64	9	22	135	128	15	8
Hancock County	20	10	1	38	40	10	-	99	25	10	15
Hancock, North	11	-	-	23	2	-	-	25	-	-	7
Hancock, Eden	4	4	3	7	-	-	-	14	-	8	37
Hancock, North Ellsworth Farmers' Club	-	1	4	11	2	-	-	18	-	-	6
Kennebec County	46	14	45	28	62	7	48	204	29	41	170
Kennebec, South	-	-	-	15	96	1	-	112	4	10	16
Knox, North	38	1	6	15	76	4	9	99	25	10	29
Lincoln County	28	1	4	5	38	6	-	54	5	3	21
Lincoln, Bristol	27	-	-	14	26	-	-	40	10	-	4

20

Oxford County	113	32	86	107	102	4	36	367	86	15	211
Oxford, Riverside Park Association	-	-	-	-	-	-	-	-	-	-	-
Oxford, West	100	14	40	70	220	30	60	434	50	20	60
Oxford, Androscoggin Valley	57	21	59	48	42	6	20	196	14	6	88
Oxford, North	-	6	23	-	44	-	23	96	39	28	18
Oxford, Western Maine Poultry Association	-	-	-	-	-	-	-	-	-	-	234
Penobscot, West	72	20	63	59	14	-	48	204	47	10	41
Penobscot, North	16	-	2	-	-	-	-	2	7	-	5
Penobscot, Bangor Poultry and Pet Stock Association	-	-	-	-	-	-	-	-	-	-	180
Piscataquis County	51	12	25	36	14	-	84	171	28	11	32
Sagadahoc County	34	39	113	77	73	6	60	308	35	38	150
Sagadahoc, Richmond Farmers' and Mechanics' Club	16	3	13	18	8	2	5	49	6	1	3
Somerset County	49	4	13	51	44	26	17	155	86	10	25
Somerset, East	46	7	10	81	12	6	30	146	31	24	31
Somerset, Central	27	8	25	26	52	6	-	111	102	8	295
Somerset, Embden	8	1	10	3	2	-	12	17	-	-	-
Waldo County	38	12	23	22	48	8	28	57	54	32	87
Waldo and Penobscot	81	13	56	44	78	32	28	251	29	8	50
Waldo, Unity Park Association	85	6	14	24	60	18	28	150	30	16	33
Washington County	19	5	14	27	10	-	12	68	24	15	20
Washington, West	40	8	19	35	40	-	-	102	56	8	43
Washington, Machias Fair Association	24	7	15	13	10	-	-	45	27	31	56
York, Shapleigh and Acton	18	1	-	5	72	10	-	88	4	-	20
York, Cornish	26	11	33	28	100	10	6	188	7	15	52
	1947	609	1667	1345	2785	393	1045	7315	1716	533	8195

ANALYSIS OF AWARDS.

NAME OF SOCIETY.	Amount of premiums awarded trotting bred stallions.	Amount of premiums awarded trotting bred brood mares.	Amount of premiums awarded draft stock stallions.	Amount of premiums awarded draft stock brood mares.	Amount of premiums awarded family horses.	Amount of premiums awarded gentlemen's drivers.	Amount of premiums awarded matched carriage horses.	Amount of premiums awarded colts.	Amount of premiums awarded horses for draft.
Maine State Agricultural	$75 00	$30 00	$116 00	$38 00	-	$50 00	$35 00	$80 00	$98 00
Eastern Maine Fair Association	77 00	15 00	46 00	10 00	$14 00	18 00	-	-	40 00
Central Maine Fair Association	77 50	15 00	32 00	7 00	-	30 00	20 00	79 00	55 00
Androscoggin County	25 00	20 00	12 00	15 00	10 00	25 00	12 00	60 00	25 00
Aroostook, Northern Maine Fair Association	49 00	20 00	89 00	86 00	31 00	13 00	-	210 00	75 00
Cumberland County	45 00	20 00	27 00	15 00	5 00	25 00	-	15 00	77 00
Cumberland Farmers' Club	3 00	-	2 00	8 00	-	-	-	10 00	16 00
Portland Agricultural Association	-	-	-	2 00	-	-	-	15 00	-
Cumberland, New Gloucester and Danville	-	-	6 00	5 00	2 00	-	-	15 50	12 00
Cumberland, Freeport Agricultural Society	-	6 00	-	-	-	8 00	-	13 25	-
Franklin County	23 00	12 00	18 00	12 00	35 00	20 00	13 00	38 50	52 00
Franklin, North	3 50	2 00	-	4 50	4 00	6 00	1 50	22 60	13 00
Hancock County	10 00	6 00	5 00	-	8 00	4 00	4 00	20 00	-
Hancock, North	-	1 50	-	1 50	-	1 50	2 00	3 75	10 50
Hancock, Eden	-	-	-	-	-	-	-	9 00	-
Kennebec County	10 00	-	2 00	9 00	7 00	11 00	3 00	25 50	13 00
Kennebec, South	5 75	-	-	2 50	2 65	-	9 75	18 00	24 00
Knox, North	3 00	3 00	-	3 00	3 00	2 50	4 50	35 75	39 75
Lincoln County	3 00	5 00	-	2 00	2 00	8 00	3 00	7 75	5 00
Lincoln, Bristol	-	-	-	-		-	-	-	10 00
Oxford County	47 00	23 00	10 00	-	24 00	31 00	10 00	70 00	156 00
Oxford, West	30 00	20 00	-	-	-	-	15 00	24 50	65 50
Oxford, Androscoggin Valley	20 00	10 00	5 00	3 00	-	10 00	5 00	14 00	72 00

Oxford, North	-	3 00	-	3 00	-	-	3 00	8 00	56 00
Oxford, Western Maine Poultry Association	-	-	-	-	-	-	-	-	-
Penobscot, West	12 00	14 00	11 00	6 00	-	6 00	5 00	31 00	109 00
Penobscot, North	-	-	-	3 50	2 00	-	-	9 00	5 50
Piscataquis County	5 00	6 00	5 00	6 00	3 00	6 00	10 00	9 50	68 00
Sagadahoc County	30 00	8 00	6 00	8 00	8 00	15 00	-	15 00	84 00
Sagadahoc, Richmond Farmers' and Mechanics' Club	-	1 00	1 00	1 75	-	-	-	4 65	1 00
Somerset County	6 00	4 50	2 00	4 50	4 00	6 00	-	21 00	38 00
Somerset, East	11 50	6 00	9 00	4 50	-	9 25	2 00	19 00	102 00
Somerset, Central	10 00	5 00	5 00	-	-	8 00	3 00	14 75	60 00
Somerset, Embden	-	-	3 00	-	-	-	-	9 00	-
Waldo County	3 00	-	9 00	-	13 00	5 00	8 00	14 00	37 00
Waldo and Penobscot	26 00	11 00	32 00	15 00	10 00	12 00	8 00	35 00	91 40
Waldo, Unity Park Association	15 50	6 00	14 00	6 00	12 00	16 00	8 00	33 50	31 00
Washington County	-	9 00	5 00	4 00	-	-	-	17 00	14 00
Washington, West	29 00	-	25 00	-	-	60 00	-	91 00	40 00
Washington, Machias Fair Association	5 00	11 00	10 00	11 00	-	-	-	5 00	2 00
York, Shapleigh and Acton	-	-	-	-	3 50	3 50	6 00	-	6 00
York, Cornish	4 00	-	-	7 00	6 00	6 00	-	23 00	40 00
	$663 75	$293 00	$507 00	$303 75	$209 15	$415 75	$190 75	$1146 50	$1643 65

ANALYSIS OF AWARDS—Continued.

Name of Society.	Amount of premiums awarded thoroughbred bulls and bull calves.	Amount of premiums awarded thoroughbred cows, heifers and heifer calves.	Amount of premiums awarded grade cows, heifers and heifer calves.	Amount of premiums awarded herds.	Amount of premiums awarded working oxen and steers.	Amount of premiums awarded matched oxen and steers.	Amount of premiums awarded trained steers.	Amount of premiums awarded beef cattle.	Amount of premiums awarded town teams.	Amount of premiums awarded oxen and steers for draft.
Maine State Agricultural	$435 50	$940 00	$210 00	$265 00	$156 00	$130 00	$20 00	$176 00	$136 00	$378 00
Eastern Maine Fair Association	30 00	33 00	-	47 00	87 00	70 00	32 00	-	75 00	-
Central Maine Fair Association	413 25	585 00	104 00	305 00	142 00	59 00	13 00	213 00	98 00	236 20
Androscoggin County	30 00	40 00	50 00	10 00	35 00	40 00	10 00	20 00	75 00	75 00
Aroostook, Northern Maine Fair Association	301 00	687 00	69 00	124 00	24 00	-	-	-	-	-
Cumberland County	115 00	75 00	43 00	30 00	53 00	27 00	8 00	22 00	16 00	183 00
Cumberland Farmers' Club	13 00	39 00	28 00	15 00	9 00	14 00	-	9 00	27 00	51 00
Cumberland, New Gloucester and Danville	5 00	10 00	27 50	-	7 00	-	2 00	-	5 00	6 00
Cumberland, Freeport Agricultural Society	5 75	11 25	5 50	3 00	3 00	-	-	-	-	-
Franklin County	95 75	173 00	82 00	92 00	75 00	57 00	3 00	27 50	160 00	100 00
Franklin, North	4 15	10 00	15 40	12 00	4 25	8 90	1 50	7 25	18 60	23 00
Hancock County	25 00	3 00	30 00	-	40 00	12 00	-	5 00	-	20 00
Hancock, North	-	-	17 50	-	1 00	-	-	-	-	-
Hancock, Eden	7 75	6 75	8 25	-	-	-	-	-	-	-
Hancock, North Ellsworth Farmers' Club	5 00	14 00	21 00	-	-	-	1 00	-	-	-
Kennebec County	24 00	43 00	34 00	24 00	9 00	13 00	19 00	5 00	51 00	-
Kennebec, South	-	-	17 25	-	23 75	26 50	10 25	4 25	49 92	33 75
Knox, North	3 00	8 50	13 75	5 00	12 00	8 00	2 00	3 00	39 00	25 50
Lincoln County	2 00	3 50	4 75	-	7 00	14 00	35 00	6 50	15 00	30 00

Lincoln, Bristol	-	-	6 25	-	5 50	-	-	-	-	3 00
Oxford County	152 00	200 00	185 00	60 00	116 00	60 00	-	14 00	82 00	182 00
Oxford, West	80 00	120 00	130 00	60 00	42 00	33 50	10 00	28 00	140 00	75 00
Oxford, Androscoggin Valley	41 00	65 00	82 00	19 00	29 00	24 00	5 00	9 00	34 00	36 00
Oxford, North	18 00	64 00	12 00	15 00	18 00	6 00	4 50	-	10 00	29 00
Western Maine Poultry Association	-	-	-	-	-	-	-	-	-	-
Penobscot, West	59 50	137 50	60 00	44 00	20 00	10 00	-	-	-	-
Penobscot, North	-	-	2 00	-	-	-	-	-	-	-
Piscataquis County	29 00	44 00	24 25	35 00	14 00	-	-	-	-	-
Sagadahoc County	214 00	572 84	115 00	109 00	82 00	40 00	7 00	11 00	37 00	166 00
Sagadahoc, Richmond Farmers' and Mechanics' Club	1 35	6 70	4 35	1 00	2 20	1 40	-	60	-	2 00
Somerset County	4 00	13 00	35 00	6 00	6 00	10 00	-	16 00	28 00	43 00
Somerset, East	19 50	24 25	59 25	14 00	14 50	-	2 00	8 00	-	-
Somerset, Central	14 50	41 00	44 50	-	16 50	16 50	-	7 00	17 00	63 00
Somerset, Embden	2 00	-	-	6 00	-	2 00	-	-	-	-
Waldo County	26 00	52 00	9 00	40 00	23 00	8 00	-	13 00	30 00	20 00
Waldo and Penobscot	51 00	130 00	39 00	142 00	34 50	-	5 00	52 00	25 00	74 10
Waldo, Unity Park Association	17 00	19 75	27 25	35 00	16 50	16 50	5 50	21 75	10 00	23 00
Washington County	12 50	15 50	32 50	16 00	7 50	-	-	-	-	8 50
Washington, West	46 00	98 00	71 00	-	88 00	-	-	-	-	26 00
Washington, Machias Fair Association	21 00	50 00	13 00	-	19 00	-	-	-	-	-
York, Shapleigh and Acton	75	-	6 25	-	6 00	31 00	-	6 00	45 00	12 00
York, Cornish	53 00	139 00	75 00	12 00	138 00	67 00	-	20 00	88 00	75 00
	$2,377 25	$4,474 54	$1,813 50	$1,546 00	$1,386 20	$805 80	$195 75	$704 85	$1,311 52	$1,999 05

ANALYSIS OF AWARDS—Concluded.

NAME OF SOCIETY.	Amount of premiums awarded sheep.	Amount of premiums awarded swine.	Amount of premiums awarded poultry.	Amount of premiums awarded grain and root crops.	Amount of premiums awarded fruit and flowers.	Amount of premiums awarded bread and dairy products.	Amount of premiums awarded honey, sugar and syrups.	Amount of premiums awarded agricultural implements.	Amount of premiums awarded household manufactures and needle-work.	Amount of premiums awarded objects not named above.	Total amount of premiums and gratuities awarded.
Maine State Agricultural.... ...	$689 00	$109 00	$369 50	$110 40	$210 00	$290 99	$62 00	–	$226 00	$250 00	$5,685 39
Eastern Maine Fair Association	–	–	187 50	103 00	296 50	63 00	15 00	–	246 30	255 75	1,761 05
Central Maine Fair Association.	645 00	58 00	751 10	187 00	315 79	203 00	32 25	–	291 74	154 30	5,122 13
Maine State Pomological........	–	–	–	–	336 00	–	–	–	–	–	336 00
Maine State Poultry and Pet Stock Association..............	–	–	2,456 25	–	–	–	–	–	–	–	2,456 25
Androscoggin County.	25 00	–	80 00	85 00	75 00	45 50	20 50	–	85 00	275 00	1,280 00
Aroostook, Northern Maine Fair Association	209 00	65 00	385 75	153 75	144 60	62 75	26 50	–	282 25	527 75	3,635 35
Cumberland County............	21 00	15 00	209 50	22 50	34 75	36 00	15 00	–	79 75	106 00	1,340 50
Cumberland Farmers' Club......	–	5 00	92 00	51 00	29 25	10 75		–	38 00	–	470 00
Portland Agricultural Association	–	–	–	–	3 00	–	–	–	14 50	75	35 25
Cumberland, New Gloucester and Danville.................	–	8 00	22 25	14 05	26 15	13 50	5 50	–	25 30	25 00	242 75
Cumberland. Freeport Agricultural Society..................	–	1 00	76 75	38 05	8 20	6 20	1 00	–	28 25	18 00	233 20
Cumberland, Freeport Poultry Association	–	–	460 75	–	–	–	–	–	–	18 50	479 25
Franklin County.................	126 25	8 50	35 50	65 00	36 45	53 25	–	$25 00	70 50	83 65	1,592 85
Franklin, North.................	40 00	2 00	3 55	12 55	8 05	4 15	5 90	–	16 20	12 15	266 70
Hancock County................	15 00	7 00	10 00	107 00	25 00	12 00	5 00	–	35 50	–	408 50
Hancock, North.................	–		3 25	15 85	19 90	50	–	–	22 38	–	101 13
Hancock, Eden.................	–	3 00	17 25	110 95	18 25	–	2 40	–	12 65	–	196 25
Hancock, North Ellsworth Farmers' Club.......................	–	–	6 00	48 05	35 00	–	3 00	–	26 95	–	160 00

Kennebec County	13 50	8 00	109 00	27 60	68 55	4 25	-	-	33 35	65 00	631 75
Kennebec, South	1 00	1 00	8 40	8 60	11 75	4 50	1 75	-	25 65	26 00	316 97
Knox, North	14 50	6 50	14 00	15 00	29 55	9 00	7 25	-	40 50	27 76	378 31
Lincoln County	2 50	4 25	11 80	20 75	27 25	4 00	1 25	-	11 55	30 00	266 85
Lincoln, Bristol	5 00	-	4 00	19 30	8 25	3 00	-	-	17 40	10 00	91 70
Oxford County	75 00	41 00	168 00	82 75	359 00	35 20	18 25	6 00	119 40	367 00	2,693 60
Oxford, West	30 00	12 50	12 00	24 75	17 80	15 20	15 25	-	15 45	173 80	1,190 25
Oxford, Androscoggin Valley	12 00	11 00	55 50	35 45	16 50	6 50	6 50	3 00	40 15	45 20	714 80
Oxford, North	16 00	14 00	10 15	25 00	10 15	6 00	6 25	5 00	45 30	20 36	407 71
Oxford, Western Maine Poultry Association	-	-	205 25	-	-	-	-	-	-	-	205 25
Penobscot, West	18 00	8 00	33 75	39 20	57 80	17 85	9 90	-	105 85	37 92	853 27
Penobscot, North	3 00	-	3 50	25 00	108 00	7 50	5 50	-	121 00	-	295 50
Penobscot, Bangor Poultry and Pet Stock Association	-	-	161 75	-	-	-	-	-	-	-	161 75
Piscataquis County	13 50	6 00	10 75	9 00	11 00	5 75	-	-	18 00	30 00	368 75
Sagadahoc County	35 00	36 00	124 00	128 00	165 00	88 00	10 00	-	85 00	240 16	2,439 00
Sagadahoc, Richmond Farmers' and Mechanics' Club	75	40	1 00	19 00	9 35	3 05	30	-	13 90	4 75	81 50
Somerset County	37 00	75	18 75	-	2 95	2 30	50	-	8 80	14 64	332 69
Somerset, East	19 25	14 75	17 50	10 75	11 25	5 40	1 00	-	13 50	45 15	443 30
Somerset, Central	96 50	4 00	123 30	30 35	30 25	25 00	1 50	-	17 50	-	654 15
Somerset, Embden	-	-	-	10 00	-	-	-	-	-	-	32 00
Waldo County	34 00	34 00	71 95	46 25	15 50	5 00	-	-	74 70	-	591 40
Waldo and Penobscot	59 00	45 00	27 00	55 75	49 00	32 00	-	-	149 50	-	1,210 25
Waldo, Unity Park Association	21 00	6 00	22 00	32 00	13 50	10 50	3 25	6 00	36 80	60 25	545 55
Washington County	17 00	5 00	17 25	14 75	14 00	15 50	8 40	-	16 30	36 45	286 15
Washington, West	76 00	39 00	39 00	194 75	63 15	13 75	29 65	-	298 20	10 75	1,338 25
Washington, Machias Fair Association	22 00	14 00	59 15	81 05	35 90	21 65	-	2 00	62 80	5 00	450 55
York, Shapleigh and Acton	3 25	-	11 50	70 50	51 25	7 50	10 00	-	50 00	93 00	423 00
York, Cornish	4 00	16 00	103 00	16 00	35 90	8 25	15 00	-	41 40	-	992 55
	$2,399 00	$608 65	$6,610 15	$2,165 70	$2,844 49	$1,158 24	$345 55	$47 00	$2,963 27	$3,070 04	$44,199 35

FINANCES.

Name of Society.	Amount received from State.	Receipts for membership.	Receipts from loans.	Receipts from entry fees for trotting purses.	Receipts from all other sources.	Total receipts.
Maine State Agricultural	$2,448 10	$100 00	–	$1,934 00	$15,266 16	$19,748 26
Eastern Maine Fair Association	–	–	–	–	–	–
Central Maine Fair Association	2,500 00	20 00	–	1,563 00	14,775 35	18,858 35
Maine State Pomological	1,000 00	55 00	–	–	188 00	1,243 00
Maine State Poultry and Pet Stock Association	1,068 78	103 00	–	–	1,346 00	2,517 78
Androscoggin County	508 69	50 00	$200 00	285 00	1,821 20	2,864 89
Aroostook, Northern Maine Fair Association	1,193 09	42 00	–	735 00	9,915 80	11,885 89
Cumberland County	581 46	–	–	255 00	5,053 76	5,890 22
Cumberland Farmers' Club	201 75	66 00	–	163 75	1,366 66	1,798 16
Portland Agricultural Association	–	790 00	–	250 00	1,171 71	2,211 71
Cumberland, New Gloucester and Danville	109 14	–	–	115 00	633 66	857 80
Cumberland, Freeport Agricultural Society	115 94	2 00	175 00	43 75	577 95	914 64
Cumberland, Freeport Poultry Association	159 21	22 50	–	287 50	202 39	671 60
Franklin County	1,262 37	743 00	–	740 00	3,138 63	5,884 00
Franklin, North	210 46	267 00	–	78 75	1,143 71	1,699 92
Hancock County	158 48	–	–	68 50	1,955 61	2,182 59
Hancock, North	49 94	4 00	–	–	411 45	465 39
Hancock, Eden	47 73	38 00	–	–	1,141 50	1,227 23
Hancock, North Ellsworth Farmers' Club	66 84	6 00	–	–	439 98	512 82

Kennebec County	423 26	11 00	500 00	-	1,080 05	2,014 31
Kennebec, South	147 76	-	-	117 50	829 41	1,094 67
Knox, North	175 93	2 00	-	-	1,946 89	2,124 82
Lincoln County	122 16	11 00	-	116 75	1,502 34	1,752 25
Lincoln, Bristol	24 49	2 25	-	-	235 75	262 49
Oxford County	1,046 17	30 00	-	737 50	6,390 89	8,204 56
Oxford, Riverside Park Association	-	-	-	-	-	-
Oxford, West	495 97	-	-	127 50	2,973 65	3,597 12
Oxford, Androscoggin Valley	294 49	6 00	-	420 00	1,499 00	2,219 49
Oxford, North	99 73	-	-	-	476 80	576 53
Oxford, Western Maine Poultry Association	-	62 00	-	-	205 54	267 54
Penobscot, West	270 85	42 00	-	320 00	2,089 50	2,722 35
Penobscot, North	90 78	3 00	-	-	475 00	568 78
Penobscot, Bangor Poultry and Pet Stock Association	51 48	59 00	-	-	308 00	418 48
Sagadahoc County	1,151 94	590 00	600 00	960 00	6,336 85	9,638 79
Sagadahoc, Richmond Farmers' and Mechanics' Club	25 34	50	-	-	115 00	140 84
Somerset County	142 97	52 50	140 00	97 50	323 03	756 00
Somerset, East	167 36	126 00	-	540 00	1,418 59	2.251 95
Somerset, Central	497 28	110 00	-	-	3,274 21	3,881 49
Somerset, Embden	21 52	-	34 50	-	15 87	71 89
Waldo County	307 09	184 85	200 00	425 00	2,666 11	3,783 05
Waldo and Penobscot	503 85	-	1,001 50	58 50	2,229 74	3,793 59
Waldo, Unity Park Association	191 92	-	-	87 50	850 00	1,129 42
Washington County	118 79	12 00	-	105 50	1,436 70	1,672 99
Washington, West	564 73	-	1,572 00	302 50	3,051 45	5,490 68
Washington, Machias Fair Association	183 67	-	367 39	210 00	1,680 41	2,441 47
York, Shapleigh and Acton	169 96	196 00	60 00	-	69 97	495 93
York, Cornish	366 28	-	50 00	360 00	2,616 70	3,392 98
	$19,337 75	$3,808 60	$4,900 39	$11,505 00	$106,646 97	$146,198 71

FINANCES—Concluded.

Name of Society.	Amount expended in improvements.	Amount expended in trotting purses.	Expenses during the fair.	Amount expended for all other purposes.	Total amount paid out including premiums and gratuities.	Value of property belonging to the society.	Amount of liabilities.
Maine State Agricultural	$500 00	$4,200 00	$1,850 25	$7,512 62	$19,748 26	$65,000 00	$18,200 00
Central Maine Fair Association	1,310 31	3,675 00	9,197 83	1,118 80	20,424 07	350 00	5,500 00
Maine State Poultry and Pet Stock Association	–	–	601 00	357 80	3,415 05	1,690 00	–
Androscoggin County	350 00	850 00	350 00	625 00	3,455 00	2,000 00	800 00
Aroostook, Northern Maine Fair Association	1,300 00	1,808 50	3,903 96	1,250 00	11,897 81	25,000 00	3,000 00
Cumberland County	287 27	1,115 00	2,311 69	–	5,054 46	7,500 00	2,475 00
Cumberland Farmers' Club	150 00	427 50	231 69	11 81	1,291 00	3,000 00	–
Portland Agricultural Association	2,200 00	800 00	300 00	–	3,335 25	5,000 00	–
Cumberland, New Gloucester and Danville	57 70	370 00	115 55	73 35	859 35	2,500 00	100 00
Cumberland, Freeport Agricultural Society	40 00	500 00	80 80	139 45	993 45	2,000 00	1,133 00
Cumberland, Freeport Poultry Association	15 00	–	165 70	87 09	747 04	300 00	–
Franklin County	1,000 00	1,850 00	823 62	–	5,266 47	11,000 00	–
Franklin, North	150 00	348 75	270 66	541 86	1,577 97	2,500 00	2,350 00
Hancock County	175 00	623 75	1,113 71	–	2,320 96	5,000 00	–
Hancock, North	30 00	–	434 25	–	565 38	200 00	99 99
Hancock, Eden	200 00	194 25	300 00	336 73	1,227 23	2,200 00	1,350 00
Hancock, North Ellsworth Farmers' Club	200 00	87 00	127 42	–	574 42	1,000 00	300 00
Kennebec County	150 00	540 00	174 56	–	1,496 31	1,500 00	1,555 00
Kennebec, South	75 00	392 50	217 05	230 43	1,231 95	500 00	700 00
Knox North	65 00	465 00	918 08	162 42	1,988 81	1,500 00	300 00
Lincoln County	–	389 25	363 78	546 63	1,566 51	–	487 00

Lincoln, Bristol	7 75	–	63 86	32 68	195 99	1,000 00	–
Oxford County	2,518 42	1,680 00	1,652 40	903 83	9,448 25	14,000 00	–
Oxford, West	258 86	975 00	812 99	35 00	3,272 10	12,000 00	1,200 00
Oxford, Androscoggin Valley	795 00	580 00	120 25	578 95	2,789 00	5,000 00	2,200 00
Oxford, North	300 00	–	75 00	30 00	812 71	1,500 00	200 00
Oxford, Western Maine Poultry Association	140 60	–	61 15	22 25	429 25	200 00	25 00
Penobscot, West	251 75	850 00	525 80	248 10	2,728 92	4,800 00	5,300 00
Penobscot, North	150 00	–	90 00	50 00	585 50	550 00	–
Penobscot, Bangor Poultry and Pet Stock Association	10 00	–	100 00	170 64	442 39	25 00	23 91
Piscataquis County	300 00	575 00	–	–	1,243 75	2,500 00	1,700 00
Sagadahoc County	800 00	1,900 00	1,256 95	4,066 46	10,462 41	8,000 00	103 16
Sagadahoc, Richmond Farmers' and Mechanics' Club	–	–	69 07	–	150 57	–	–
Somerset County	35 00	194 75	83 30	250 26	896 00	1,500 00	440 00
Somerset, East	231 99	1,350 00	264 19	370 99	2,660 47	2,500 00	1,020 65
Somerset, Central	100 00	1,020 00	100 00	2,007 34	3,881 49	4,000 00	2,210 43
Somerset, Embden	–	–	5 50	34 00	71 50	–	4 50
Waldo County	375 50	1,250 00	1,000 00	566 15	3,783 05	6,000 00	200 00
Waldo and Penobscot	281 61	766 00	552 32	940 34	3,750 52	10,000 00	1,651 50
Waldo, Unity Park Association	100 00	554 00	215 00	–	1,414 55	–	285 13
Washington County	51 75	329 50	230 40	741 95	1,639 75	–	8 75
Washington, West	375 00	650 00	1,432 75	1.634 98	5,430 98	1,961 00	2,156 15
Washington, Machias Fair Association	–	788 00	1,202 92	–	2,441 47	–	367 39
York, Shapleigh and Acton	–	–	26 00	15 35	464 35	2,000 00	–
York, Cornish	29 95	870 00	604 00	655 22	3,151 72	4,000 00	–
	$15,368 46	$32,968 75	$34,395 45	$26,348 48	$151,183 44	$221,276 00	$57,446 56

PUBLICATIONS

OF THE

Maine Agricultural Experiment Station

IN

1910

There are given on the second following page a list of the chief publications of the Maine Agricultural Experiment Station issued in 1910. Two of these, Miscellaneous Publication 383, Apple Insects of Maine, and Bulletin 185, Maine Apple Diseases, are here reprinted in combined form. A number of the other publications would have been included had space permitted.

BULLETINS PUBLISHED IN 1910.

No. 176. The Ligaments of the Oviduct of the Domestic Fowl.
No. 177. Insect Notes for 1909.
No. 178. An Endomyces from Apple.
No. 179. Poultry Notes.
No. 180. The Fungus Gnats of North America. Part II.
No. 181. Gall Aphids of the Elm.
No. 182. Four Rare Aphid Genera from Maine.
No. 183. Experiments in Breeding Sweet Corn.
No. 184. Digestion Experiments with Poultry.
No. 185. Maine Apple Diseases.
No. 186. Meteorology, Finances, Index.

OFFICIAL INSPECTIONS PUBLISHED IN 1910.

No. 19. Fertilizer Inspection.
No. 20. Feeding Stuff Inspection.
No. 21. Short Weight of Creamery Butter, Cider Vinegar, Pork Sausage.
No. 22. Ice Cream, Soda Water, Pork Sausage, Lard, Currants and Raisins, Pickles, Canned Fruits.
No. 23. Feeding Stuff Inspection.
No. 24. Currants and Raisins, Prepared Mustard, Cream of Tartar, Canned Vegetables, Salt, Condensed and Evaporated Milk, Oysters, Dirt and Flies.
No. 25. Food and Drug Regulations. Shellfish, Cold Storage and Preserved Eggs, Compressed Yeast, Dressed Poultry.
No. 26. Headache Remedies.
No. 27. Soda Water, Ice Cream.
No. 28. Seed Inspection.

MISCELLANEOUS PUBLICATIONS.

The more important Miscellaneous Publications issued by the Station during the year are:

No. 337. Home-mixed Fertilizers.
No. 383. Apple Tree Insects of Maine.
No. 395. Exercises at the Twenty-fifth Anniversary of the Establishment of the Station.

APPLE TREE ENEMIES OF MAINE.

O. A. Johannsen, W. J. Morse,
Edith M. Patch, C. E. Lewis.

APPLE TREE INSECTS.

Before it is possible to combat an insect pest intelligently we must learn something of its habits and of its vulnerable points. When these are known proper remedial measures may then be taken for its extermination or repression. To meet the needs of those who wish to learn something of the commoner injurious insects which affect the apple tree and its fruit this circular has been prepared. It is a compilation largely from the Entomological bulletins and circulars of the Maine Agricultural Experiment Station. We desire to acknowledge the use also of publications of the United States Department of Agriculture and of other sources.

There are very many different species of insects ranging in size from less than 1-50 of an inch to about 8 inches in length. From the United States alone over 30,000 species have been recorded of which over 400 are known to affect in greater or less degree the apple tree or its fruit. Though there are many that are, it must not be supposed that all insects are injurious for by far the larger number are either harmless or actually beneficial. Ruthless destruction of insects by means of trap lanterns and the like is to be deprecated since these methods are as apt to capture the beneficial and the harmless as the injurious. Poisons, traps, and other repressive measures must be used with caution, and at the right time and place in order to be most effective.

Though technical terms will be avoided in this circular when possible, it may not be out of place here to explain the few which it will be necessary to use in the descriptive matter which is to follow.

Though differing in many particulars all insects possess a segmented body which in the adult stage is arranged in three regions, head, thorax or midbody, and abdomen or hind body. The thorax in the adult is provided with 3 pairs of legs and may be either winged or wingless.

Some insects (e. g., grasshoppers) after emerging from the egg gradually increase in size until they reach maturity but without undergoing any abrupt change in external appearance except in the acquisition of wings. Others, however, pass through 4 distinct stages, viz., egg, larva (caterpillar, or grub or maggot), chrysalis or pupa (often enclosed in a cocoon) and the imago or mature insect. After the insect has acquired wings it is mature and no longer increases in size. Thus a small beetle is not the young of a larger one, nor is a small fly the early stage of one of greater magnitude.

Insects are divided into a number of natural groups or orders by which they are known in technical literature and not infrequently in popular accounts also. The *Orthoptera* are four winged; the first pair are thickened and partly overlap when at rest; the second pair are thinner and are folded in plaits like a fan. The mouth parts are formed for biting. To this order belong the cockroaches, crickets and grasshoppers. The *Neuropteroids* include the dragon flies (popularly known as darning needles), May flies, stone flies and the like. The only insects which are rightly called "bugs" are the *Hemiptera,* creatures of various shapes, having jointed beaks adapted for piercing and sucking. Plant lice (figs. 31, 32), scale insects (figs. 3, 4), bed bugs, plant bugs (fig. 28), etc., belong to this order. The butterflies and moths, scaly winged insects, are classed as *Lepidoptera.* These are harmless to vegetation in the adult stage, but many species in the larval (caterpillar) stage, then provided with biting mouth parts, are among our most destructive pests. The codling (fig. 40), gypsy, brown-tail and other moths are well known examples. The *Diptera* to which the mosquito, apple maggot (fig. 24), and house or typhoid fly belong, are two-winged when mature. The larva of the mosquito, so common in a rain water barrel, is known as a wriggler, while the corresponding form of the fly is known as a maggot. The plum curculio (figs. 25-27), the apple tree borer (figs. 1, 2), the blundering June beetle, and the potato beetle are members of the *Coleoptera,* insects having hard, shell-like fore wings which meet in a longitudinal line along the middle of the back. Both the larvæ (known as grubs) and the adults have biting mouth parts and in some species are equally concerned in the destruction of plants. Some lady beetles on the other hand are beneficial because they feed on small injurious insects such as scales and aphids. Ants, bees, wasps, a host of species of minute 4-winged parasitic flies, as well as some injurious saw-flies are members of the order *Hymenoptera,* the adults of which are four-winged. The larvæ, most of which are known as grubs or maggots, usually have well developed heads with biting mouth parts and frequently provided with legs.

While the foregoing classification is adopted in most text books, it is more convenient in dealing with the species of the apple to arrange them in accordance with the character of the injury they cause and to this end we will first divide them into 3 primary groups.

A. Injuring root, trunk or branch; borers and sap feeders. Page 323.

AA. Injuring the foliage; biting or sucking insects. Page 333.

AAA. Injuring the fruit; maggots, caterpillars, bugs and beetles. Page 366.

A. INJURING ROOT, TRUNK, OR BRANCH.

a. *Borers in the wood.*

1. A large white grub about 1 inch long when grown, with brown head; thorax not much thicker than the abdomen. Bores mainly at the base of the trunk. Its presence is indicated by the wood dust it throws out of its burrow. (fig. 1). *Round-headed borers.* Page 324.
2. A whitish grub about ½ inch long when grown, with flattened thorax about twice as wide as the abdomen. Works on the trunk and large branches. (fig. 2.) *Flat-headed borers.* Page 326.
3. A very small larva which lives in small rounded "shot holes" about 1-16 inch in diameter. Adults are small brown beetles. *Shot-borer beetle.* Page 328.

b. *Scale insects and plant lice.*

1. Scale about 1-10 inch long on twigs; shaped like oyster-shell. (fig. 3). *Oyster-shell scale.* Page 329.
2. A small rounded scale. (fig. 4). *San Jose scale.* Page 330.
3. Plant lice with white downy secretion; cause wart-like swellings on roots, and also are found on the twigs. (figs. 34-35). *Wooly aphis.* Page 332.

a. BORERS IN THE WOOD.

1. ROUND-HEADED APPLE-TREE BORER.

(*Saperda candida* Fab.)

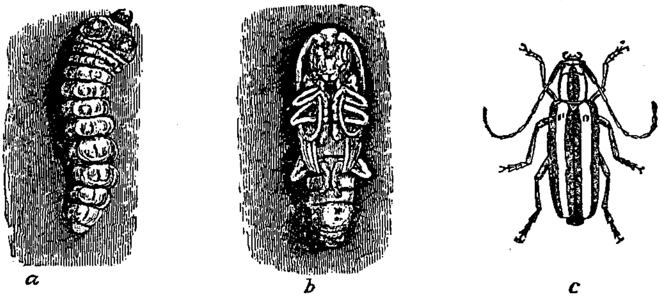


Fig. 1; a, larva; b, pupa; c, adult. (After Riley).

The first intimation that the grower may have of the presence of this borer in his trees, unless he be forewarned, is in their retarded growth and the sawdust-like castings, consisting of excrementitious matter and gnawings of woody fiber, which the larvæ extrude from the openings into their burrows. This manifestation is usually accompanied by more or less evident discoloration of the bark and, in early spring particularly, by slight exudation of sap.

The parent of this borer is a beautiful beetle, measuring from three-fourths to nearly an inch in length, the male being perceptibly narrower than the female. The legs are gray, the under surface of the body and the head are silvery white, and the upper surface is light yellowish brown with two longitudinal white stripes extending through the thorax and elytra or wing-covers to the tip, as is shown in the accompanying figure 1, *c.*

The larva, when mature, measures from three-fourths to a little over an inch in length. It is legless, fleshy, and somewhat grub-like in appearance, cylindrical in form, and light yellow in color. The head is darker.

The pupa, illustrated at *b,* is nearly as long as the adult insect, which it resembles in a superficial manner, the head being bent down toward the breast, and the legs and long antennæ folded upon the ventral surface. Its color is similar to that of the larva.

The beetles make their first appearance of the season late in May or in June, according to locality. During the night they come forth from the trunks of the trees in which they have bred, and at this time may be seen in flight.

Soon after their first appearance the sexes mate and eggs are deposited. The female first makes an incision in the bark—probably by means of her mandibles—causing it to split slightly; then, turning head upward, she places an egg under the bark nearly a quarter of an inch from the incision, accompanying the deposition by the extrusion of "a gummy fluid which covers and secures it to its place and usually fills up the aperture. In young trees with tender bark the egg is usually thoroughly hidden, while in older trees it is sometimes so shallowly imbedded as to be readily seen."

The larvæ, soon after hatching, tunnel under the bark and feed on the sap-wood, gradually working their way upward and afterwards downward, usually remaining within a short distance of, or below the surface of, the ground, particularly in young trees. By the end of the second year the larvæ have increased considerably in size and have now penetrated deeper into the solid heart-wood, their burrows being closely packed behind them with castings. The third year the larvæ gnaw outward to the bark, form a pupal cell composed partly of their castings and, with their heads pointing toward the bark, transform to pupæ. With the approach of May and June they cut their way out by means of their powerful mandibles and issue through a round hole as mature beetles.

METHODS OF CONTROL.

After borers have once entered a tree there is no better remedy known than to cut them out with a knife or other sharp instrument. Cutting the borers out, unless practiced with the greatest care, is apt to result in injury, and it is far better to prevent the parent insects from depositing their eggs upon the tree. This is not difficult of accomplishment, as oviposition is practically confined to two months in any single locality, usually June and July. The best preventives are impenetrable substances placed about the trunk and various washes of a repellent nature.

For this a few thicknesses of newspaper wrapped rather loosely about the trunk and extending about two feet from the base are all that is necessary. This covering should be tied, by preference with cord, which will readily yield or break with the natural expansion of the tree in its growth, and also be tightly fastened at top and bottom and hilled up with earth so that the beetles cannot obtain access to the tree from below. From the top of this covering upward it is best to use some deterrent alkaline or carbolated wash.

Any one of several washes in general use against boring insects may be used as a deterrent. A good alkaline wash is prepared of soft soap reduced to the consistency of thick paint by the addition of caustic potash or washing soda in solution. A good fish-oil, or whale-oil soap, or common soft soap, is often used, and in some cases any one of these is sufficient to deter the insects from depositing their eggs. The alkaline wash may be carbolated, if desired, by the addition of crude carbolic acid, at the rate of 1 pint to every 10 gallons of the wash. Such a wash not only affords protection against this and other borers, but against scale and fungous diseases at these points, and is, moreover, of positive benefit to the tree. Caustic potash fish-oil soaps are among the best for insecticides.

2. Flat-Headed Apple-Tree Borer.

(*Chrysobothris femorata* Fab.)

Fig. 2; a, larva; b, pupa; c, adult. (After Riley.)

The adult insect (represented at *c*, fig. 2), measures from a little less to a little more than a half inch in length. It is flattened above, the upper surface of the body is a dark metallic brown, and fresh specimens are coated here and there with a powdery gray substance, which is easily rubbed off. The wing-covers are ornamented as shown in the illustration, and underneath, as may be seen when the insect is in flight, the body is a bright metallic greenish blue. The under surface is coppery bronze.

The larva differs greatly from that of the round-headed borer. Its name, flat-headed borer, is derived from the peculiar flat expansion of the second thoracic segment—which is close to the head. In color it is light yellow and in length measures nearly twice that of the mature insect. It habitually rests in a curved position (fig. 2, *a*). The pupa (*b*) shows the form of the future beetle and is of the same yellow color as the larva.

This borer attacks diseased or dying trees by preference, inhabits all parts of a tree from the base of the trunk to the limbs, and is not restricted to fruit trees. In all these respects it differs from the round-headed borer, but agrees with the latter in that it is injurious chiefly to young trees, its injuries being practically confined to newly transplanted nursery stock and to trees which have been weakened through any cause, such as careless pruning, or insufficient nourishment due to poor soil or drought. Infestation may be detected by the discoloration of the bark.

REMEDIES.

The remedies advised for the round-headed borer are also of value and are generally employed against the present species. It is necessary, however, that deterrent coverings and washes should be applied farther up the trunk and to as many branches as can be conveniently reached.

Careful cultural methods.—Careful, clean methods of orchard management are essential as a measure of protection, and involve the cutting out of dead, dying, and injured deciduous forest and shade as well as orchard trees known to be chosen as food by this species. Care should be exercised in transplanting, and especially in pruning; and fertilizers should be used in order that the trees may be thrifty and better able to withstand attack. Proper regard for these measures should give practical exemption from injury.

3. SHOT-BORER.

(*Xyleborus dispar.*)

The female beetles bore into the wood, making deep channels which in small twigs interfere with the circulation of the sap, and the twigs wither, giving the appearance of blight. The exit holes through the bark are .06 of an inch in diameter and nearly circular, looking like small shot holes. The wood is green, showing that the insect attacks the growing tree. Living wood does not appear to be essential to the life and comfort of this species, for after a period of several weeks we found in a limb that had been in a dry place in a box, young larvæ, full grown pupæ, and perfect beetles.

When the larvæ are full grown they transform to pupæ in the burrows, and finally emerge as small beetles about one-tenth of an inch long and of a dark brown or nearly black color, with the antennæ and legs of a rusty red. The thorax is short, very convex, rounded and roughened. The wing covers are marked by longitudinal rows of punctures. The hind part of the body slopes abruptly. The beetles leave their burrows in June and July and deposit eggs before August.

REMEDIES.

As the beetles work wholly under the bark they cannot be reached by insecticides. The only way is to watch the trees during the latter part of June and July and, if blighted twigs or diseased limbs are noticed, examine the branches for small pin holes; if found, the presence of this or some related species may be suspected. The diseased limb should at once be cut far enough below the injury to include all the burrows, and burned, to prevent the beetles emerging and attacking new trees. As these beetles live in forest trees, orchards near timber are more liable to become infested.

b. SCALE INSECTS AND PLANT-LICE.

1. Oyster-Shell Scale.

(*Lepidosaphes ulmi.*)

This scale, which resembles an elongate oyster shell in shape (fig. 3, *b*) has long been known in this country, though believed to be a native of Europe. It is widely distributed and is exceedingly abundant in Maine. Besides seriously injuring apple trees, the twigs of which often densely covered by them, they are found on the pear, plum, currant, dogwood, elm, maple and a number of other trees and shrubs.

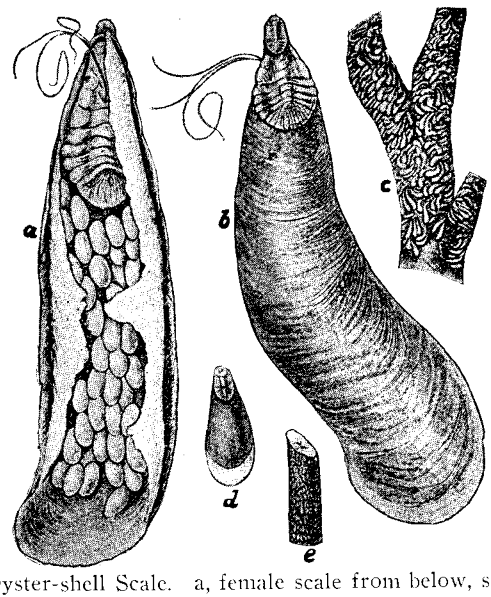


Fig. 3. Oyster-shell Scale. a, female scale from below, showing eggs; b, same from above greatly enlarged; d, male scale enlarged; c, female scales on twig, natural size, e, male scales natural size. (From year book, 1894 U. S. Dept. Agr.)

In June the eggs hatch, the active young appearing as small white specks which soon attach themselves to new shoots by their beaks. The scale then begins to form, gradually increasing in size. The scale of the female (fig. 3, *a, b, c*) is less than one-eighth of an inch long, narrow, usually curved when not crowded, (fig. 3, *c*) and nearly the same color as the bark upon which it is found. The scale of the male (fig. 3, *d*) is much smaller, less curved and usually not found on fruit trees. As with the San Jose scale the adult male is provided with both wings and legs while the female, remaining under the scale, has neither.

REMEDIES.

This insect is quite resistant to the application of sprays unless it be put on at the time when the young appear, before the formation of the scale. This is about the middle of June, though the exact date cannot be given as it varies with latitude and temperature. As soon as the young larvæ are observed the trees should be sprayed with soap solution (Formula 10), kerosene emulsion (Formula 7), or whale-oil soap solution (Formula 9), repeating if possible a week later. The kerosene emulsion should be put on in sunshiny weather and care should be exercised not to use an excess amount, lest the tree be injured.

2. SAN JOSE SCALE.

(*Aspidotus perniciosus.*)

The San Jose which is one of the worst insect pests of orchards in other states was discovered in the town of Limerick, Maine, in 1909. As there is always a danger of its introduction upon nursery stock from neighboring states, the observation of small circular scales about the diameter of a pin head (fig. 4) upon the twigs of fruit trees should immediately be reported.

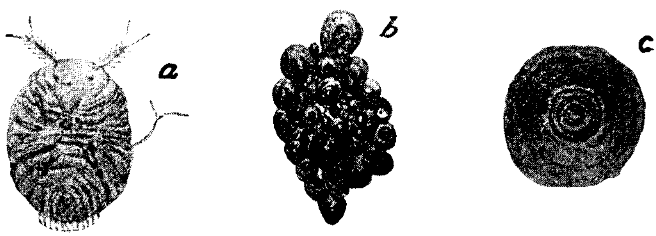


FIG. 4, a, Female, scale removed; b, cluster of scales; c, female scale; all greatly enlarged. (After Felt.)

The female scale is circular in outline, grayish or blackish in color, and when examined under a lens will be seen to be somewhat raised above the bark especially in the center where there is a little prominence. When the scale is somewhat rubbed the center portion appears yellowish, around which the concentric circles, representing lines of growth, may be seen (fig. 4, *c*). The full grown male scale is elongated, the prominence near one end and the lines of formation eccentric instead of concentric. If the scale be lifted by means of a needle, there will be seen a little yellowish body; the insect proper (fig. 4, *a*). The newly born insects of both sexes possess eyes, legs, antennæ and mouth parts, and crawl about for a few hours upon twigs. When a suitable place is found they settle, insert their long beaks through the bark and begin to suck the plant juice. The scale begins to form even before the young insect becomes fixed, and is at first pale grayish yellow, gradually becoming darker, the central projection usually remaining lighter colored. The insect under the scale now loses legs and antennæ, the female also losing her eyes. Later the male scale assumes an elongate oval shape, and later still, 3 or 4 weeks after birth, it again undergoes a transformation and appears as a mature insect with legs, antennæ, eyes and wings. The female matures in 5 or 6 weeks, remaining fixed in position under the scale, legless and wingless. There are several generations each season.

REMEDIES.

While there are a number of insect parasites which are natural enemies of the scale, chief reliance must be placed upon fumigation and spraying early in the spring before growth begins to keep it under control. Miscible oils, kerosene emulsions (Formula 7), and lime and sulphur washes (Formula 4) are all to be recommended for sprays, while nursery stock imported from localities known to be infested should be fumigated. Complete directions for spraying and fumigating will be found in Farmers' Bulletin 127, "Important Insecticides: Directions for their Preparation and Use," and "San Jose Scale," Circular 42, Second Series, Division of Entomology. These papers may be obtained upon request by addressing "United States Department of Agriculture, Washington, D. C."

3. Woolly Aphis of the Apple.

(*Schizoneura lanigera* Hausmann.)

Throughout the summer on the lower portion of the trunk and particularly on the water sprouts of the apple may often be seen small bluish-white flocculent or cottony patches, which indicate the presence of colonies of one of the worst enemies of the apple, viz., the insect known as woolly aphis (fig. 34).

It exists in two forms, the one just referred to, above ground on the trunk or water shoots, and another inhabiting the roots. On the roots its attacks induce enlargements or galls or swellings, and in the cracks of these galls and swellings the root form occurs in clustered masses. The injury to the trees is due both to the sucking up and exhaustion of the vital plant juices and to the poisoning of the parts attacked, as indicated by the consequent abnormal growths.

The damage is particularly serious in the case of nursery stock and young trees and is less often important after the tree has once become well established and of some size. Where this insect is abundant all the roots of a young tree to the depth of a foot or so become clubbed and knotted by the growth of hard fibrous enlargements (fig. 35) with the results in a year or two of the dying of the rootlets and their ultimate decomposition with attendant disappearance of the galls and also of the lice, so that after this stage is reached the cause of the injury is often obscure. On the trunks the presence of the lice sometimes results in the roughening of the bark or a granulated condition which is particularly noticeable about the collar and at the forks of branches or on the fresh growth around the scars caused by pruning, which latter is a favorite location. On the water shoots, they collect particularly in the axils of the leaves, often eventually causing them to fall, and on the tender greener side of the stems. The damage above ground, though commonly insignificant, is useful as an indication of the probable existence of the lice on the roots. A badly attacked tree assumes a sickly appearance and does not make satisfactory growth, and the leaves become dull and yellowish, and even if not killed outright it is so weakened that it becomes especially subject to the attacks of borers and other insect enemies.

The common forms both on the roots and above ground are wingless lice, not exceeding one-tenth of an inch in length, and of a reddish-brown color, and abundantly covered, especially in the aerial form, with a flocculent waxy excretion.

In October or November, among the wingless ones, numbers of winged individuals appear, which are also all females, and are the parents of a true sexed generation of minute, wingless lice, the females of which give birth to a single "winter egg." This egg is attached within a crevice of the bark.

The winged females appear somewhat abundantly in autumn, and are one of the means of the dispersal of the insect. They are very minute, clear-winged, gnat-like objects, greenish-brown, almost black in color, with the body covered with more or less of the cottony excretion.

REMEDIES AND PREVENTIVES.

The foregoing account of the habits and characteristics of the woolly aphis will enable us to suggest certain measures to control it. The aerial form presents no especial difficulty, and can be very readily exterminated by the use of any of the washes recommended for plant-lice, such as kerosene emulsion, tobacco decoction, a strong soap wash (Formulas 7, 9, 11), etc., the only care necessary being to see that the wash is put on with sufficient force and thoroughness to penetrate the covering and protecting cottony excretion. If the wash be applied warm, its penetration will be considerably increased.

The much more important root form, however, is more difficult to reach and exterminate. The common recommendations are of applications of strong soap or tobacco washes to the soil about the crown, or soot, ashes, or tobacco dust buried about the roots; also similarly employed are lime and gas-lime.

Badly infested nursery stock should be destroyed, since it would be worth little even with the aphides removed.

AA. INJURING THE FOLIAGE.

(Divisions a, b, c, and d).

a. *Plant lice, small greenish, blackish or reddish lice-like sucking insects.*

1. Greenish plant lice in colonies causing leaf curl. (fig. 33).
   Green Apple-aphis. Page 336.
2. Reddish plant lice in colonies causing leaf curl.
   Rosy aphis. Page 337.

b. *Insects feeding freely upon the leaves without a nest and not concealed within leaf or bud.*

1. A "measuring worm" or looping caterpillar, when grown about 1 inch long; olive green when young, becoming yellowish or brownish when grown; with brownish longitudinal stripes and white band on sides; under side pale or flesh colored. (figs. 5, 6).
   - I. With 2 pairs of legs at rear of body. *Spring canker Worm.* Page 339.
   - II. With 3 pairs of legs at rear of body. *Fall canker Worm.* Page 340.
2. Very large hairless green caterpillar, 4 inches long when grown; body with several red, yellow and blue bead-like tubercles. (fig. 7). *Cecropia caterpillar.* Page 341.
3. A large black and yellow longitudinally striped caterpillar with yellow neck; very sparsely covered with long soft hairs. (fig. 9). *Yellow-necked caterpillar.* Page 342.
4. A caterpillar with black, white and yellow longitudinal stripes; head and fourth body segment bright red, with a number of stiff, blunt black spines. (fig. 10). *Red-humped Caterpillar.* Page 344.
5. A smooth mottled caterpillar; grayish brown above, gray-green beneath with yellow head. (fig. 55). *Mottled fruit Caterpillar.* Page 345.
6. Smooth greenish caterpillar 1½ inches long when grown, with various colored blotches and marks on the back. (fig. 11). *Saddled prominent.* Page 345.
7. Very small smooth greenish yellow caterpillars (½ inch or less), feeding upon upper surface of leaf. (fig. 14). *Apple-leaf Bucculatrix.* Page 347.
8. Hairy caterpillar with four white humps of hair on the back, and black pencils of hair on head and tail. (fig. 15).
   - I. Head red. *White-marked tussock.* Page 349.
   - II. Head black. *Antique tussock.* Page 349.
9. Hairy caterpillar; ground color bluish with a single line of white dots on the back. (fig. 16). *Forest tent Caterpillar.* Page 350.
10. Hairy caterpillar, ground color brownish, with broken white stripes on each side when full grown; the young are in winter nests, they are brownish with 2 reddish dots on back. *Brown-tail.* Page 352.
11. Hairy caterpillar, ground color dusky; with 2 rows of red spots and 2 rows of blue spots along back and with dim yellowish stripe between them. *Gypsy.* Page 355.
12. Hairy caterpillars. when grown with long pencils of hairs at each end; when young only sparsely hairy.

I. Body white, black spotted, hair gray or white, with spreading tufts of white hairs and decorated down the back with a row of 8 black tufts. (fig. 17). *Hickory tiger.* Page 356.

II. Body black, body hair yellow; more or less black at ends. *Spotted tiger.* Page 356.

13. Hairy caterpillars with soft hairy lappets low on the sides; a black band between joints 3 and 4 which shows when walking; warts on joint 3. *Velleda lappet.* Page 358.

14. A long-legged yellowish brown beetle feeding on the foliage. (fig. 18). *Rose chafer.* Page 358.

c. *Caterpillars living in web nests or cases in spring or summer, or concealed in folded leaf or bud.*

1. Dusky yellowish, hairy caterpillar usually with broad dark stripe along middle of back; body hairs long and dark; in colonies. (fig. 19). *Fall web worm.* Page 360.

2. Hairy caterpillar, ground color bluish, white stripe along middle of the back; in colonies. *Orchard tent-caterpillar.* Page 361.

3. Small bud-feeding caterpillar, with head and top of next segment black, body brownish. *Bud Moth.* Page 363.

4. Small smooth olive greenish or brownish caterpillar, with yellow head, black dot on each side of segment behind the head; lives in folded leaf in fall. (fig. 22). *Leaf sewer.* Page 364.

5. Caterpillar living in small cigar-shaped case (or from fall to early spring a curved case) about ¼ inch long. (fig. 23). *Cigar case bearer.* Page 365.

d. *Conspicuous winter stages. Egg masses, cocoons, etc.*

1. A small clump of dried leaves firmly tied together with silk fastened to the twig, concealing small dark living caterlars within. (fig. 38). *Brown-tail moth nest.* Page 352.

2. A large spindle-shaped cocoon upon the twigs with a single large brown pupa within. (fig. 37). *Cecropia cocoon.* Page 341.

3. A flat, oval, tan-colored, felt-like mass attached to tree trunks, old boards and all kinds of rubbish. *Gypsy moth egg mass.* Page 355.

4. A band of blackish eggs encircling a twig.

I. Egg mass with rounded ends. (fig. 36). *Orchard tent-caterpillar eggs.* Page 361.

II. With square ends. *Forest tent-caterpillar eggs.* Page 350.

5. Eggs adhering to a grayish cocoon; cocoon enclosing a brownish empty pupal skin. (fig. 39). *Antique tussock.* Page 349.

6. A whitish frothy mass enclosing several layers of eggs adhering to a grayish cocoon, with empty pupal skin within. *White marked tussock.* Page 349.

a. PLANT LICE.

Besides the woolly aphis which does its chief damage to the apple roots, several species of aphids attack the leaves, and tender stems. These are minute insects about 1/8 of an inch long. They pierce the tissue of the shoots with their beaks and suck the sap or infest the leaves causing them to curl, or become sickly. Some species of these pass their whole life upon the apple while others spend part of the year on other plants. But as all the important species return to the apple twigs to lay eggs in the fall and as they resemble one another closely, both in appearance and manner of injury, it is not necessary to discuss more than two species here.

Aphids are frequently attended by ants which are attracted by honey dew, a sweet secretion of the aphids, and the presence of ants about the apple leaves is a pretty certain sign of aphid infestation.

Lady beetles (figs. 52, 53) both in the adult and larval stage feed greedily upon aphids and should not be mistaken for injurious insects. Syrphus maggots also are among the most beneficial insects in the State in this respect, as they destroy aphids in great numbers.

1. Green Apple Aphis.

(*Aphis pomi* De G.)

The body is pear-shaped, the colors being yellowish green, greenish, or darker, varying considerably in detailed markings and in the several generations.

Winter eggs (fig. 30) are deposited by the sexual females in the fall. They hatch in the spring, and, like the species next considered, the aphids developing from them cause a curling of the leaves. The green apple aphis infests the apple throughout the year. Upon the hatching of the winter eggs in spring a succession of agamic generations is produced, the earlier ones, except the first, with numerous winged individuals which migrate to other trees and establish new colonies.

2. Rosy Apple Aphis.

(*Aphis pyri* Boyer.)

The rosy apple aphis, regarded by Gillette as possibly *Aphis pyri* Boyer, is readily distinguished from the preceding by its larger size, rounder body, and usually rosy color, which, however, may vary from salmon to tan or even to slaty gray or black, the body being covered with a whitish pulverulence.

Winter eggs are deposited in the autumn by sexual females, and more often on the trunk and larger limbs than with the other species mentioned. They hatch in spring as the apple leaves are pushing out, and the young aphids infest the young leaves and later the tender shoots and foliage, the latter thus becoming usually badly curled. Three generations from the egg are said to occur on the apple in the spring, many individuals of the second and third generations developing wings and migrating to other trees and to other host plants. After the third generation the apple is deserted by the insects until fall, when the return migrants appear and give rise to the true sexual forms, the females depositing eggs as described.

METHODS OF CONTROL.

Pruning.—As has been stated, the aphids under consideration pass the winter in the egg stage on the apple, the eggs being deposited more or less promiscuously over the more nearly terminal twigs (fig. 30). With young trees especially, which are seen to be heavily stocked with the eggs, the latter may be largely removed during the work of pruning, and the prunings should be collected and burned.

The insects in the egg condition are frequently distributed on nursery stock; therefore, if in planting trees this stock be well pruned and the prunings destroyed, the establishment of the aphids in young orchards may be often prevented or delayed.

Winter spraying for destruction of eggs.—Excellent results have followed the use of lime-sulphur wash, almost all of the eggs of the apple aphis having been destroyed by one thorough application in spring shortly before the buds opened. The use of this wash for the eggs of aphids would also control the San Jose scale when present.

Spring and summer treatments.—Effective work in controlling these insects may be done in the spring just after they have hatched from eggs and have collected on the expanding foliage. Trees seen to be badly infested at this time should be thoroughly sprayed, taking pains to wet as completely as possible all parts of the leaves, twigs, and branches. However thoroughly the work may be done, some of the "lice" are almost sure to escape destruction, owing to the difficulty of forcing the spray between the unfolding leaves, more or less covered with hairs, where some of the insects will have penetrated. A subsequent treatment in the course of a week should usually be made, especially if the first application is seen to have been unsatisfactory.

After the foliage is well out and more or less distorted from the presence of the aphids, effective spraying is quite difficult, since many of the insects on the lower surface of the curled leaves will not be hit by the spray. Repeated applications must be made, therefore, as necessary to keep the insects under control.

Spray mixtures.—The lime-sulphur wash for the destruction of winter eggs is made according to the usual formula for the wash (Formula 4).

After the trees are in foliage, a more dilute contact insecticide must be employed, as strong tobacco decoction, 15 or 20 per cent kerosene emulsion, or whale-oil soap (Formulas 7, 9, 11). Since aphids secure their food by sucking up sap from within the plant, none of the arsenical poisons would be effective.

b. INSECTS FEEDING FREELY UPON THE LEAVES WITHOUT A NEST AND NOT CONCEALED WITHIN LEAF OR BUD.

1. CANKER WORMS.

I. SPRING CANKER-WORM.

(*Paleacrita vernata.*)

The male moths of this species have rather large, thin, silky wings, about one inch across when spread. The general color is bluish gray. A well defined row or band of light markings near the outer margin of the front wings, and three darker, irregular bands, across the same wings, together with the slightly lighter color and absence of markings on the hind wings, are characteristic features. The inconspicuous female moths are wingless and, because of this fact, the spread of the species is very slow, occurring mainly by the transportation of nursery stock infested with eggs.

The moths usually emerge from the ground early in the spring—about April, or farther south, in March—and the females climb up the trunks of trees to deposit eggs. The eggs, which are shaped something like hens' eggs and are about the size of fly specks, are deposited in irregular masses, usually partially concealed by loose pieces of bark. They hatch about the time the leaves unfold; the time varying with the locality and the season. The larvæ are "measuring worms" with 2 pairs of legs at the hind end of body (fig. 5). The young

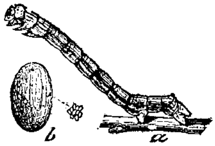


Fig. 5. a, larva, showing the two pairs of posterior legs; b, single egg, much enlarged. (After Riley).

larvæ are voracious feeders and they grow rapidly, usually attaining full size in from three to four weeks from the time of hatching. Upon reaching full size they drop to the ground, burrowing beneath the surface to a depth of two to five inches. Here each one forms a cell, lined with silk which it spins, and soon transforms to the chrysalis stage, where it remains until the following spring, when the adult moth emerges as before.

II. FALL CANKER-WORM.

(*Alsophila pometaria.*)

The fall canker-worm so closely resembles the other species as to be frequently mistaken for it. For all practical purposes they may be considered together, but the fall canker-worm is more distinctively a northern insect. As in the other species, the female moth is wingless, but in this species she lacks the hairiness which characterizes the other. The male moth has two light bands across the front wings instead of the single one of the preceding, and the rear wings are slightly shaded. The larvæ of this species also, besides having three pairs of legs under the hind end of the body, as shown in figure 6, have a broad, dark stripe along the back, as opposed to the narrow markings of the other species. The eggs, which are slightly larger than in the previous species, somewhat resemble small flower pots and are attached to the bark, in exposed situations, in masses of from 60 to 200, placed side by side as seen in figure 6, *e*. The eggs highly magnified, are shown in figure 6 *a*.

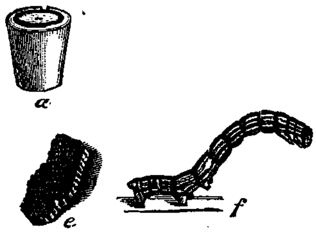


Fig. 6. a, single egg, much enlarged; e, egg mass; f, larva showing the three pairs of posterior legs. (After Riley).

The eggs are deposited in fall or early winter (sometimes in mild winters as late as March). They hatch about the same time as those of the other species and the larvæ act in a similar manner, entering the ground about the same time. Instead of forming a cell lined with silk, however, this species spins a tough cocoon, and the moths come forth and begin laying eggs in October and November.

HOW TO FIGHT CANKER-WORMS.

One of the surest preventive measures is to place a band of tarred paper about the tree in March and smear it with tree tanglefoot, thus preventing the ascent of the female moths and the deposit of eggs. In case the bark is very rough, it should be scraped smooth to prevent the insects from crawling up behind the paper. If the fall canker-worm is present, of course the treatment must begin in October. If the trees are already attacked, jarring the limbs will cause many of the worms to spin a thread and drop to the ground. If the band of tanglefoot is in place they will be unable to return to the attack and may be destroyed.

The surest way of fighting this pest, however, is by spraying with Paris green or arsenate of lead (Formula 6).

2. Cecropia Moth.

(*Samia cecropia.*)

The large gray or brown cocoon of the Cecropia moth is frequently found attached to the twigs of trees (fig. 37).

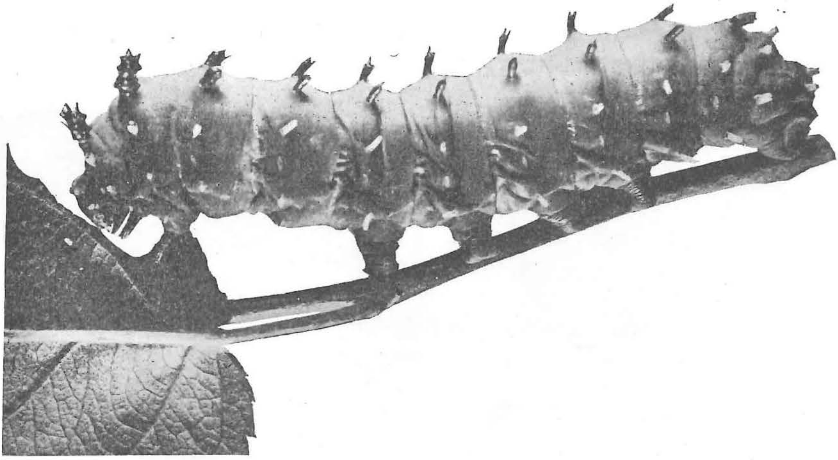


Fig. 7. (From Me. Agr. Exp. Sta. Circular.)

These are spun late in August or September by a green caterpillar about four inches long. The body of the caterpillar is ornate with colored bead-like tubercles, the two pairs nearest the head being red with black spines, and the other dorsal tubercles smaller and yellow. Along the sides of the body the tubercles are bluish. (Fig. 7).

After the cocoon is spun the caterpillar changes to the pupa, a dark brown object which may be found by opening one of the cocoons during the winter.

In the spring the insect breaks open the brown pupal skin and emerges from the cocoon as the adult insect, the largest moth in the state and one of the most beautiful. Its expanded wings measure about five and one-half inches. In color the wings are brownish with a border of gray and submarginal lines of white and red. The form of the markings is better represented by the accompanying illustration than by a description.

The caterpillar is well attended by insect parasites and is devoured by birds. In this state it has not occurred to a troublesome extent and need not be feared as a pest, although it feeds on apple and various forest trees. No remedies usually seem necessary. If the caterpillars are found upon a small trees which they are likely to injure, hand picking will prove effectual.

Those who find the Cecropia cocoons during the winter are often interested to save them in a warm room for the sake of observing the beautiful moth which emerges (fig. 8).

Fig. 8. (From Me. Agr. Exp. Sta. Circular.)

3. Yellow-Necked Caterpillar.
(*Datana ministra.*)

During the late summer the yellow-necked caterpillar is a common orchard pest in Maine.

The moth is tannish brown in color with head and the part of the thorax nearest the head a rich chestnut brown. Several dark brown lines cross the fore wings transversely. The hind wings are pale buff. The female moth deposits about 100 eggs in a cluster on a leaf.

The caterpillars which hatch from these eggs, attain their full growth in 5 or 6 weeks. They are then about two inches long. The head is black and the segment just back of the head is orange colored, a character which gives rise to the popular name "yellow-neck." The body is striped longitudinally with alternate yellow and black lines. Soft white hairs occur over the whole body but are too thin to be especially noticeable (fig. 9). Like the red-humped caterpillar, these caterpillars are clustered together both while feeding and when at rest. The caterpillars when at rest assume a characteristic and peculiar position on the branch with both extremities of the body raised. When alarmed they jerk their heads and tails in an irritated manner.

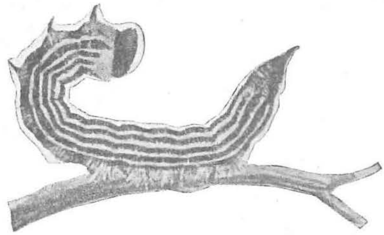


Fig. 9. (After Holland).

The full grown caterpillars bury themselves in the earth a few inches below the surface, where they transform into brown pupæ, unprotected by any cocoon. They remain in the earth all winter and emerge about the middle of the next summer, when they are transformed to the moth, or mature insect.

REMEDIES.

As in the case of the red-humped caterpillar, gathering the caterpillars by hand is the simplest remedy and perhaps the only one which it is necessary to recommend. The caterpillars are gregarious and the whole brood is easily removed from the tree and destroyed. Arsenical sprays (Formula 6) will kill them, and may sometimes be a convenient means of combating them.

4. Red-Humped Caterpillar.

(*Œdemasia concinna.*)

During August, September and October, the red-humped caterpillar is one of the most troublesome orchard caterpillars in the State. Many correspondents reported that entire orchards of young trees were stripped of their foliage, except for the mid ribs of the leaves, before the presence of the pest had been discovered.

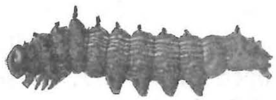


Fig. 10. (From Me. Agr. Exp. Sta. Circular).

The mature insect is an inconspicuous brown moth with wing expanse of slightly more than one inch. The female deposits eggs on the under side of a leaf in a cluster, usually during July. The young caterpillars, which soon hatch from these eggs, feed upon the tender tissues of the under side of the leaf, not attacking at first the upper surface. When they become larger they devour the whole leaf except the mid rib. They move in flocks, an entire brood feeding together and remaining in a cluster when resting. In the caterpillar or larval stage this insect is readily recognized. The body of the full grown caterpillar is marked with fine longitudinal stripes of black, white and yellow, and short black spines occur in rows. The head is bright red and the first segment of the abdomen, which is conspicuously humped, is of the same color (fig. 10). The caterpillars reach their full growth (about 1¼ inches) from August to late October. When full grown, they descend to the ground and hide under leaves or other rubbish and make a glassy transparent cocoon, within which they pass their pupal period. They remain in the cocoon all winter and emerge the following season as mature moths.

REMEDIES.

The red-humped caterpillars are not especially difficult to combat if a watch is kept for the colonies while they are young. As they are gregarious, it is a simple matter to clip off the small twig containing the whole brood of little caterpillars. When they are larger they can often be dislodged by jarring the branch and destroyed on the ground. Arsenical sprays (Formula 6) will kill them, but the presence of fruit makes this remedy undesirable for bearing trees late in the season.

5. Mottled Fruit Caterpillar.

(*Crocigrapha normani.*)

The eggs are laid in a mass flatly attached to the leaf. They hatch in mid-June in Maine. The larva is a smooth, hairless caterpillar, 1½ inches long when full grown. Its head is shiny yellow with one dark blotch on each lobe. Its body is mottled grayish brown above, and pale grayish green beneath. The legs are pale. This caterpillar feeds both upon the foliage and the fruit. (See fig. 55). The pupal stage is passed in the ground. It is a glistening brown object about ¾ inch long. The mature insect is a brownish moth expanding about 1½ inches.

REMEDIES.

Arsenical sprays (Formula 6) applied for other species will control this one also. As this caterpillar is very readily dislodged, jarring the tree and killing the insect on the ground is a convenient combative measure.

6. Saddled Prominent.

(*Heterocampa guttivitta* Walker).

This species is well known in Maine because it has been excessively destructive to orchard and forest trees during some seasons. The full grown caterpillar is about 1½ inches long; body green usually, with reddish brown markings on the back, smooth and hairless (fig. 11). The mature insect is a moth expanding about 2 inches, ground color olive-greenish ashen with cream white patches and black markings (figs. 12, 13).

For Maine the saddled prominent has but one brood. The moths emerge in greatest numbers late in May and early in June. Oviposition begins soon after mating which occurs the first night after emergence. The eggs hatch in about 9 days and the larvæ become full grown in 5 weeks (or more according to weather conditions and food supply). During this time they molt four times. The full grown larvæ enter the ground for pupation. In Maine pupation takes place from mid July to late August, the majority of larvæ burying late in July. They pass the winter in the pupal stage, under the leaf mold, and the moths emerge in the spring.

The eggs are deposited singly by the female which in captivity applies the eggs to both sides of the leaf. From the reason that the *tops* of the trees are stripped first and then the lower branches it is to be concluded that the moths by preference deposit the eggs upon the upper leaves. Perhaps the same tendency to fly high may account in part for the fact that the hillside forests are in general more largely attacked than the lowlands.

The full grown larva drops or climbs to the ground and constructs a cell in the earth or under the leaves at a distance of 1 to 3 inches below the surface. This cell is oval and is lined by a thin spinning of silk.

The insect after remaining in the pupal stage all winter emerges with the warm spring days.

FIG. 11. (After Packard).

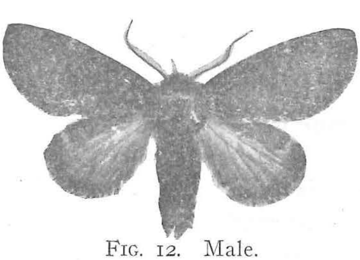


FIG. 12. Male.

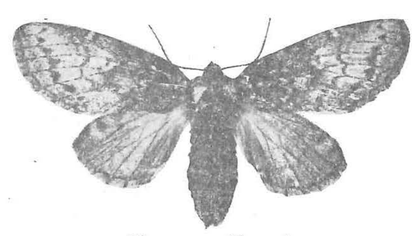


FIG. 13. Female.

(FIG. 12 and 13 from Me. Ag. Exp. Sta. Bul. 161).

COMBATIVE MEASURES.

For the orchard or shade trees there are several practical measures which have proven successful the past season in preventing serious injury from the saddled prominent.

Spraying.—This species is susceptible to arsenical poisons and the caterpillars readily died on apple trees which were thoroughly sprayed. Arsenate of lead or Paris green (Formula 6) will kill these caterpillars and should be applied as soon as they begin appreciable work. Applications from the middle to the last of June would probably get all these caterpillars which hatched upon the trees. In case a migration to an orchard from an infested forest growth is feared, the orchard should be sprayed as soon as the caterpillars begin to travel in search of fresh food. If trees not already attacked are banded with a sticky substance, the ascent of caterpillars up the trunk will effectually be prevented.

Jarring and banding.—The saddled prominents are readily shaken from the branches. The cool of the morning is the most propitious time for jarring. The caterpillars once dislodged, their reclimbing can be prevented by banding.

A material useful for this purpose is sold under the name of Tree Tanglefoot. This substance consists principally of resin softened by the admixture of suitable oils. It is quite similar to that used in the manufacture of adhesive fly-paper, seems to possess the merit of not injuring the trunks of trees, and is very effective in checking the ascent of caterpillars thereon. Where the number of caterpillars jarred from the trees is excessive it is expedient to kill them. A hand spray charged with kerosene or gasoline is a useful means to this end.

Fowls and Pigs.—Hens will devour these caterpillars greedily and if given the range of an orchard will eat great numbers of the caterpillars which drop to the ground or descend to pupate.

Pigs pastured in an orchard will, by rooting up and eating the pupæ, prevent great numbers of saddled prominents and other moths from emerging and depositing eggs for the following season.

7. Apple-Leaf Bucculatrix.

(*Bucculatrix pomifoliella.*)

The larva of this insect is about one-half inch long when mature, cylindrical, tapering at both ends. Joints of the body rounded and prominent, color dark yellowish, with a greenish tinge and reddish shades on the anterior segments. The larvæ are active and when disturbed suspend themselves by a silken thread.

The cocoon is dirty white, slender, about one-fourth inch long, ribbed longitudinally by about six prominent ridges, oblong, tapering at both ends, flattened on the side to which it is attached. Usually fastened to the twigs and branches in groups. (Fig. 14).

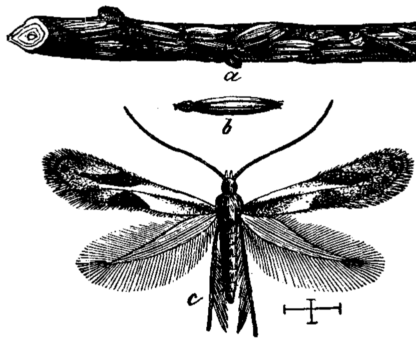


FIG. 14. (After Riley.)

The small moth has only about one-fourth inch expanse of wings. Fore wings whitish, tinged with pale yellow and dusky brown. (Fig. 14).

This insect spends the winter in the pupa state in the cocoon, usually attached to the twigs and branches of the host plant. About the time the leaves unfold, the moths come forth and lay their eggs upon the tender foliage. The larvæ are full grown in July.

In September or October the cocoons in which the pupæ spend the winter are formed. The larvæ feed externally upon the foliage, the upper epidermis and pulp eaten away in patches, the veins and lower epidermis intact.

REMEDIES.

Jar the trees when the larvæ are full grown and they will suspend themselves by threads and can be swept down by a broom and killed by hot water or crushed.

Apply kerosene emulsion with a spraying pump in winter, to the branches that bear the cocoons. The same application might be made for the first brood when the foliage is on.
eating insects.

Spray with arsenical poisons (Formula 6) as for other leaf-

8. Tussock Moths.

I. WHITE-MARKED TUSSOCK (*Hemerocampa leucostigma*).

II. ANTIQUE TUSSOCK (*Notolophus antiqua*).

The conspicuous white egg masses of these moths are deposited late in the summer or in the fall upon the cocoons from which the female moths emerge. As the hairy cocoons are commonly attached to the rough bark, or twigs of trees the caterpillars infest, the egg-masses are readily found at any time after the leaves have fallen. The eggs which the white-marked tussock deposits are covered with a white frothy substance which becomes brittle upon exposure to the air. The antique tussock does not protect its eggs in this manner but leaves them uncovered upon the cocoon (fig. 39).

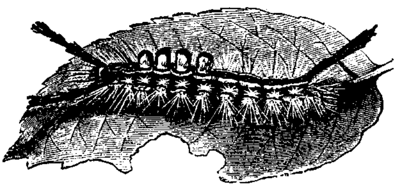


FIG. 15. (After Riley).

The caterpillars which emerge from these eggs in the spring are most grotesque in appearance. The caterpillar of the white-marked tussock moth when full grown has a shiny coral red head beyond which extend two stiff pencils of black hairs directed forward like horns. A single pencil of similar construction supplies the other end of the body with a tail. Upon the middle of the back, starting a little behind the head, is a row of four regular tufts of soft whitish hairs which resemble small paint brushes neatly trimmed off at the tip. In a line with these but nearer the tail occur two little bright red tubercles (fig. 15). The full grown antique tussock caterpillar resembles closely the species just described. Its head, however, is jet black and it has an additional pair of black pencils, similar to though shorter than the horns, projecting from the sides of the body, which is lacking in the caterpillar of the white-marked tussock.

After feeding for four or five weeks the caterpillar becomes full grown and spins a rough cocoon of silk with which it mixes the hairs that have decorated its body. These cocoons are usually formed upon the bark or in the angles of twigs. Often a leaf is attached to the mass.

In about two weeks the adult insects emerge from the cocoons. The males are winged, the white-marked tussock having gray wings which expand nearly one and one-half inches and the antique tussock having smaller brown wings. The female moths of these two species are not readily distinguishable. They never acquire wings and their distended bodies are practically little more than animated sacs of eggs. The females being unable to fly and their bodies being too heavy for their slender legs to drag about, cling to the cocoons from which they emerge and soon after mating deposit about 300 eggs in a mass upon the cocoon.

REMEDIAL MEASURES.

The white egg masses deposited on the cocoons remain on the trees all winter. These are readily seen and can be removed and burned. Cocoons of the tussock not covered with eggs should not be disturbed as they are either the empty cocoons of males or cocoons containing parasites. If the cocoons are empty they can do no harm and if they contain parasites, these insect enemies of the tussock should be allowed to develop.

The fact that the females cannot fly makes this pest easily controlled locally, for the orchardist need not especially fear his neighbor's infested trees.

The caterpillars are susceptible to arsenical sprays (Formula 6) and this means of combating them is sometimes necessary where the winter collecting has been neglected or when the tussocks appear in destructive numbers upon shade trees.

9. FOREST TENT CATERPILLAR.

(*Malacosoma disstria.*)

The eggs of this insect are deposited in a belt encircling a small twig, about 200 in each mass. These egg masses resemble those of the orchard tent caterpillar, except that they are more nearly square at the ends. A glistening varnish-like protective substance is deposited with the eggs which renders the mass more readily seen in the sun.

The colonies of young larvæ do not construct tents as do the orchard tent caterpillar, but they are usually massed during dark or rainy weather.

The caterpillars resemble the orchard tent caterpillars, the most striking difference being that the cream colored line along the back is broken into a line of dots in the forest tent caterpillar while with the orchard tent caterpillar this line is unbroken. They grow to be about two inches long.

The full grown caterpillar constructs a filmy outer cocoon with an inner firm cell which it soaks with a yellow discharge drying to a pale yellow powder. These cocoons are often attached to buildings.

Moth—In from 10 to 14 days after spinning the cocoon the adult insect emerges. This yellowish-brown moth resembles that of the orchard tent caterpillar closely but the transverse bands on the wings are darker than the ground work of the wings instead of paler as with the other species. It is not practicable to combat the insect in this stage.

REMEDIAL MEASURES.

Arsenical sprays (Formula 6) applied early in the season will satisfactorily dispose of this pest and for orchard or shade trees protected in this manner no other means are necessary. After the caterpillars are half grown it is their custom to congregate in great masses on the trunks of the trees while they molt their skins. Here they may be destroyed by a stiff broom dipped in kerosene or swept into a pail of water and kerosene.

When not congregated for molting the older caterpillars when not feeding stretch out motionless along the branches or trunk and are difficult to see, especially as they are likely to choose the upper side of the branch.

However, it is not necessary to wait for the molting periods in order to combat the older caterpillars on trees which have not been protected by spraying. These caterpillars drop downward when disturbed. "This habit leads to the suggestion that by a combination of jarring and banding much injury may be prevented." After the caterpillars are jarred from the tree the trunks of trees are painted with a band of "tanglefoot" such as is used against the gypsy caterpillar to prevent their ascending.

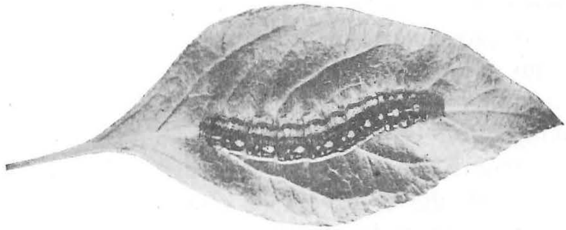


FIG. 16. Forest Tent Caterpillar. (From Me. Ag. Ex. Sta. Circular).

10. BROWN-TAIL MOTH.

(*Euproctis chrysorrhœa.*)

The caterpillars of the brown-tail moth are capable of ruining orchard, shade and many woodland trees. They are also a dreaded nuisance, because the caterpillar hairs break off, and on coming in contact with the human skin, cause extreme irritation and often illness.

So serious a pest should be known by every one in the State, because although extermination of this insect may not be possible, much practical and effectual work can be done in holding it in check and reducing its numbers so that damage to orchard and shade trees may be very slight.

The moths, expanding from one and one-fourth to one and three-fourths inches, are white except for the abdomen, which is tinged with brown and tipped with a tuft of brown hairs. This tuft is small and dark in the male, but the large golden-brown tuft in the female is conspicuous enough to be the most striking characteristic of the moth, and has won for this insect its descriptive name of "brown-tail." These moths are on the wing in July, and unlike some closely related pests, the brown-tail females as well as the males are strong flyers. They are active at night, and as lights have an attraction for them, they sometimes fly a long way toward a lighted district.

The female usually selects a leaf near the tip of the branch on which to deposit from one hundred and fifty to three hundred eggs. Some of the brown hairs from the abdominal tuft adhere to the egg mass and give it the appearance of a brown felt lump.

By the middle of August most of the eggs are hatched and the young caterpillars spin a slight web over the leaf near the egg cluster. When they have eaten all but the skeleton of the first leaf, they draw another into the web and repeat the process at intervals during the late summer. They feed slowly, however, and spend so much time spinning their web that they do comparatively little damage to the trees in fall, and they are still very small (about one-fourth of an inch in length) when cold weather comes on.

The winter nests.—(Fig. 38). In the fall the young caterpillars weave additional layers of silk about their retreat, fastening it securely to the branch by the web, and pass the winter thus in colonies of one hundred and fifty to three hundred in a single nest. This is a very unusual yet most commendable habit in a caterpillar pest, for they can be killed, hundreds at a time, simply by burning the nests in which the colonies hibernate. The nests, composed of leaves, bound firmly together by a silken web, are varied in shape. In spite of the superficial variety the essential characteristics of the brown-tail moth nests are soon learned, and even anyone unfamiliar with the nest can make himself perfectly certain if he will cut carefully into the nest. *If the structure contains one or more silken cells filled with tiny living caterpillars it is the winter nest of the brown-tail moth.*

Early in the spring the young caterpillars emerge from their winter nests and feed upon the opening leaf buds. Until about the middle of June they feed greedily upon the leaves, completely stripping the trees where they are numerous. When full grown the caterpillars are about one and one-half inches long. They are dark brown with a sprinkling of orange. Long fine reddish-brown hairs cover the body, and a row of conspicuous white hairs runs along each side. Like the caterpillars of the tussock and gypsy moths, they bear bright red tubercles on the top of the sixth and seventh abdominal segments.

Poisonous qualities of the caterpillars.—Were the caterpillars to be feared only for their ravages upon orchard and other trees, the situation would be alarming enough, but not less serious is the physical discomfort experienced by people living in infested districts. When the minutely barbed hairs of the caterpillar come in contact with the skin they cause an eruption similar to and in many cases worse than ivy poisoning. These hairs are brittle and where the caterpillars are numerous few people are likely to escape, as the caterpillars drop from the branches and creep about, even entering houses. Direct contact with the insects themselves is not necessary, however, for when the caterpillars shed their skins the molts are blown about, widely scattering the barbed hairs.

The caterpillars are usually full grown in June. They then spin loose cocoons, attached commonly to leaves, though some times other shelter is sought. Within these they transform to brown pupæ about three-fourths of an inch long. From the first to the twentieth of July the moths with pure white wings and brown-tipped abdomens emerge from these cocoons to deposit eggs for the next generation of caterpillars.

REMEDIAL MEASURES.

Destruction of breeding places.—Old and worthless orchard trees, wild cherry tangles and other susceptible trees in infested regions should be cleared away, thus lessening the labor of direct search for the destruction of winter nests, by eliminating likely breeding places.

Cutting and burning the winter nests.—This is the most important of the direct remedies because it is the easiest, cheapest and, if thoroughly done, a sufficient protection against the ravages of this pest. The webs and leaves that compose the nest are woven tightly to the tips of the branches and hang there like dead leaves all winter. With so many months for inspection there is no excuse for harboring the hibernating caterpillars on shade or orchard trees. After they are cut from the branches the nests should be burned, as this is the simplest way of destroying the colony within.

Spraying.—The young caterpillars can be killed by arsenical sprays (Formula 6). This remedy is most effective when applied as soon as the leaves develop in the spring. Of course where the winter nests have been destroyed there will be no need of this remedy and it is much easier to kill about two hundred caterpillars enclosed in a nest than to wait until they are scattered over the tree.

11. Gypsy Moth.

(*Porthetria dispar.*)

Unlike the brown-tail moth, the gypsy moth winters in the egg stage. Although winged, the female gypsy moth does not fly, but deposits the eggs in any convenient place to which it can crawl. The egg masses are most commonly attached to the bark of trees but they are also found in such places as under edges of stones, beneath fence rails, on buildings, and in old cans and rubbish. The eggs are laid in July and August in a mass of 400 to 500. They are covered with tan colored hairs from the body of the female moth, and form an irregular oval mass.

As the eggs do not hatch until about May 1, eight months at least are available for their destruction.

The young larvæ or young caterpillars are dark in color and well furnished with dark hairs. The full-grown larva is between 2 and 3 inches long, dark brown or sooty in color, with two rows of red spots and two rows of blue spots along the back, and with a yellowish but rather dim stripe between them. The body generally is clothed with long hairs, and sometimes reaches the length of 3 inches.

The larvæ usually become full grown about the 1st of July, and then transform to pupæ. The pupæ are found in the same situations as those we described for the egg clusters, but are found also in the foliage of trees and shrubs.

The male moth is brownish yellow in color, sometimes having a greenish-brown tinge; it has a slender body, well-feathered antennæ, and a wing expanse of about an inch and a half. The forewings are marked with wavy zigzag darker lines. It flies actively all day as well as by night.

The female moth is nearly white, with slender black antennæ, each of the forewings marked with three or four zigzag, transverse, dark lines, and the outer border of both pairs of wings with a series of black dots. The body of the female is so heavy as to prevent flight.

REMEDIAL MEASURES.

Killing the Eggs.—"No single method of destruction against the gypsy moth is more effective than killing the eggs. The egg masses, wherever accessible, can be killed from August to May by soaking them thoroughly with creosote mixture. The creosote may be applied with a small swab or paint brush. Creosote mixture may be purchased at agricultural warehouses and seed stores at from 50 cents to $1.00 per gallon, depending on the quantity."

The caterpillar can be controlled by arsenical sprays (Formula 6).

12. Tiger Moths.

I. HICKORY TIGER MOTH (*Halisidota caryæ*).

II. SPOTTED TIGER MOTH (*Halisidota maculata*).

These two closely related insects are so similar in habits and are so commonly associated in Maine orchards that they may be discussed together.

The hickory tiger caterpillars are, when full grown, covered with spreading tufts of white hairs and decorated down the back with a row of 8 black tufts. The fourth and tenth segments each bear two long slender pencils of black hair.

The caterpillar of the spotted tiger moth is yellow and black, these colors occurring in widely variable proportions. Sometimes the whole body is covered with yellow hairs in which case there is a row of 8 tufts of black along the back as with the hickory tiger. Often, however, both ends of the caterpillar are covered with black hairs with scattering pencils of white and the yellow hairs are limited to the central portion of the body. Both the hickory tiger and spotted tiger caterpillars have jet black heads and legs.

The young tiger caterpillars are only sparsely supplied with hairs and bear very little resemblance to the fuzzy full grown ones. They are gregarious when young and at first their presence may be detected by skeletonized leaves but later the colony scatters and the caterpillars feed separately, eating the whole leaf substance. If they are disturbed they curl up like a hedgehog and drop to the ground. The hairs are easily brushed from the body of these caterpillars and cause, upon contact with sensitive skin, an irritating itching sensation.

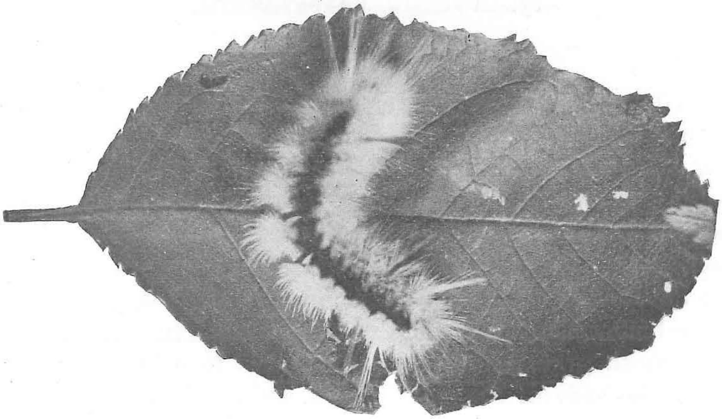


FIG. 17. Caterpillar of hickory tiger moth. (From Me. Agr. Ex. Sta. Circular).

They feed until they are nearly one and one-half inches in length and then they leave the trees and seek suitable shelter for their cocoons, the sides of buildings often being selected. The cocoons are oval, snug little objects less than an inch long and are composed almost entirely of the hairs which have covered the caterpillars, closely felted together. Within the cocoon the insect remains all winter—as short, thick, rather blunt brown pupæ.

The winged moths emerge from the cocoons in June and deposit their egg clusters upon some suitable food plant. The hickory tiger moth is pale buff. The fore wings are thickly sprinkled with little brown dots and set with irregular yellowish white spots. The hind wings are unmarked. The spotted tiger moth resembles the related species closely, but the spots are variable in size and number.

REMEDIAL MEASURES.

Arsenical sprays (Formula 6) will poison these caterpillars. However, where trees are carefully watched, the colonies of the tiger caterpillars could be easily removed by hand while they are young and congregated together. Sometimes, too, it is possible to get rid of them by jarring them off on to a sheet. Where they form coccoons along the edges of clapboards and in other crannies about buildings, much can be done by sweeping down the cocoons and destroying them.

13. Velleda Lappet Moth.

(*Tolype velleda.*)

The larva of this insect is remarkable for having on each side of each segment a little lappet or flat lobe; from these many long hairs are given out, forming a fringe to the body. It is bluish gray, with many faint longitudinal lines; and across the back of the last thoracic segment there is a narrow velvety black band. When at rest the body of the larva is flattened, and the fringes on the sides are closely applied to the surface of the limb. The larva is full grown during July. The cocoon is brownish gray, and is usually attached to a branch of the tree. The body of the moth is milk white with a large blackish spot on the middle of its back, the wings are a soft bluish gray crossed by white lines. The moths have an expanse of wing ranging from 1¼ to 2 inches.

REMEDIAL MEASURES.

It is rarely necessary to apply repressive measures. Arsenical sprays (Formula 6) will control these insects.

14. Rose-Chafer.

(*Macrodactylus subspinosus* Fab.)

The rose-chafer (fig. 18), a long-legged beetle of a light yellowish brown color, and about a third of an inch in length, appears in June, the date varying somewhat according to locality and season, and the beetles mate and begin feeding soon after they emerge from the ground. For from four to six weeks after their appearance they continue feeding, almost constantly paired. The female deposits her eggs singly, from twenty-four to thirty-six in number, a few inches beneath the surface of the earth, and in about two or three weeks' time they hatch and the young larvæ or grubs begin feeding on such tender rootlets, preferably of grass, as are in reach. In autumn they have reached maturity. They are yellowish white in color, with a pale brown head. Late in autumn they descend lower into the earth, beyond the reach of frost, and in early spring they ascend, and each grub forms a little earthen cell in which it passes the winter. Later in the spring, in April or early May, they transform to pupæ, and in from two to four weeks afterwards the beetles emerge, dig their way out of the ground, and the destructive work is renewed. A single generation of the species is produced in a year, and about three weeks is the average duration of life for an individual insect.

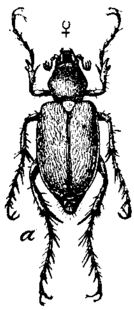


FIG. 18. (After U. S. Div. of Entomology).

The beetles do not confine their ravages to any particular portion of a plant, but consume blossoms, leaves, fruit, and all alike (fig. 41, 42). Whole orchards are often devastated, and the fruit crop of large sections of country destroyed. It is no uncommon sight to see every young apple on a tree completely covered and obscured from view by a sprawling, struggling mass of beetles.

REMEDIES.

The rose-chafer is one of our worse insect enemies to combat successfully. The difficulty is that any application that may be made is unsuccessful unless applied almost continually. The arsenites will kill the beetle, but are not of much value when the insects are abundant, because of the slow action of the poison. Every beetle on a plant might be destroyed one day, but on the day following the plant would be completely covered again.

They may be jarred from trees on to sheets saturated with kerosene, but these methods are tedious and must be practiced daily in early morning or toward sundown to be effective.

Small orchards may be protected, at least from the first arriving hordes of the chafers, by planting about them early flowering plants that particularly attract the beetles. Spiræas, Deutzias, Andromeda, magnolias, blackberries, and white roses are especially useful as counter attractives. The beetles swarm on the flowers of these plants in preference to many varieties of fruits, and when thus massed in great numbers, their destruction by the use of collectors or other mechanical means is greatly facilitated. All ground which might serve as a breeding place and which it is posible so to treat, should be plowed and harrowed early in May for the destruction of the larvæ or pupæ.

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c. CATERPILLARS LIVING IN WEB NESTS WHILE THE TREE IS IN LEAF, OR MORE OR LESS CONCEALED IN FOLDED LEAF OR BUD.

1. Fall Web Worm.

(*Hyphantria cunea.*)

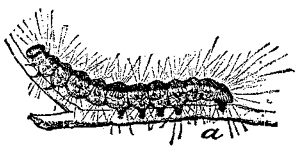

Fig. 19. (After Riley).

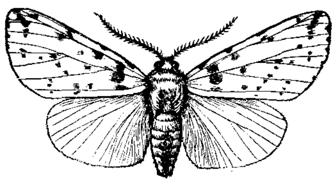

Fig. 20. (After Howard).

The mature insect is a moth with a wing expanse of about 1½ inches. It varies much in coloration but the most common form is white or slightly fulvous with white wings. The wings may be pure white or dotted with black and brown. In the spring the moths emerge from the cocoons in which they have passed the winter and the female deposits eggs upon a leaf in May or June. Each moth lays from 400 to 500 eggs from which hatch minute caterpillars in 10 days or more according to weather conditions. These caterpillars remain together and cover themselves with a small silken web. As they grow, more and more leaves are drawn into the web which may in time include the leaves of several small branches or all upon a large branch. Such webs sometimes attain dimensions of several feet and are conspicuous and unsightly masses.

If they are so numerous on one tree that the food supply gives out they leave the web and seek other trees. Otherwise they remain until they are full grown (a little more than an inch in length), when they drop to the ground and seek a place where they may make cocoons. Recesses which attract them for this purpose are crevices in bark, spaces under boards or door steps, or near the surface of the ground in rubbish. These insects pupate within thin, almost transparent cocoons and remain in them all winter, emerging as mature moths in the spring.

REMEDIAL MEASURES.

Trees well protected with arsenical sprays (Formula 6) will not need other treatment for fall web worm, for the poisoned leaves will be drawn into the web for food. In many cases the simplest means for combating them is to keep close watch upon the trees and clip off and burn the web when it is still small. Even the full sized web can be pruned off from trees not valuable, but in the orchard there is, of course, no excuse for allowing them to remain until large branches are involved in the web. The web may be effectually drenched with a strong washing powder solution or kerosene emulsion.

2. ORCHARD TENT CATERPILLAR.

(*Malacosoma americana.*)

Encircling the twig of apple, plum, and wild cherry trees is frequently found a glistening brown mass about three-fourths of an inch in length (fig. 36).

From such an egg cluster hatch in the spring from two hundred to three hundred caterpillars, which live in a colony and construct a whitish tent-like web in the angle of two convenient branches. It is the habit of the tent caterpillars to pass their time when not feeding, particularly at night and during cold or stormy weather, within the tent which they enlarge as their own rapid increase in size calls for more room. During the warm sunny hours of the day they leave their protection and feed voraciously, defoliating the branches in the vicinity of the tents. One colony is enough to denude a young tree or several large branches of an old tree.

The tent which is at first a delicate filmy silken web becomes by the time the caterpillars are full grown a structure two feet or more in length, unsightly with the accumulation of molted skins and other rubbish.

The full grown caterpillar is nearly two inches long. It is slender, dark, and velvety with numerous soft golden brown hairs upon the body. A white stripe marks the middle of the back, while the sides are streaked irregularly with white or yellow. Along each side of the dorsal white line is a row of transverse pale blue spots.

After feeding for four or five weeks the caterpillars leave the tree in search of a sheltered place for their cocoons, a crevice in the bark, the eaves of buildings, or rubbish piles, proving attractive for this purpose. The cocoon is an elongated oval with the outer silk delicate and loosely woven and the inner part firmer and close. The inner cell is painted on the inside with a thick yellow liquid which soaks through the cocoon and soon dries to a yellow powder.

The insect remains in the cocoon from two to three weeks, when it emerges as a brown moth expanding about one and one-half inches. The fore wings are crossed obliquely by two pale lines. The general color of the moth varies from buff to reddish brown in different individuals.

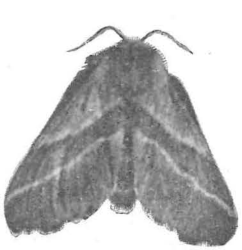

FIG. 21. Female moth photographed in resting position; slightly enlarged.

REMEDIES.

This insect is so easy to combat that its presence to any great extent in an orchard is due largely to negligence. During the bright days of winter and spring the egg masses are readily detected on young twigs as their varnished surfaces glisten in the sun. These should be removed and burned.

Since the caterpillars congregate in their tents at night and are not early risers, they can be destroyed, the whole colony at once, by soaking the tent with kerosene emulsion, or soap or washing powder suds (Formulas 7, 10). This may be applied by a swab attached to a pole. Any time when the whole family is "at home" is suitable for this remedy, as the early morning, evening, or a cold or cloudy day.

Arsenical sprays (Formula 6) will kill the caterpillars and may be applied to the branches near the tents. Trees sprayed early in the spring for the bud moth and other early caterpillars will be sufficiently protected against the tent caterpillar also.

3. Bud Moth.

(*Tmetocera ocellana.*)

This is probably one of the worst pests to apple orchards in Maine. It works in the unfolding flower and leaf buds of orchard trees, often doing great damage to the crop, besides attacking nursery stock and young trees.

The half grown, brown, hibernating caterpillars usually emerge from winter quarters about the time the buds begin to expand, their first appearance depending on the advance of the season, and ranging over two or three weeks. When they are out early, they gnaw into the buds. If the buds are open they crawl inside. They attack both flower and leaf buds, fastening the parts together with silken threads forming a nest, within which they feed upon the enclosed tender flower or leaf parts. They do not confine their depredations to a single leaf or flower in the bud, but increase the injury done by sampling nearly all. They sometimes bore down the stems a few inches, killing the terminal shoots. The bud attacked turns brown, making the nest conspicuous. The caterpillars feed mostly at night for 6 or 7 weeks and moult 3 times. When full grown the caterpillar forms a tube out of leaves, which it lines with thin, closely woven silk, and within it soon changes to the pupa. In about 10 days the pupa works its way nearly out of the tube by the hooks on its back. The skin splits open and the moth appears. The moths are on the wing during the latter part of June and the first of July. They fly mostly, at night, resting on the trees during the day time, when they may be easily recognized by the white bands on the ash colored wings. The moth has a wing expanse of 3-5 of an inch. They live 2 or 3 weeks, during which time they mate and the eggs are laid. The eggs, which resemble small fish scales, are laid singly or in clusters, mostly at night, on the under side of the leaves. The eggs hatch in 7 to 10 days. The young larvæ feed upon the epidermis of the leaf, forming a silken tube for protection. After the fourth moult, which occurs the last of August or the first of September, or before the leaves fall, they leave the silken tubes and form a silken winter home (*hibernaculum*) on the smaller twigs near the buds, in which they spend the winter. The appearance of the hibernating larva in the spring completes the cycle of life.

REMEDIES.

Pull off and burn the withered clusters of leaves containing the caterpillars and chrysalids early in spring. Spray with arsenate of lead (Formula 6) as soon as the buds begin to swell in the spring. It will not do to wait until the attack is made.

4. LEAF SEWER.

(*Ancylis nubeculana.*)

The leaf is folded along the mid rib, the two sides being brought together, the caterpillar constructing its nest within (fig. 22). The winter is passed in the larval condition in the folded leaves which lie on the ground. In April the larvæ transform in pupæ and about 10 days later the moths begin to appear, laying eggs in June. The caterpillar is about ½ inch in length when full grown, yellowish green, with yellow head,

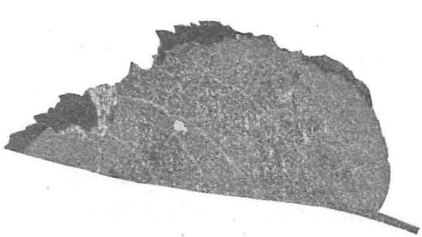

FIG. 22. (From Me. Ag. Exp. Sta. Bul. 177).

and horny shield on the next segment a little darker, with a black dot on each side. On each of the remaining segments there are some pale, shiny, raised dots (tubercles) from every one of which arises usually a single hair.

In the perfect state this insect is a small white moth with brown markings with an expanse of wings of about ¾ inch.

REMEDIES.

When the injury to the tree is serious the fallen leaves may be raked up and burned in the autumn to restrict the development of the moth the following season.

5. The Cigar Case-Bearer.

(*Coleophora fletcherella.*)

The caterpillars infest mainly the leaves, but in the spring they may also be found on the buds and the young fruits. The full grown caterpillar is reddish orange and averages 1-5 of an inch in length. The case, as it is made in the fall, is a minute flattened curved structure composed of portions of the upper

Fig. 23. (After Slingerland).

and lower skins of the leaf. In the spring a second case (fig. 23) is made, which is longer, cylindrical or cigar-shaped, in which the larva pupates. The adult insect which emerges from the pupa during June and July is a small, steel gray moth expanding less than ½ an inch.

REMEDIES.

This insect can be kept in check by arsenical sprays (Formula 6), the first to be applied as soon as the cases are noticed on the opening buds. A second and perhaps a third application may be necessary at intervals of 4 to 7 days on badly infested trees.

AAA. INSECTS ON OR IN THE FRUIT.

(Divisions a, b, and c.)

a. *Caterpillars with 3 pairs of thoracic and several abdominal legs.*

1. Full grown caterpillar less than ½ inch long, with an anal fork*, mining in the fruit.
   1. *Lesser apple worm.* Page 367.
2. Full grown caterpillar nearly ¾ inch long without an anal fork, mining in the fruit. (fig. 40).
   2. *Codling Moth.* Page 367.

Full-grown mottled caterpillar, 1½ inches long eating into the fruit. *Mottled fruit caterpillar.* Page 345.

b. *Legless maggots or grubs.*

3. Very slender white maggots mining in the flesh of the apple leaving brownish tracks.
   3. *Apple maggot or railroad worm.* Page 369.
4. A small white grub mining in the very small windfalls in early summer. (fig. 25). 4. *Plum curculio.* Page 371.

c. *Mature insects with wings and legs.*

4. A gnarled blackish snout beetle with dusky reddish markings, puncturing the fruit. (fig. 27).
   4. *Plum curculio.* Page 371.
5. A flat yellowish mottled bug with slender beak; ovipositing in and deforming the fruit. (fig. 28).
   5. *Tarnished plant bug.* Page 374.
6. A long legged yellowish brown beetle feeding on fruit. (fig. 18). *Rose chafer.* Page 358.

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* The anal fork can only be seen with a high power microscope, the larva being slightly compressed between cover glass and slide.

1. Lesser Apple Worm.

(*Enarmonia prunivora.*)

The larva feeds upon the apple in a manner similar to that of the codling moth, for which it is doubtless frequently mistaken. Besides by its smaller size the larva may be distinguished from that of the codling moth by the presence of the anal fork. The adult moth expands about 5/8 of an inch across the wing. The ground color of the front wings is black, with patches of pale rusty red, of gray, and of yellowish white and steel blue oblique lines. The hind wings are dusky gray at the base, shading to black at the apex.

REMEDIES.

The insect may be combated by spraying used against the codling moth.

2. The Codling Moth.

(*Carpocapsa pomonella* L.)

The codling moth passes the winter in the larval stage in silken cocoons in cracks and holes in the trees and in houses where apples have been stored. In the spring these larvæ change to pupæ, and the moths emerge about a month after the apple is in blossom.

The moth (fig. 40, *a*) varies somewhat in size, but the maximum spread of its wings is about three-fourths of an inch. The front wings are of a brownish gray color and are crossed with lines of gray scales, giving them the appearance of watered silk. At the tips of the wings there is a large brown spot, in which are many scales of bronze or gold. The hind wings are grayish brown in color. The moth lays her eggs, a few days after emergence, on the leaves of apple or other food plant, or on the fruit. A majority of the eggs of the first generation are laid on the leaves, while the greater part of those of the second generation are laid upon the fruit.

A large number of the larvæ which hatch from eggs deposited on the leaves eat small portions of the leaves before finding fruit. The larva, living most of its life within the fruit, throws out through its entrance hole, which it enlarges from time to time, or through its exit hole in the side of the fruit, the characteristic mass of frass or excrement which is the sign of infestation.

The larvæ have some difficulty in entering the smooth sides of the fruit, and about 80 per cent of the first generation enter by way of the calyx, while the majority of the second generation enter at the sides, especially where the fruits are touching.

Before entering the young apple the larva feeds, as noted, on the leaves, but also for a day or two within the partial concealment formed by the calyx or blossom end of the apple. During several days, therefore, the little apple worms feed externally, both before they enter the calyx and within the latter, and the object of spraying is to insure their being poisoned by thoroughly coating in advance, with an arsenical mixture, the leaves, and especially the blossom end of every fruit, before the shutting up of the lobes of the calyx. Most of the larvæ enter the calyx after it is closed, and are then beyond the reach of any poison later applied.

The pinkish larva lives in the fruit about twenty days, and grows to a length of about five-eighths of an inch (fig. 40) when, being full fed, it makes a tunnel to the outside of the fruit, the entrance of which is filled with frass and silk. When ready to leave the apple this plug is pushed out. The larva then crawls out and immediately seeks a place in which to spin its cocoon.

Cocoons have been observed in the following places: In holes and cracks in the trunks and branches of the trees; under rough bark; in the fruits (though rarely); in the cracks in the ground around the tree; on or between the clods among the fallen fruit; under bands or anything else resting on or against the tree; in cracks and angles of the walls and roof of the building in which apples are stored; under shingles of buildings near apple trees; in fence posts and under pickets of nearby fences; in paper or other rubbish on the ground; and in various other places. The cocoons of the first generation are composed entirely of silk, while in those of the second generation are incorporated bits of wood and bark. The larvæ inside the cocoons transform into pupæ in about six days from the time of spinning the cocoon.

In about twenty days from the spinning of the cocoon the pupal skin splits and the moth emerges (fig. 40, *a*), lays its eggs, and gives rise to another generation.

MEASURES USED AGAINST THE CODLING MOTH.

An arsenical spray (Formula 6) immediately after the blossoms have fallen should be used and repeated 7 to 10 days later. Use burlap bands on trunks, killing all insects under them every 10 days from July 1 to August 15, and once later before winter.

3. Apple Maggot or Railroad Worm.

(*Rhagoletis pomonella.*)

The adult stage of the apple maggot is a fly, a little smaller than the house-fly and readily distinguished by four dark irregular bands across the wings; these are found in the apple orchards from about July first until frost. During this time the females are employed laying eggs, by piercing the skin of the apple with a sting-like ovipositor and leaving at each incision one egg buried in the pulp. Each female is capable of laying at least three or four hundred eggs.

From these eggs hatch apple maggots which tunnel through the pulp where they feed until full grown. The maggots are small, plump, white objects without legs and with head so ill defined that it is difficult to find it at all. The mouth parts are reduced to a pair of rasping hooks. The apple maggot works in soft discolored mushy trails anywhere in the pulp. The trails of the apple maggot never contain little round sawdust-like pellets. Often their tunnels lie directly beneath the skin of the apple, showing through in the light colored varieties as dark trailing tracks which have won for the apple maggot the popular name of Railroad Worm (fig. 44). *But, though the maggot frequently comes near the surface of the apple, it never breaks through the skin until it is through feeding and is thus always protected, a circumstance which shows clearly that it is of no use to try to destroy this pest by spraying.*

When the eggs are laid, the apples are young and hard and for some time the maggots grow very slowly. At this stage the tunnels are very inconspicuous and the maggots themselves are not likely to be detected except by careful search. As the apple matures, the maggot makes more and more headway and is frequently full grown by the time the apple is ripe (fig. 43). Moreover the presence of the maggots seem to hasten the development of the apples and much of the infested fruit comes to the ground as windfalls. *This is the reason so much stress is laid on the destruction of windfalls to get rid of the maggot.*

Since the flies are so long on the wing and lay their eggs over such an extended time, the full grown maggots are found at different periods. The first eggs are laid naturally in the early fruit and accordingly as soon as August tenth full grown maggots have been recorded in Early Harvests. On the other hand, some of the later maggots, from eggs laid in harder winter varieties, do not acquire their full size until late in the fall or winter. These are the maggots that are stored with the fruit.

The full grown maggots bore out of the windfalls and bury themselves an inch or less in the ground. Or, if they are in gathered fruit where they cannot find a suitable burying ground, they creep away beneath some protecting object instead. Soon after leaving the apple (sometimes the transformation takes place within the apple but not often) the maggots shrink a little in length and bulge a little in thickness, the skin at the same time growing tougher and slightly darker. The insect is known in this form as the pupa, and rests in this stage all winter. With the return of summer a second transformation takes place when the tough skin which has covered the pupa all winter is broken open by the adult insect (a fly with dark bands on its wings) which has developed inside the pupal case. This mature fly spends its life laying eggs in the flesh of young apples, thus starting a new generation of apple maggots.

Maggot. Fly. Pupa.

FIG. 24.

The apple maggot enlarged 3 times.

The maggot, pupa, and adult fly are shown in the accompanying illustration, enlarged about 3 times. (Fig. 24).

PREVENTIVE MEASURES.

As pointed out here, it is useless to try to poison the growing maggots as they are within and protected by the apple. It is also evident that if the maggots contained in windfalls and picked fruit are destroyed one year there will be no trouble to fear from them the next. Of course it is highly improbable that even by the greatest vigilance, every maggot could be thus destroyed. But when it is considered that each maggot left to its own devices has a chance of becoming a fly capable of laying at least three hundred eggs, and that each maggot undestroyed this year may mean three or four hundred next year, the importance of killing as many as possible is evident. If the apple maggots, as do many insects, all developed about the same time, the problem would be much simpler, but as full grown maggots are found in apples from before the middle of August until into the winter, the watch for them must extend over several months.

If enough hogs or sheep to eat the windfalls are kept under infested trees from the second week in August until the fruit is finally gathered, all the maggots in windfalls will be got rid of. Of course the same results, as far as destroying the maggots is concerned, can be obtained by having windfalls faithfully gathered during this time and fed to stock, or made into cider.

In one orchard where the main crop is not sweet fruit, a plan of baiting for the apple maggot has proven successful. A few Tolman sweet trees are grown in the orchard as traps. The flies deposit the majority of eggs in these sweet apples by preference, and the other fruit is saved to a great extent. All of the Tolman sweet apples, in this case, are gathered and destroyed.

4. PLUM CURCULIO.

(*Conotrachelus nenuphar.*)

At about the time in early spring when vegetation resumes activity and buds begin to push, curculios, which have hibernated under rubbish on the ground, under the rough bark of trees and in other secure hiding places, emerge from concealment and seek the fruit plants upon which they feed and breed. About the time the trees bloom, mating begins and as soon as the young fruit enlarges the deposition of eggs begins. Apples no larger than small peas often bear from 1 to 3 of the characteristic crescent marks made by the curculio. These punctures as well as those made by the adult beetle in feeding cause a serious deformation of the fruit (fig. 45). The deposition of eggs goes on most rapidly during the month of June, but continues through July and August, gradually growing less and less as the beetles die. The majority of the beetles of this generation do not live beyond the month of July, but a few may survive until September, or in rare instances until late fall. During the season both males and females feed upon the same fruits in which eggs are deposited, making small, usually cylindrical punctures. The eggs hatch in from 4 to 6 days and the young larvæ start tortuous burrows through the fruit. Development of the larvæ causes the fruit to fall within a few days. In about 20 days the larvæ mature, cease feeding, bore out of the fruit, and at once enter the ground where they complete their transformations and in about 28 days emerge as perfect beetles. (Figs. 25, 26, 27). The newly emerged beetles usually remain quiet for a day or two, allowing the body wall, beak and jaws to harden; then they fly into the trees and begin feeding upon the fruit. Beetles of this new generation do not (except possibly in rare cases) pair and no eggs are laid during this first season. The fruit is freely punctured for feeding purposes and the amount of this work increases as the season advances. It is this feeding of the new generation that causes the greatest injury to the fruit crop. (See fig. 45). Feeding continues as long as fruit remains upon the trees. Late in the fall the beetles leave the trees and hide away in secure places for the long winter period of hibernation. Such in brief is the life history of the plum curculio.

Another curculio known as the *Apple curculio* is smoother and has a longer snout. This species has not been recorded from Maine.

REMEDIAL MEASURES.

Destruction of fallen fruit is one of the chief means of combating this pest. Where hogs are pastured in the orchard with a view to devouring apple maggots in fallen fruit the curculios would be incidentally disposed of. The recommendations that fallen fruit be destroyed commonly conveys no idea of the first fallen apples. The mind turns to the tangible fruits of midsummer and fall, and where the recommendation is followed the small apples that fall in early summer are entirely ignored. The same small apples are, however, an important factor, and should be considered in any systematic attempt to control the ravages of the plum curculio.

FIG. 25. Larva (enlarged).

FIG. 26. Pupa (enlarged).

FIG. 27. Adult (enlarged).

It does not seem possible for an apple one-fourth inch or less in diameter to supply nourishment enough to bring a larva to full maturity, but it has been learned that larvæ can and do develop in just such apples. To gather them would be impracticable, but if clean culture is practiced they and the larvæ they contain could be largely destroyed by use of the disk harrow or some other tool that would chop them up or bury them. If the ground is clean and the orchard sufficiently open, so that the sun can shine upon the apples as they lie upon the ground, nothing further is necessary, because direct sunlight upon the apples will kill the contained larvæ. Superficial tillage of the surface soil can be commended as an effective method of attacking curculio. This tillage should be carried on continuously or at frequent intervals for a period of from 30 to 40 days, during which the great bulk of the new crop of plum curculios is in the ground. The object of tillage is to turn the pupæ out, kill some in the process, and expose the rest to the elements and to birds and insects that prey upon them.

5. Tarnished Plant-Bug.

(*Lygus pratensis.*)

This insect is a very destructive one, and injuriously affects a large number of cultivated plants. It passes the winter in the perfect state, taking shelter among rubbish, or in other convenient hiding-places, and early in May, as soon as vegetation starts, it begins its depredations.

These insects are partial to the unopened buds, piercing them from the outside and sucking them nearly dry, which causes them to become withered and blackened. Sometimes a whole branch will be thus affected, being first stunted, then withering and finally dying. This insect also causes serious deformation of the fruit both by feeding and egg-laying punctures. Early in the morning these plant-bugs are in a sluggish condition, and may be found hidden in the expanding leaves; but as the day advances and the temperature rises, they become active, and when approached dodge quickly about from place to place, drop to the ground, or else take wing and fly away. In common with most true bugs, they have when handled a disagreeable odor. In the course of two or three weeks they disappear, or cease to be sufficiently injurious to attract attention.

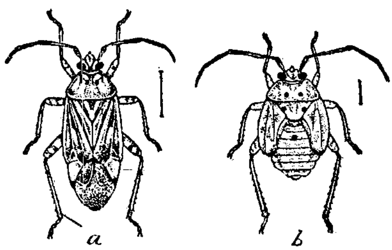


Fig. 28. (After Chittenden). Enlarged.

The mature bug (fig. 28, *a*) is about one-fifth of an inch long, and exceedingly variable in color and markings, ranging from a dull brown to a greenish or yellowish-brown. In a typical specimen the head is yellowish, with three narrow reddish stripes; the beak is about one-third the length of the body, and is folded upon the breast when not in use. The prothorax has a yellow margin and several longitudinal yellowish lines; behind the prothorax, upon the scutellum, is a yellow V-shaped mark; the wings are dusky brown, with a pale cuneus and black point at the apex; the legs are dull yellow. The immature insects are greenish; if a little older they possess a pair of round black dots on the back of the thorax, another pair on the scutellum, and a single dot on the abdomen.

COMBATIVE MEASURES.

Since these insects hibernate among rubbish of all kinds, clean culture is very important. By clean culture is understood the removal of all litter from fence corners, so as to take away the shelters in which the insect winters. When they appear in spring the plants upon which they are should be shaken early in the morning, while the bugs are still in a torpid condition, making them fall upon a sheet underneath and then destroying them. As soon as it becomes warm the insects are exceedingly active, and so swift in all their motions that they cannot be captured readily.

BENEFICIAL INSECTS.

(Adapted from Packard.)

In a great variety of ways certain insects are helpful to man, and are especially efficacious either in insuring his crops or in destroying those insects which would otherwise devour them.

Pollenizers of Fruit-trees.—A very important part in the production of abundant crops of fruit is played by bees and other honey or nectar gatherers, and pollen-feeding insects. It is now generally acknowledged that bees, especially the honey-bee, act as "marriage-priests" in the fertilization of flowers, conveying pollen from flower to flower, and thus insuring the "setting" of the fruit. Many wasps, as well as butterflies and moths, species of pollen-eating beetles, thrips, and other insects, by unconsciously bearing pollen from distant flowers, prevent too close in-and-in breeding. Indeed, as Goethe said, flowers and insects were made for each other. Many plants would not bear seeds did not insects fertilize them. Insects are in the first place attracted to flowers by their sweet scent and bright colors, and it is claimed that the lines and circles on the corolla of certain flowers guide them to the nectary; though we do not see why the scent is not in the main sufficient for this purpose. According to Sir John Lubbock, "The visits of insects are of great importance to plants in transferring the pollen from the stamens to the pistil. In many plants the stamens and pistil are situated in separate flowers; and even in those cases where they are contained in the same flower, self-fertilization is often rendered difficult or impossible; sometimes by the relative position of the stamens and pistil, sometimes by their not coming to maturity at the same time. Under these circumstances the transference of the pollen from the stamens to the pistil is effected in various ways. In some species the pollen is carried by the action of the wind; in some few cases, by birds; but in the majority, this important object is secured by the visits of insects, and the whole organization of such flowers is adapted to this purpose."

Parasitic Insects (*Ichneumons and Tachinæ*).—While insectivorous birds accomplish much towards reducing the numbers of injurious insects, they often as likely as not eat the beneficial as well as the destructive kinds. Without doubt the leading factor in preventing the undue increase of noxious insects are the parasitic kinds belonging to certain dipterous and hymenopterous families.

An ichneumon-fly (figs. 46-49) lays its eggs either on the outside of the caterpillar or bores under its skin inserting an egg within the body. The larva of the ichneumon upon hatching works its way into the interior of the host. Here it does not injure the muscles, nerves, or the vital parts of the caterpillar, but apparently simply lies motionless in the body-cavity, absorbing the blood of its host.

Tachina (*Senometopia*) *militaris* has been observed by Riley to lay from one to six eggs on the skin of the army-worm, "fastening them by an insoluble cement on the upper surface of the two or three first rings of the body." The young maggots on hatching penetrate within the body of the caterpillar, and, lying among the internal organs, absorb the blood of their host, causing it finally to weaken and die. Sometimes but a single maggot lives in its host. Many grasshoppers as well as caterpillars are destroyed by them.

Insectivorous Insects.—There are very many carnivorous kinds which devour insects entire. Such are the ground-beetles (fig. 51), water-beetles, the larvæ of Tenebrionids and of lady-beetles (Coccinella) (figs. 52, 53), and those of the lace-winged flies (Chrysopa) which prey on Aphids, though the maggots of the Syrphus flies are more abundant and efficacious as Aphis-destroyers.

Practical Application.—When the life of an injurious insect is carefully studied, it is frequently found that the pest can be combated by breeding and distributing its natural parasitic and predaceous enemies. For a most remarkable example of such an undertaking, it is only necessary to mention the work of the U. S. Government and Massachusetts against the Gypsy Moth. For current accounts of this work the reader is referred to the Annual Reports of the Mass. State Forester, and publications of the U. S. Bureau of Entomology.

REFERENCES TO LITERATURE ON APPLE INSECTS.

a. CIRCULARS AND BULLETINS FROM THE MAINE AGRICULTURAL EXPERIMENT STATION.*

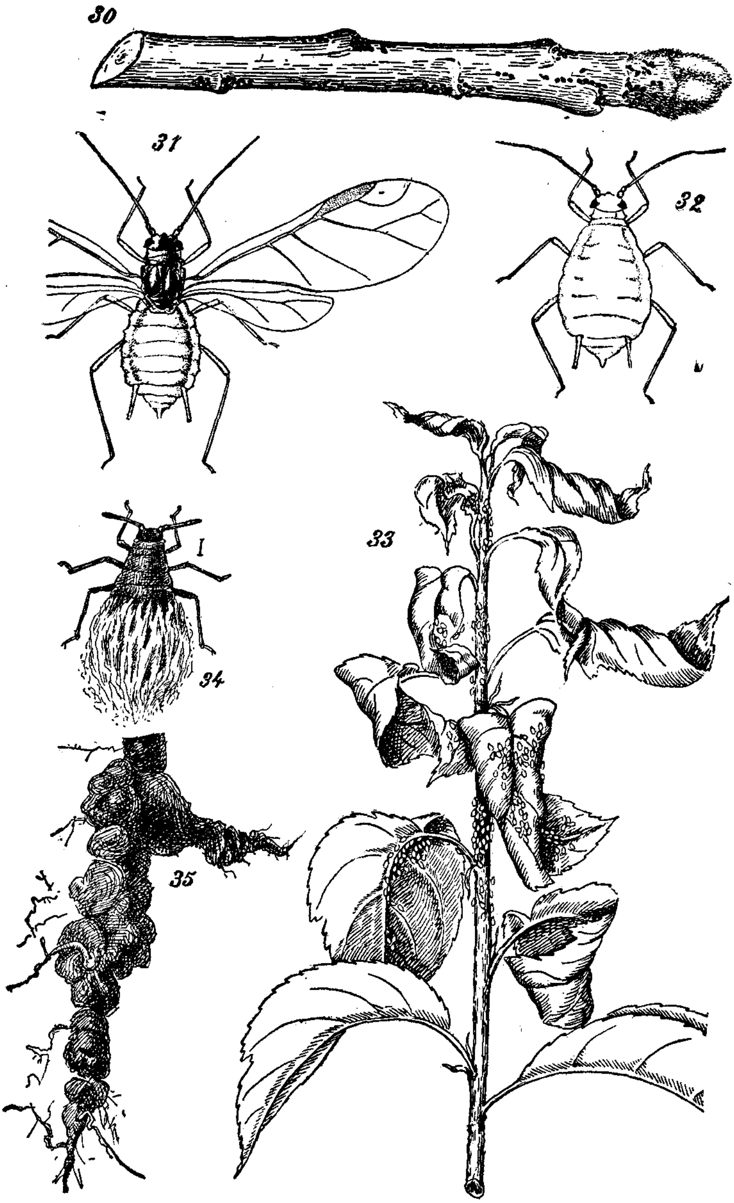
Circular. Red-Humped Caterpillar.
" Yellow-edge or Mourning Cloak Butterfly.
" Yellow-neck Caterpillar.
" Cecropia Moth.
" Tent Caterpillar.
" Forest Tent Caterpillar.
" Tussock Moth.
" Brown-Tail Moth.
" Apple Maggot or Railroad Worm.
" Plum Curculio.
" Tiger Swallow-tail Butterfly.
" Sphinx Chersis and other Hawk Moths.
" Fall Web Worm.
" Tiger Moths.
" Bud Moths.
" Io Moth.
" Two Scale Insects of Maine.
Bulletin 161. Saddled Prominent.

b. CIRCULARS AND BULLETINS OF THE UNITED STATES DEPARTMENT OF AGRICULTURE.**

Circular	7.	Bureau of Ent.	Pear-tree Psylla.
"	9.	" " "	Canker Worms.
"	11.	" " "	Rose Chafer.
"	20.	" " "	Woolly Aphis of the Apple.
"	26.	" " "	Pear Slug.
"	29.	" " "	Fruit-tree Bark-beetle.
"	32.	" " "	Larger Apple-tree Borers.
"	42.	" " "	How to Control the San Jose Scale.
"	81.	" " "	Aphids Affecting the Apple.
"	98.	" " "	Apple-tree Tent Caterpillar.
Farmers' Bulletin	127.	Bu. of Ent.	Important Insecticides.
" "	264.	" " "	Brown-tail Moth and How to Control It.
" "	275.	" " "	Gypsy Moth and How to Control It.

*These may be secured free of charge by applying to "Maine Agricultural Experiment Station, Orono, Maine."

**These may be secured free of charge by applying to the U. S. Department of Agriculture, Washington, D. C.



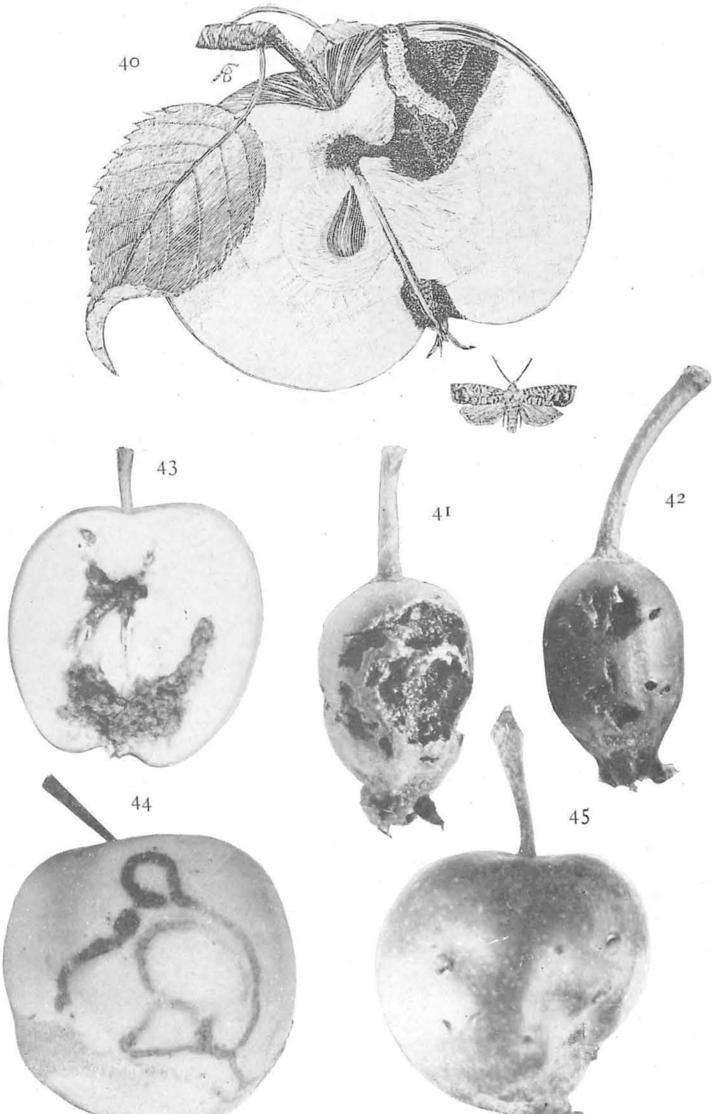
APPLE APHIDS AND WORK.

FIGS. 30-33 Green apple-aphis; 30, Winter eggs; 31, Winged form; 32, Wingless form; 33, Leaf curl caused by Apple-aphis; 34, Woolly aphis wingless form; 35, Knotty root caused by Woolly aphis.

(FIGS. 30-33 after Quaintance; 34, 35 after Marlatt; 31, 32 and 34 enlarged).

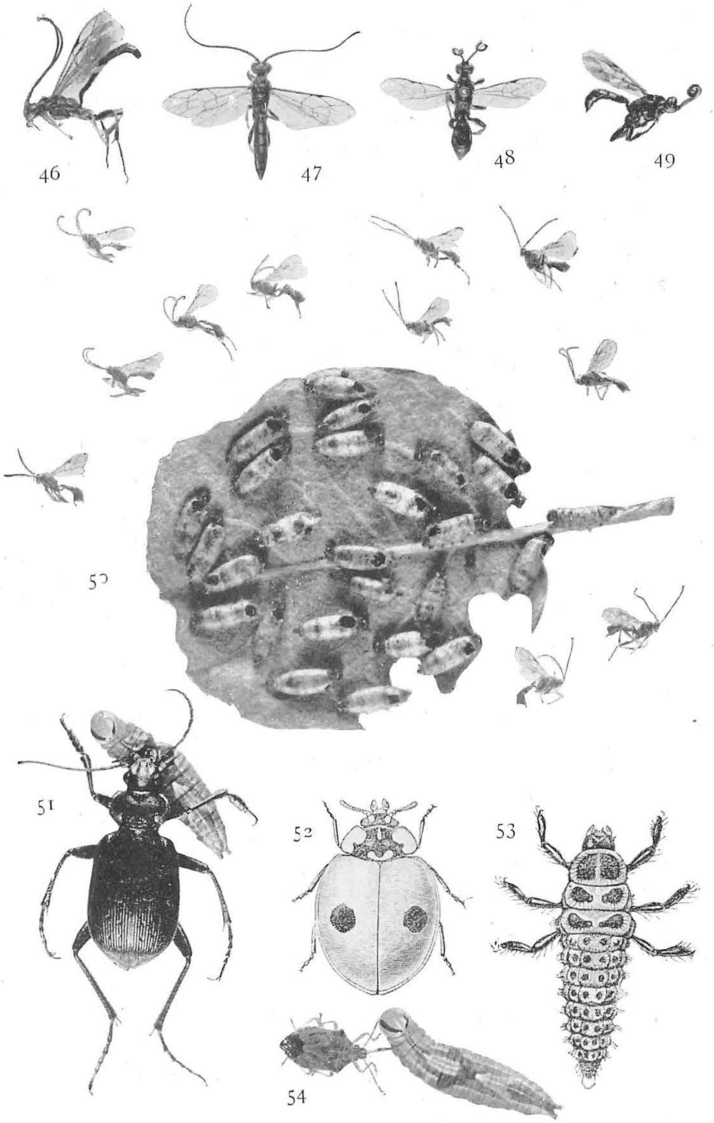
WINTER STAGES

Photographed from Maine specimens. Fig. 36, Eggs from which Tent Caterpillars hatch. Fig. 37, Cocoon of Cecropia Moth ($\frac{1}{2}$ size). Fig. 38, Winter nest of Brown-tail Moth. Fig. 39, Eggs of the antique Tussock Moth on cocoon.



APPLES INJURED BY INSECTS

Fig. 40, Coddling Moth *(after Lodeman)*. Figs. 41, 42, Apples eaten by Rose Chafer (photographed July, 1907). Fig. 43, Section of apple showing work of apple maggot (Photographed Oct., 1907). Fig. 44, Hightop with characteristic trail of apple maggot (Photographed Sept., 1903). Fig. 45, Apple deformed by apple curculio (Photographed July 11, 1907).



BENEFICIAL INSECTS

Figs. 46-49, Ichneumon sublatus, parasites bred from pupae of Saddled Prominent. Fig. 50, Parasitized specimens of young Red-humped Caterpillars attached to apple leaf and parasites *(Limneria guigardi)* which emerged from them. Photographed August 29, 1906. Fig. 51, Beetle *(Calosoma)* feeding on Saddled Prominent (Bul. 161 Maine Agr. Exp. Sta.) Fig. 52, 53, Lady Beetles, adult and larva, which feed on Aphids (enlarged) *(After Marlatt.)* Fig. 54, Podisus modestus, a bug stabbing the Saddled Prominent (From Bul. 161 Maine Agr. Exp. Sta.)

Fig. 55. Mottled Fruit Caterpillar (*Crocigrapha Normani*). Photographed July 10, 1907.

MAINE APPLE DISEASES.

MAINE APPLE DISEASES.

INTRODUCTION.

While Maine is well to the north of the apple-growing section of the United States, there is no settled part of the State where at least some varieties of eating apples cannot be grown successfully. Even in northern Aroostook in the latitude of Quebec certain of the Russian varieties, and some of the more hardy apples of American origin, are grown to perfection and are of a quality unexcelled. Moreover these varieties are perfectly hardy there, sometimes withstanding temperatures of —40 degrees F. and below. During the winter of 1906-7, when southern Maine and certain other parts of New England and adjacent portions of Canada suffered great loss from winter killing of apple trees, practically no damage was observed in Aroostook County.

Fortunately or unfortunately, as it might be regarded from one point of view, climatic and soil conditions are such in Maine that a fair crop of good apples can be produced usually with a minimum of care and attention. In too many instances in years gone by the owner has not felt the necessity of giving his orchard any attention after setting the trees other than to harvest the grass which grows therein and to pick an occasional crop of apples which may be produced; cultivation, if any, being secondary as a result of growing some annual crop in the rows between the trees. The fact that a considerable number of trees would survive this treatment, producing fair returns for the labor involved, has in the past materially helped to delay the general adoption of more approved systems of orchard management.

Competition with apples produced farther west, which command a higher price simply on account of more attractive appearance and packing, has resulted in rapidly increased attention to and adoption of better methods of orchard management. In every case where these improved methods have been introduced, the results have far exceeded expectations. At the same time there has been within the last few years a combined and united effort among the various agencies in the State which are concerned in the furtherance and betterment of the agricultural and horticultural interests to bring about the production of more and better fruit in Maine. As a result of these various factors working together, the old let-alone methods of orcharding are rapidly passing. Old orchards are being trimmed and renovated and orchard cultivation and spraying are yearly receiving more attention. Not only are the old orchards receiving better care, but probably more new trees have been set in 1910 than in any other single year in the history of orcharding in the State.

With increased attention to the welfare of the trees, the owners are becoming aware of the fact, as never before, that there are various diseases which impair the health of the tree by attacking the trunk, limbs and leaves, which also are detrimental to the appearance and keeping qualities of the fruit. Therefore, in response to many inquiries addressed to the Station for information along this line, it has seemed best to prepare a somewhat comprehensive publication upon the nature and treatment of Maine apple diseases. While, as far as possible, the results of studies and investigations made at this Station are made the basis of the recommendations given, the published reports of work in other parts of the country have been freely drawn upon where necessary.

Published data with regard to the nature and extent of Maine apple diseases is rather meager. Therefore it is hoped that in addition to providing descriptions and giving methods for the control of the more common diseases which interest the orchardist this publication will be of some value in extending the known range of the various diseases of the apple and in a measure give some idea of their prevalence and distribution in the State. With this end in view some few diseases, particularly some of the apple decays, which are either new or little known in America, but which have been found in Maine, have been mentioned and briefly described. As a rule these are not of much economic importance in the State. Similarly a description of some diseases, like the bitter rot of the fruit, which occur to a slight extent in the State have been included because these are of great economic importance in other parts of the country. These latter may or may not become factors in Maine orcharding, but it seems desirable that all apple growers become familiar with their characters.

CHARACTER AND CAUSES OF APPLE DISEASES.

If we accept a rather broad definition that disease in plants includes the effect of every unfavorable factor entering into the life of the plant it follows that various agencies of the living and non-living environment may be responsible for the condition known as disease. While it is not always easy or convenient to discuss the disease apart from the cause, it should be kept clearly in mind that the parasite or other exciting factor is not the disease. The latter is the condition induced in the host as the result of the presence of the former, rendering the plant partly or wholly incapable of responding to its environment. Therefore all methods of disease control should be based upon an as extended and as detailed knowledge as possible of the responsible factor or factors regardless of their nature, but it is important as well to be able to recognize the outward manifestations or signs of the disease upon the host to aid in its identification. The outward manifestations of plant diseases are frequently not apparent until too late to remove the cause and save the plant or fruit. Hence from their character and mode of attack preventive measures must be largely relied upon to prevent losses from plant diseases, particularly those which attack the apple.

Those diseases which are induced by unfavorable soil and climatic conditions or other non-living agencies are said to be *non-parasitic*. Those which result from the attacks of various forms of organic life upon the host or from their presence within its tissues are classified as *parasitic* diseases.

This bulletin is concerned with certain non-parasitic diseases and those parasitic diseases of apple trees and fruit in Maine which are produced by fungi and bacteria.

In this State fungi are responsible for the major part of the loss from the diseases under consideration. Fungi are low forms of plant life made up of threads of microscopic size. These threads constitute the *mycelium* of the fungus, which penetrates into the tissues of the host, causing the death of the cells which compose these tissues and living upon their contents. The conspicuous portions of the fungus which are seen on the surface of the host are in most cases the fruiting organs. Instead of seeds these fruiting organs produce various forms and in various ways, often in vast numbers, more simple bodies which are known as *spores*.

In combating apple diseases caused by fungi, the chief object is to prevent the formation of these spores, or if they are formed to destroy them before they can germinate and gain a foothold upon healthy fruit, foliage, or wood. This is more frequently brought about by destroying the diseased portions as soon as observed and by coating or spraying the healthy parts with some substance which will prevent the germination and destroy the spores if by chance they fall thereon.

The threads of many fungi are colorless, while others are more or less colored or darkened, but all are devoid of the green coloring matter which enables the higher plants to manufacture their food substances, through the aid of energy obtained from sunlight, from the simpler compounds which they get from the air, soil and water. Hence fungi and bacteria which are also deficient in green coloring matter must depend upon more complex organic bodies to supply their food materials. Through the action of various ferments which they produce, parasitic fungi can break down and destroy, with varying degrees of ability, the tissues of their host plants. The results of this decomposition furnish them the food materials necessary for their maintenance and growth. The threads of a wood destroying fungus may be penetrating deep into the interior tissues of an apple tree, causing their death and decay with very little evidence of disease upon the surface. In fact the conspicuous, external symptoms do not as a rule appear till the fungus has used up considerable of the available food material and throws out fruiting organs on the surface.

Those fungi and bacteria which are able to attack living bodies are said to be *parasitic* or *parasites*. Those which secure their nourishment from dead organic matter are designated as *saprophytic* or *saprophytes*. The saprophytes far outnumber the parasites and the majority of them cannot under any condition cause disease. However, there is no hard and fast line between the two classes. Some fungi which ordinarily live as saprophytes may, under favorable conditions, attack and destroy living plant tissues. Some fungi are obligate parasites but a large number of the disease producing forms are capable of a saprophytic mode of existence as is shown by the fact that they may be successfully grown upon a variety of artificial culture media. This fact is of great importance to the orchardist. Dead limbs, piles of rubbish and rotted fruit which frequently are allowed to accumulate in the orchard are breeding centers for those fungi which attack the fruit, leaves, and wood of the tree. Hence the first step in removing the cause of disease is thorough orchard sanitation.

NON-PARASITIC DISEASES.

Winter Injury. Those parts of Europe and Asia where the apple is native have very moderate rainfall and are not subject to such wide range and abrupt changes of temperature as in this State. The northern limit of range of the apple except in the case of the very hardy varieties is determined approximately by the lowest winter temperatures, or —30° to —32° F., repeated at frequent intervals. Some varieties, like the Baldwin and Ben Davis, in Maine apparently are liable to be injured where the repeated minimum winter temperatures are several degrees warmer than this.

Other conditions also enter into winter killing, such as deficient rainfall in spring and early summer followed by a late fall, thus preventing early growth, maturity and ripening of the season's wood. Similarly too, late cultivation and the application of large amounts of fertilizer rich in nitrogen may also stimulate to late growth and prevent ripening of the wood before cold weather comes on, and predispose to winter injury. The amount of moisture which the plant cells contain at the time the low temperatures are experienced is also a contributing factor. The more water they contain, beyond certain limits, the more likely will they be injured by freezing. This probably accounts for the fact that very frequently in Maine the trees in the more exposed locations have suffered less from winter-killing than those in more sheltered situations. There was better drainage, the ground frozen more deeply and the roots chilled and inactive and not supplying water to the plant tissues above.

The severe winter-killing of 1906-7 was probably due to the combined influence of low temperatures alternating with high and a large percentage of water in the tissues of the trees. Weather conditions of January, 1907, were particularly favorable to this as will be seen by examination of Fig. 56 which shows within a week a record of —40° F. and —35° F. with two warm days having a maximum temperature of + 45° F. and +47° F. situated midway between. Moreover it will be seen that the changes from extreme cold to thawing and back to cold again were quite abrupt, particularly in the case of the latter. Winter-killing of trees may occur, however, as the result of a deficiency of moisture in the soil associated with continued cold, dry winds in winter.

Much of the danger from winter-killing can be avoided by planting only those varieties which have been found to be perfectly hardy in a given locality. Only the most hardy varieties should be planted in those parts of the State where the minimum winter temperature frequently reaches or approximately reaches —30° F. The planting of Baldwins and possibly Ben Davis as large commercial ventures should be restricted to those parts of the State where the minimum winter temperature, repeated at frequent intervals, seldom reaches below —20° F. or at the utmost —25° F. The location of the orchard may have much to do with hardiness. Low, heavy or wet soils should be avoided,—it was orchards in such locations which suffered most in the severe winter-killing of 1906-7. Those which were located on more or less sloping land with good air drainage, with plenty of natural or artificial soil drainage as a rule suffered much less from winter injury.

There is considerable difference of opinion among Maine orchardists with regard to the value of wind-breaks. A very good illustration of the good they may do was furnished by an Orono orchard following the severe winter just referred to. This orchard was badly injured, particularly on the north and northwest sides of the more exposed trees and in the direction from which come the prevailing cold winds of winter. A natural wind break of evergreens and coppice growth was situated so as to protect a portion of the trees and here the injury was much reduced or absent altogether.

Aside from the possible value of planting wind-breaks very little can be done to prevent winter injury in orchards already planted except to provide artificial drainage where necessary and to avoid forcing the trees to too luxuriant and late growth during the latter part of the season, as has already been mentioned. However, much of the ill effects following an adverse winter may be eliminated by proper attention to the injured trees. Observations made in Maine orchards for 4 seasons following the winter injury of 1906-07 have convinced the writers that as much if not more damage has occurred indirectly from the attacks of fungi following the winter injury and which gained entrance through the wounds thus made than as a direct result of the winter injury itself. In many cases very little was done to remove the injured parts and they were allowed to decay and serve as breeding places for wood destroying fungi. Later this decay followed back along the injured limbs or into the interior of the trunks, resulting in the death of the entire tree.

While severe pruning and cutting back immediately following winter injury is not advocated, all dead wood should be cut out as fast as seen and the wounds at once covered with a good liquid grafting wax or two or more coats of pure white lead in boiled linseed oil, and then repainted as frequently as necessary to keep the wounds well coated till they are covered with the new growth.* The dead bark on trunk and crotch injured areas should be removed back to healthy tissue and the wood thus exposed kept well covered with grafting wax or pure white lead and boiled linseed oil. Bridge grafting may be used where collar freezing occurs.

Crotch injury. Associated with the winter-killing of 1906-07 many of the injured trees showed the bark killed in the crotches as illustrated in Fig. 57. A similar trouble was observed in Ontario and other parts of Canada. There is some difference of opinion as to just how this crotch injury was produced, but there is no reason for regarding it other than as one form of winter injury. This should not be confused with a similar trouble caused by the pear blight bacillus which has been described by Whetzel in New York.

Frost bands on fruit. Occasionally late frosts occur which are not sufficient to destroy the young fruit, but do result in a peculiar characteristic russeting. As the apple enlarges and approaches maturity this appears in the form of a band of vary-

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*In some instances severe injury to the trees has been reported where the entire trunks have been heavily coated with lead and oil, to prevent insect attacks. This may be due, however, to the use of impure lead and either unboiled oil or some substitute for linseed oil. In the writers' experience, and so far as can be learned, the use of pure white lead in boiled linseed oil has been universally successful in treating wounds made in pruning.

ing width extending entirely around the fruit midway between the stem and calyx.

Frost injury of the leaves. Very frequently associated with frost bands on the fruit there is more or less injury on the foliage. This has been described by Stewart and Eustace as follows:*

"On the upper surface the leaves were variously wrinkled and puckered, but the under surface was fairly even and normal in appearance except for certain areas on which the color was gray green. On some trees the leaves were badly distorted with the margins drawn downward and together as if they were unable to unfold properly. Usually, the wrinkles were most abundant along the mid-rib of the leaf and the elevated portions were of a somewhat lighter green than the other parts of the leaf. By cutting across the leaf with scissors it was found that where the wrinkles occur the lower epidermis is separated from the green, pulpy tissue (mesophyll), thus forming a large interior cavity or blister. The distance between the green tissue and the loosened epidermis was frequently as much as four millimeters (one-sixth of an inch), and the blisters thus formed were of all sizes up to those having an area of 100 square millimeters or even more. In many cases the separated epidermis became ruptured as if slit with a knife, leaving the cells of the mesophyll exposed. Sometimes the tender cells thus exposed died, causing the formation of an irregular, dead, brown spot, visible on both surfaces of the leaf. However, in the majority of cases the exposed cells remained green throughout the season."

They ascribe this to a frost occurring about the 10th of May, and the appearance of the trouble first came to their attention about June 1. They state that in 1902 this condition was general throughout New York except in the Hudson Valley and on Long Island. A similar condition has appeared in Maine but no such general occurrence has been observed by the writers. This curling of the leaves as the result of early frosts should not be confused with that caused by apple scab, aphids or plant lice.†

*Stewart, F. C. and Eustace, H. F. N. Y. Expt. Sta. Bul. 220, p. 218. 1902.

† See pp. 16 and 17 of the Circular on Apple Tree Insects of Maine.

*Protecting orchards from frost.** The apple crop in Maine, as in many other parts of the country, is often materially reduced and in some sections may amount to a total failure as the result of frosts occurring at blossoming time or when the fruit is small. From time to time the question of starting fires and smudges in the orchards on cold nights to ward off the frost has been agitated, but the practicability of this has remained more or less of an open question. Recent work in the far West indicates that it is entirely possible, under some conditions at least, to prevent the destruction of the crop in this way at relatively small expense. Interested parties are advised to write to the Secretary of Agriculture, Washington, D. C., for the free Farmers' Bulletin 401 which tells how this work is done.

Mr. P. J. O'Gara, the author of this bulletin, says: "The results of the past season's work in the Rogue River Valley have shown that many acres of crops valued at from $500 to $1,000 per acre have been saved at a total expendture of not more than $15 to $20 per acre for firing. Very striking examples have been seen where unsmudged orchards adjoining those that have been smudged have borne no fruit."

Russetting or spray injury of fruit. Bordeaux mixture, some of the prepared brands of lime-sulphur, and to a less extent home-cooked and self-boiled lime sulphur spray, may produce a russeting of the fruit.** The relative merits of lime-sulphur and bordeaux mixture as a spray for apple trees will be discussed elsewhere in this publication.

Experience at other places and at this Station has shown that bordeaux mixture is more likely to produce spray injury than most of the lime-sulphur sprays now on the market. Bordeaux injury first appears as small, regular, black or brown spots scattered over the apple, but more frequently on those parts which received the most spray. These spots differ from

*For many practical suggestions with accounts of successful commercial tests in several states in protecting orchards from frost at blossoming time the reader is referred to the special "Orchard Heating Number" of Better Fruit. Vol. V, No. 4, October, 1910.

**For an account of spraying experiments conducted in 1910 with a discussion of the spray injury from lime-sulphur and bordeaux mixture the reader is referred to Bulletin 189 of the Maine Experiment Station by Mr. W. W. Bonns.

those caused by the apple scab fungus in that they are more regular and are not sunken. As the apple grows these spots are replaced by russeted blotches. In severe cases the fruit may become distorted, irregular and sometimes cracked. Fig. 58 represents the later stages of bordeaux injury on the fruit.

The following list prepared by Hedrick classifies apples according to their immunity to bordeaux injury.†

"1. *No injury or very slight.*—Alexander,* Akin, Bietigheimer, Bloomfield, Baxter, Canada Baldwin, Doctor, Doctor Walker, Deacon Jones, Domine, Early Harvest, Esopus *Spitzenburg,* Fall Pippin, Fall Wine, Fishkill, Florence, Gano, Golden Russet, Judson, Keswick, Northern Spy, Oliver, Perry, Pomme Grise, Ralls, Red Canada, Richard Early Winter, Rome, Roxbury, Rutledge, Smokehouse, Stump, Swaar, Titovka,* Thompkins King, Yellow Bellflower.

"2. *Slight injury.*—Buckingham, Chenango, Clayton, Elgin Pippin, Fallawater, Fameuse, Fanny, Gideon, Grimes, Haas, Holland Winter, Hubbardston, Jewett, Karabovka,* Lady, Lady Sweet, Landsberg, Louise, McIntosh, McMahon, Maiden Blush, Monroe Sweet, Munson, Oldenburg,* Ontario, Pewaukee, Primate, Prince Albert, Pumpkin Sweet, Red Astrachan,* Reinette Pippin, Saint Lawrence, Shannon, Stanard, Stark, Sutton, Tetofsky,* Tolman *Sweet,* Tufts, Wallace Howard, Washington Strawberry, Western Beauty, Williams, Wolf River, York Imperial. Crabapples—Excelsior, Montreal Beauty.

"3. *Badly injured.*—Autumn Streaked,* Barry, Belborodooskoe,* Ben Davis, Borsdorf,* Boskoop, Canada Reinette, Constantine,* Copper Market, Czar Thorn,* Ewalt, Flory, Golden Sweet, Gravenstein, Hurlbut, Jeffris, Jersey Sweet, Kalkidon,* Lankford, Late Duchess,* Longfield,* Milden, Milwaukee, Monmouth, Mother, Nero, Newman, Northwestern *Greening,* Ostrakoff,* Paragon, Parry White, Peck *Pleasant,* Peter, Rambo, Red June, Scott, Smith Cider, Sops of Wine, Switzer,* Wagener Improved, Walbridge, Washington Royal, Wealthy, White Pippin, Windsor, Winesap, Workaroe,* Yellow Newtown, Yellow Transparent.* Crabapples—Chicago, Coral, Hyslop, Martha, Paul Imperial, September, Transcendent, Whitney.

†Hedrick, U. P. N. Y. Expt. Sta. Bul. 287, p. 142, 1907.
*Russian varieties.

"4. *Very badly injured.*—Baldwin, Collamer, Jonathan, Mann, Red Transparent,* Repka,* Rhode Island *Greening,* Romna,* Saint Peter,* Twenty Ounce, Vineuse Rouge,* Winter Banana, Wagener, Yellow Calville.*"

Much of the injury from bordeaux mixture may be avoided if proper attention is given certain factors which have more or less to do with its occurrence. Too strong bordeaux should not be applied—a 3-3-50 mixture is recommended. The lime should be of good quality and approximately equal parts of lime and copper sulphate should be used. Never pour concentrated solutions together—equal and full dilution of the milk of lime and copper solutions should be made before mixing. Cover the fruit and foliage with a fine mist, but do not apply sufficient mixture to cause the trees to drip. Do not spray during rainy, foggy or damp weather. Study susceptibility of varieties. Those varieties which are listed above as badly or very badly injured by bordeaux mixture, and any others which the orchardist's experience indicates should be placed in this class, should not be sprayed with bordeaux mixture after the leaves begin to unfold. Past experience has shown that under Maine conditions with those varieties like the Ben Davis which are quite susceptible to spray injury, the ill effects resulting from the application of bordeaux mixture, except early in the season, have equalled or exceeded the good. There is considerable reason to believe that some form of the lime-sulphur sprays in proper dilution may be of service on such varieties. Bulletin 135 of the Illinois Station by Prof. Chas. S. Crandall, and Bulletin 287 of the New York (Geneva) Station by Prof. U. P. Hedrick, treat of bordeaux mixture and bordeaux injury in relation to the apple in a very comprehensive and exhaustive manner, and these publications are recommended to any who wish further information on this subject.

Leaf spot. Spotting of the leaves is closely associated with the russeting of the fruit by spray. However, a study of this trouble extending over several years and representing material collected in many different parts of the State shows that leaf-spot in Maine is by no means confined to that caused by the use of sprays. In 1908 leaf-spot was exceedingly abundant on

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*Russian varieties.

unsprayed trees all over the State. As is stated elsewhere in this bulletin (p. 401) various fungi were found in these spots on leaves from sprayed and unsprayed trees, but of these *Sphaeropsis malorum* Pk. was the only one which was capable of causing the disease on inoculation from pure cultures.

While in some instances the spots caused by sprays did not appear quite identical with those caused by the fungus, these differences were not constant enough to enable one to distinguish one from the other with any degree of accuracy. Moreover old spots made by sprays were usually attacked by fungi so that it is only by knowing the history of the case and noting the relative amount of spotting of leaves on sprayed and unsprayed trees under like conditions that one is able to judge whether the spotting is caused by sprays or fungi. Fig. 59 illustrates spotting caused by spraying and Fig. 60 spotting caused by *Sphaeropsis malorum*.

The first indication of the formation of a leaf spot is the appearance of minute specks on the leaves where the healthy green has changed to a reddish or purplish color. Soon these change to larger, dead, brown spots, usually quite sharply defined against the adjoining green, though in severe cases of spray injury the whole leaf begins to turn yellow and soon drops off, resulting in many instances in partial defoliation. As a rule the spots are round, or oval and quite regular, but they may be of various shapes and sizes.

It has been claimed that lime-sulphur sprays do not cause leaf-spot. The experiments already referred to (p. 388) which were conducted by Mr. Bonns in 1910 with lime-sulphur and similar substitutes for bordeaux mixture used with lead arsenate as an insecticide, indicate that exceptions to this statement may be expected when these sprays are tried on the more tender varieties like the Ben Davis.

Experiments conducted at Orono by the writers in 1908 and 1909 with self-boiled lime-sulphur in comparison with bordeaux mixture on Milding, Fameuse and McIntosh resulted in no injury with either spray. Moreover published reports of spraying apple trees in Arkansas, Oregon, Missouri, New York and New Hampshire, with self-boiled, home-cooked and certain of the commercial lime-sulphur sprays are agreed as to the absence of spray injury from lime-sulphur. However, in our own experiments and in some of the others mentioned the trees used were not those which are particularly susceptible to bordeaux injury, and while the results are of value as showing the fungicidal value of lime-sulphur, they do not show that it would not produce spray injury on the more tender varieties. Much more experimentation will be necessary to determine this point; hence it is impossible at this time to state with any degree of accuracy what may be expected from the lime-sulphur sprays in the line of spray injury. However, there is every reason to believe that it may be used on the more tender varieties with much less danger of injury than with bordeaux mixture. It is probable that the combined use of the two would yield the more satisfactory results. That is, for the more tender varieties, use bordeaux mixture for the first spraying, in the spring before the leaves unfold, followed with lime-sulphur for the later sprayings.

Baldwin spot. The disease which is generally known in Maine under this name is not of fungus origin. It takes its name from the fact that it was first observed on and occurs most commonly on Baldwin apples, but it is not confined to that variety.

This disease is characterized by sunken spots distributed irregularly over the surface of the apple, as shown in Fig. 61. These spots are somewhat hemispherical in shape. They vary in size from one-eighth to one-fourth inch in diameter and have very much the appearance of bruises. An examination of the tissues beneath shows that they are brown in color and have become somewhat dry and spongy. In some cases the Baldwin spot appears on apples as they are ripening but in other cases it develops in storage. It may be confined to individual trees in an orchard or to certain branches of a tree.

In late stages the tissues beneath the spots become shrunken so that the pitting is deeper. The brown coloring is not confined to the region just beneath the spot but is found also in the tissues surrounding the vascular bundles in later stages.

This disease should not be confused with the spot of apples caused by the fungus *Cylindrosporium pomi* Brooks, see page 398. The fungous disease can be controlled by spraying but the Baldwin spot cannot be controlled by that means. The writers believe that confusion of these two spots of apples in the past is responsible for reports which have been made of the control of Baldwin spot by spraying. The cause of the trouble is not well understood and until this is known little can be done toward finding methods of prevention.

In many of the earlier descriptions, spots on apples caused by the fungus were confused with spots which are not caused by a fungus and a composite description was made. In New Hampshire Experiment Station Report 20, p. 342, Brooks says: "It would be difficult to decide from the earlier descriptions given in the bulletins of the New Hampshire Station whether the Fruit Spot or the Fruit Pit (the original Baldwin spot) was under special observation. The descriptions are better if taken as applying to the two diseases than if considered as applying to either to the exclusion of the other. The spraying experiments were undoubtedly made upon the Fruit Spot. So far as the writer has been able to learn, a distinction between these two diseases has never been made."

The fact that the two diseases were sometimes confused and considered as one before the time of Brooks' publication together with the name which he has applied to the fungous disease has led a number of people to conclude, without careful study of the distinction which he has made, that all of the spotting of Baldwin apples is due to the fungus *Cylindrosporium pomi.*

The observations of the writers have convinced them that the Baldwin spot is of common occurrenec in Maine, and that apples affected by this disease are more seriously injured than are Baldwin apples affected by the fungous disease.

Hail injury. During the past 2 or 3 years different parts of the State have experienced hail storms of sufficient severity as to badly injure the young fruit on the apple trees. There is nothing which can be done to prevent this injury, but frequently it is not noticed at the time and is later attributed to fungi, insects or other causes. The fruits may be badly deformed and scarred resembling somewhat curculio injury but the characteristic crescent shaped scars of the latter are not present. Quite frequently hail injury is followed by fungous decays of the fruit resulting from infections of the wounds.

Stag horn. Very frequently apple trees are seen with the topmost branches dead and remaining as dry sticks like antlers projecting above the foliage. This condition may be due to various unfavorable conditions, but in Maine it is chiefly encountered with old trees which have long remained unsprayed, unpruned, uncultivated and unfertilized. This allows opportunity for wood destroying fungi to gain an entrance. Once started their growth will eventually destroy the whole tree. Severe heading back and clearing out of the dead and fungous infested wood followed by cultivation and fertilization should be resorted to. In some instances it may be necessary to top graft to renew the head of the tree. The full results of such treatment do not show the first year. Great care should be taken not to leave wounds through which the spores of fungi can gain an entrance to cause future decay.

Lichens on apple trees. Not infrequently complaints are received, particularly from coast towns, with regard to fruit trees being over-run by lichens, sometimes improperly called "mosses" by orchardists. While mosses are not uncommon on old, neglected fruit trees, lichens are much more frequent. The latter are foliacious growths of various colors, the more common being grayish and found indiscriminately upon trunks of trees, rocks, old fence boards, etc. Quite frequently these lichens are found in large numbers upon orchard trees—apples, pears and plums—particularly so in the states farther south. Fig. 63 represents a portion of a branch from a neglected Maine apple tree. A large proportion of the branches were covered with lichens as shown in the illustration.

In temperate climates lichens occurring on tree trunks are not considered to be parasitic. In the tropics there is evidence that one or more kinds are probably parasitic. However, all are agreed that lichens are decidedly objectionable on fruit trees. They harbor insects and fungi, tend to keep the branches moist and more likely to decay, besides being untidy and unsightly. While they may not secure any nourishment from the trees they certainly must interfere seriously with the functions of the bark on the younger limbs.

Two or 3 pounds of copper sulphate to 50 gallons of water or a 5-5-50 bordeaux sprayed on the trees before the buds swell in the spring will generally destroy the lichens. A wash such as is used for borers consisting of one pound of potash or concentrated lye to 5 gallons of water, put on with a brush, is said to be effective. *None of these materials should be sprayed on the trees when in leaf on account of injuring the foliage.* Thorough spraying with 3-3-50 bordeaux in the spring and early summer, as recommended for apple scab and other fungous diseases, would doubtless do much to hold the lichens in check, if not destroy them altogether. Hence, if the orchard is well cared for and sprayed it will not be infested with lichens.

Parasitic Diseases.

DISEASES OF THE FOLIAGE AND FRUIT.

Scab. Probably no other disease of the apple is of so much economic importance to Maine orcharding as the common apple scab caused by the fungus *Venturia pomi* (Fr.) Wint. The losses from this disease are not so much in the destruction of the fruit as in the lowering of its market value. On account of the attacks of this one disease, which is largely preventable, the financial returns from the orchards of many sections of the country are reduced from 25 to 50 per cent yearly.* Were it properly controlled in Maine a large proportion of the crop of some varieties which now goes as No. 2 and No. 3, might be marketed with the No. 1 grade. Moreover where spraying operations have not been generally practiced the importance of this fungus is in no way realized. For years it has been common and widespread, particularly on certain varieties and the orchardist has learned to regard it as one of the things to be expected and not as something which can and should be prevented.

The apple scab fungus may attack the flowers, twigs, leafstalks, leaves and fruit but it is upon the last two that its appearance is most prominent. While severe attacks on the leaves do much to weaken the trees, often causing considerable defoliation, the direct monetary loss to the orchardist is greatest from the effects of fruit injury for the reasons mentioned above.

Scab appears on the leaves in the form of a superficial, somewhat velvety, olive-colored growth, darker than the leaf green.† This growth is more likely to be observed on the under side of the leaf but both sides may be attacked. It may occur in spots but is frequently more abundant along the line of the mid-rib and large veins. The later stages may be compact, thin-scurfy,

*Duggar, B. M. Fungous Diseases of Plants. p. 265, 1909.

† Before the spores begin to form the affected areas are of a lighter green than the healthy parts of the leaf.

or more frequently especially if viewed with a magnifying glass of low power it will be seen to be ramifying and much branched giving a beautiful, delicate, "moss agate" effect. Badly attacked leaves may be more or less curled and crinkled and where defoliation occurs a pronounced yellowing may appear. Fig. 66 shows the characteristic appearance of a well developed leaf attack where the spots have run together along the veins.

Scab on apple leaves was very abundant in Maine during the summer of 1910 and samples showing the disease were received by the Experiment Station repeatedly from all of the apple growing sections of the State. Cool, moist weather either in the spring or summer favors the development and distribution of scab, while hot, dry winds and sunny days tend to keep it in check.

Two forms of spores are produced on apple leaves. If some of the olive-colored growth from the living leaves where the fungus is growing parasitically is scraped off and examined under the microscope a large number of the summer stage spores are found. These, and like spores produced on the fruit spots, are responsible for the summer spread of the disease. In the winter the fungus develops saprophytically in the fallen leaves under the trees and there produces an entirely different type of spore. While the summer spores can live for some time and doubtless it is not impossible for them to remain alive over winter especially on fruit left on the trees or on the ground it is probable that much of the spring infection comes from the winter spores formed on the fallen leaves. It is a matter of common experience that the lower leaves on the tree are the first to show attacks of scab in the spring. Hence raking and burning the leaves would do much to lessen the danger of infection. The formation of winter spores takes place more readily when the leaves fall on sod or are partly covered by grass, other leaves, etc. Orchard cultivation produces conditions unfavorable to the propagation of scab spores and early spring plowing buries many of them where they will decay and do no damage.

Scab on the fruit is too familiar to need much description. It first appears as small, circular, olive-colored spots on the skin of the apple, these later enlarge, many of them becoming one-fourth of an inch or more in diameter, roundish, roughish and dark olive-colored, usually surrounded by a light gray border.

Several spots may coalesce and form irregular patches, sometimes covering a large portion of the apple. In severe attacks, especially those resulting from early infections when the fruit is small, the apples often become cracked and badly distorted in shape due to the unequal growth of the healthy and diseased portions. Fig. 64 represents an apple in this condition.

While scab on the fruit is largely a superficial growth, the injury it does directly and indirectly is by no means confined to simple damaging of the appearance of the fruit. As is pointed out elsewhere in this publication (p. 407) epidemics of pink rot and some of the blue mold decay come from secondary infections of these fungi through scab spots. Scabby apples in addition to being more likely to decay wither more rapidly in storage than do perfect apples.

In a former publication of this Station attention was called to what then appeared to be a rather novel and uncommon form of the development of scab on apple fruit—its appearance and growth on apples in storage cellars.* Since the publication of this article certain more or less general statements have been found in the early Station literature indicating that somewhat the same thing had been noted and recorded at least 20 years before.** From information collected since publishing the account above referred to, it would seem that the appearance and spread of apple scab in storage is by no means uncommon in eastern states but in the past it has been largely overlooked.

Apple scab in storage may develop on fruit which, when placed in the cellar, appeared entirely free from the disease. It differs in appearance from the spots formed out-of-doors so much that at first one is doubtful as to the identity of the two diseases. Cultures made from the storage developed spots settled this point beyond doubt. Instead of soon breaking out and producing olive-colored summer spores the fungus usually remains beneath the unruptured cuticle, and the diseased portions appear as slightly sunken, small, black, somewhat shiny spots. As observed in Maine these storage developed spots have always been much smaller than those produced out-of-doors. Many of them

*Morse, W. J. Me. Exp. Sta. Bul. 164, p. 4, 1909.

** Garman, H. Ky. Exp. Sta. Rep. 2, p. 48, 1889.

McCarthy, Gerald. N. C. Exp. Sta. Bul. 92, p. 88, 1893.

Henderson, L. F. Idaho Exp. Sta. Bul. 20, p. 83, 1899.

are only of pin-head size. Brooks, however, has shown that they may attain a much larger size.* Fig. 65 shows the characteristic development of apple scab in storage. Doubtless much of the infection takes place immediately before or at the time of picking, but in one instance, at least, observed during the past winter, the evidence plainly indicated spread in storage. In a box of very clean No. 1 McIntosh, packed for perfect apples, one bearing a medium sized scab spot covered with spores was placed by accident. This box was placed in a relatively cool but quite moist cellar and when opened by one of us in mid-winter several apples lying immediately below the summer-scabbed apple were covered with the small black spots above described. The remainder of the fruit in the box was without blemish of any kind.

Fruit from trees that are well sprayed will be less likely to develop the disease in storage. Scabby apples should be carefully sorted from the sound before storing. The temperature of storage should be as low as consistent with safety and not subject to abrupt changes. Very moist storage conditions should be avoided.

Cylindrosporium fruit spot. This spot of apples which was first described by Brooks** is caused by a fungus, *Cylindrosporium pomi* Brooks. It should not be confused with the disease of apples which has been known for several years as Baldwin spot and which has been studied by a number of investigators. The Baldwin spot is not caused by the growth of a living organism, as has been proved a number of times by men working in widely separated places.

In Brooks' paper he has distinguished very clearly between the two diseases, but the writers regard it as unfortunate that he has substituted the name "Fruit Pit" for a disease which has been generally known in other parts of New England under the name "Baldwin spot," because certain writers and others have erroneously used the term "Baldwin spot" so as to include an entirely distinct disease. It is freely admitted, however, that if no confusion would result and the disease were being described for the first time, "Fruit Pit" is a more accurate descriptive term. In

*Brooks, Chas. N. H. Exp. Sta. Bul. 144, p. 113, 1909.

** Brooks, Charles. The fruit Spot of Apples. N. H. Exp. Sta. Report 20; 332-365. 1908.

a recent text-book on plant diseases, the *Cylindrosporium* disease has been indexed as "Baldwin Fruit Spot" and this leads to more or less confusion. The writers have heard the opinion expressed a number of times that the cause of Baldwin spot was explained by Brooks' study of this fungus. They wish simply to assist in making clear the fact that Brooks recognized and described two distinct diseases and that the disease caused by *Cylindrosporium pomi* is not the same as the well known Baldwin spot, the characters and occurrence of which were so well pointed out by Jones.* Unfortunately in Jones' account of Baldwin spot he includes the results of Lamson's apparent control of the disease by spraying with bordeaux mixture. Brooks shows, however, that there is every reason to believe that Lamson's results were really from the control of the *Cylindrosporium* fruit spot which he confused with the true Baldwin spot.

The *Cylindrosporium* fruit spot occurs on a number of varieties of apples, and the writers are convinced by their observations that it does much more damage to some other varieties like the Bellflower in Maine than it does to the Baldwin.

According to Brooks, the *Cylindrosporium* disease appears first about the middle of August. (The true Baldwin spot does not appear till nearly harvest time or in storage). When it first appears one notices spots of deeper red on the darker colored portions and darker green on the lighter portions of the surfaces of affected apples. At this stage they are but slightly sunken, if at all, and there is no suggestion of a bruise. From Brooks' studies it appears that the fungous spots on red surfaces become more sunken later in the season, the color gradually changes from brown to black, and in cellar storage the red spots become badly browned and sunken. The green spots may take a similar course but in many cases there is no marked change in their surface appearance. However, according to the experience of the writers, the spots caused by the fungus are not as a rule so large and do not produce such deep pits in the surface as are characteristic of later stages of the non-parasitic trouble. Also on the lighter skinned apples there is not so much danger of confusing the two troubles when one once has the characters of each clearly in mind.

On yellow-skinned apples like the Bellflower the spots are very

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* Jones, L. R. Vt. Exp. Sta. Rep. 12, p. 161. 1899.

conspicuous at harvest time. They are of a bright carmine, the older and larger having a darker, brownish center, with seldom any pitting even after some time in storage. The disease is of almost universal occurrence in Maine on this variety— so much so that some apple growers have come to regard the *Cylindrosporium* spots as a natural marking of the variety and frequently exhibit such apples for prizes at fairs and pomological meetings.*

The superficial appearance of apples of the Bellflower variety which are affected with the *Cylindrosporium* disease is quite distinct from that produced by the true Baldwin spot on other varieties as will be seen on comparison of Figs. 61 and 62.

Brooks has made a careful study of the control of the *Cylindrosporium* fruit spot in New Hampshire. He found that infection of the apples takes place in July and that the spots make their appearance in August. He found that either bordeaux mixture or lime-sulphur gave good results in the control of the spot if applied at the same time or a little later than for the control of apple scab.

This disease is of common occurrence in Maine and it does considerable damage by injuring the appearance of fruit. Fruit growers should become familiar with the disease and make efforts to prevent the loss which it causes by reducing the price which they receive for their apples.

Sooty blotch and Fly-speck of the fruit. These diseases take their names from the appearance which the growth of the fungus gives to the fruit. Both are now regarded by certain writers† as caused by the same fungus, *Leptothyrium pomi* (Mont. & Fr.) Sacc. The fungus does not penetrate into the apple. In the case of sooty blotch, the mycelium spreads over the surface covering areas which vary in size and sometimes practically the whole apple is covered in bad attacks. Fig. 68 is a photograph of an apple affected with sooty blotch. Fly speck is characterized by the development of black shining bodies composed of fungous threads closely woven together, which occur in patches on the surface of the apple.

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*Following the methods by which the fungus was originally isolated, i. e., by transferring pieces of the browned tissue to tubes of sterile, distilled water, it has been obtained from these spots a sufficient number of times to show its constant association with them.

† Duggar, B. M. Fungus Diseases of Plants, p. 367. 1909.

The chief loss caused by these diseases is in injuring the appearance of fruit and thereby lowering its market value. Neither sooty blotch nor fly speck is of so common occurrence in Maine as they are farther south. Where thorough spraying is done, these diseases are effectually controlled.

Sphaeropsis leaf spot. Leaf spot is a common and widely distributed disease of the apple in Maine. With some varieties and under certain weather conditions a spotting of the leaves is caused by spray injury, see p. 390. It is a matter of common observation, however, that orchards or trees which have never been sprayed are often affected with a spotting of the leaves which in some cases is quite serious.

Affected leaves show little spots of dead tissue, usually somewhat circular in outline. The dead portion is not quite so thick as the surrounding green tissue and takes on a brown color. On the dead spots little black bodies are frequently found which are the fruiting portions of the fungi associated with the spots. The dead spots often show concentric rings.

Leaf spot of the apple has been discussed by a large number of writers and the cause attributed to a number of different fungi. In many cases the fact that a certain fungus was very frequently found on the spots was taken as sufficient evidence that it was the cause of the disease. Of recent years it has been questioned whether the presence of a fungus on a leaf spot, no matter how constantly it occurred there, should be taken as evidence that the fungus caused the disease. It has been held that it is necessary to isolate the fungus in pure culture and then produce the disease by inoculation under control conditions before the matter could be definitely settled. In the summers of 1906 and 1907 Scott and Rorer* made a study of the disease in the Ozarks in which they isolated fungi from leaf spots and carried on inoculation experiments. Of the various fungi isolated *Sphaeropsis malorum* Pk., the same fungus which causes a destructive fruit rot (p. 404) and limb canker (p. 414) in Maine was the only one capable of causing the disease when its spores were sprayed on the leaves.

On account of the importance of the fungous leaf spot in Maine it was thought desirable to make a thorough study of the

*Scott, W. M., and Rorer, J. B., Bureau Pl. Ind., U. S. D. A., Bul. 121, Part V, pp. 47-54, 1908.

pathogenicity and interrelation of the various fungi found associated with leaf spot, fruit decays, and limb cankers in this State. The results of a part of this work have already been published* and other parts will be published later. It is sufficient for our present purpose to state that out of a large number of fungi isolated from leaf spot in Maine *Sphaeropsis malorum* was the only one which would produce the disease on inoculation.

The results obtained here, taken together with the conclusions of Scott and Rorer and the work of Lewis† in New Hampshire would seem to indicate that *Sphaeropsis* is the only one of the fungi occurring so abundantly on the dead spots in apple leaves which is capable of causing the disease in this section of the country.

This fungous leaf spot causes a considerable amount of loss in Maine orchards and this loss is not always realized by the apple growers. The dead spots in the leaves interfere with their function, and, in addition to this, large numbers of the diseased leaves fall prematurely, thus seriously interfering with the nutrition of the trees.

As has already been mentioned the fungus causes the canker of the wood and the black rot of the fruit, therefore preventive measures must be directed toward all 3 forms of the disease. Since inoculation experiments indicate that in Maine infection must take place before the middle of July spraying as recommended for apple scab would do much to control the disease. This should be supplemented with the removal and destruction of limb cankers and decayed fruit.

From their observations the writers are convinced that leaves of trees which are well fertilized, cultivated and generally well cared for are not so susceptible to the disease as the leaves of neglected trees. It must be borne in mind, however, that a similar spotting of the leaves of susceptible varieties may occur as the result of spray injury.

Rust. This disease of apple leaves and fruit which does great damage in some apple growing districts does not seem, according to the observations of the writers, to be of very common

* Lewis, C. E. Apple Diseases Caused by *Coryneum foliicolum* and *Phoma mali.* Me. Exp. Sta. Bul. 170, 1909. A New Species of *Endomyces* from Decaying Apple. Me. Exp. Sta. Bul. 178, 1910.

†Lewis, Isaac M., N. H. Exp. Sta. Rep. 20, pp. 365-369, 1908.

occurrence in Maine. The fungi* which cause this trouble pass a part of their life upon the apple and related plants and a part upon the red cedar where they cause the abnormal development of small brown knots on the twigs which are known as "cedar apples." In the spring these knots produce thread-like tubes which when wet with rain swell up, become gelatinous, are orange yellow in color, and throw off large quantities of spores. These spores are capable of infecting apple leaves and are produced when the latter are young and most susceptible to infection.

On the apple leaf there is first a thickening of the tissues in small spots at the points of infection. Later in the season these thickened places become ruptured on the under side and short, thread-like growths project beyond the broken epidermis. Orange-colored spores are formed in these places. It is on the leaves and fruit of the apple that the injuries caused by this rust become of economic importance. Spraying has not been very successful in controlling this disease. Where the rust appears, the removal of red cedars from the neighborhood of apple orchards is recommended.

Powdery mildew. The common name for this trouble comes from the appearance of the affected leaves, which is shown in Fig. 67. The fungus, *Podosphaera oxyacanthae* (DeC.) DeBary, grows upon both surfaces of the leaf but does not penetrate the tissues, except to throw in short feeding branches. During the summer many spores are formed and it is the masses of spores which give the white powdery appearance. The parasite spreads rapidly by means of these summer spores. Later in the season another stage of the fungus develops on the diseased leaves and this is indicated by the presenec of small but plainly visible, spherical, black bodies which are scattered here and there among the white mycelium. Spores are produced in these bodies which carry the fungus over winter.

On the apple, the chief damage done by this fungus is in its attacks upon nursery stock where it causes considerable loss. Spraying with diluted lime-sulphur should go far toward controlling this disease.

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*Apple rust may be produced by *Gmynosporangium macrocarpus* Lk., or *G. globosum* Farl. It is not known which species is responsible for the rust in Maine but probably it is the latter. The red cedar, *Juniperus virginiana* L. is the alternate host for both.

FRUIT DECAYS.

During the past 3 years this laboratory has devoted considerable attention to a study of the fungi which cause decay of apples in Maine. Fungi have been isolated from decaying apples from various places and these have been tested by means of inoculations in order to determine the extent to which each was capable of causing decay. It has been found that Maine has a considerable number of the apple decay fungi which have been described from other places but the relative amount of rot caused by some of these fungi under local conditions differs materially from the amount attributed to the same fungi in other parts of the United States. For example the "bitter rot" fungus while it occurs here does very little damage in comparison with the amount of loss resulting from its attacks in other sections. The apple decays which have been found in Maine will be described in the following pages together with the means of control so far as these measures are understood.

Black rot. This rot is caused by *Sphaeropsis malorum* Pk. which also causes a decay of pear and quince. The fungus attacks apples both on the tree and in storage and is responsible for much of the rot on the trees in this State. It is capable of causing decay of green fruit but its progress is much more rapid in apples which are ripe or nearly ripe. Early apples are especially susceptible. As a cause of storage decay, *Sphaeropsis* probably ranks second to *Penicillium* which is described below. On account of the relation to leaf-spot, and limb-cankers as well, the black rot fungus in distribution and economic importance probably ranks second in the State to that which causes apple scab.

Black rot of the apple takes its name from the appearance of the fruit in the late stages of the decay. In early stages, the decayed region is brown in color but the mycelium of the fungus takes on a dark color with age and thus colors the apple. The fungus usually enters the apple at either the blossom or stem end, and, if the temperature is favorable for growth, spreads rapidly and causes the complete decay. The decaying region is marked by concentric rings. When the mycelium has grown in the apple for a sufficient length of time the threads begin to form little aggregations just beneath the epidermis which develop into the small black bodies which later break through the epidermis. The spores of the fungus are formed inside these bodies and escape through an opening at the apex. The appearance of an apple in this stage of the decay is shown in Fig. 69. There is only one other fungus (*Phoma mali*, see p. 408) which in Maine causes a similar appearance of decayed apples and the amount of loss caused by that fungus is small as compared with the loss caused by *Sphaeropsis*.

Since the fungus which causes the black rot of apples also causes a disease of the wood and leaves, any means of control of the rot must take into consideration these sources of infection of the fruit. Old, diseased trees are almost certain to produce *Sphaeropsis* spores in large numbers on dead and dying limbs and these spores are ready to infect the apples as they mature and to cause their decay. One good means of control then is to remove the source of infection by cutting out and burning all dead and diseased wood. All decayed fruit should also be destroyed. If this is followed by the spraying which is recommended for apple scab it will go far toward the control of this disease.

Penicillium or blue mold decay. This is the rot of apples which is caused by the common blue mold which is familiar to every one on preserved fruits, jellies, etc. Blue mold grows as a saprophyte on a large number of dead organic substances and produces large numbers of spores so that the spores are practically everywhere present and may start a new growth of the mold whenever they fall upon a substance which furnishes a suitable food supply provided that the temperature is favorable for growth. It is a widespread cause of decay in Maine, especially where the fruit has not been carefully handled.

This decay of apples is probably caused by more than one species of this genus. In some cases other fungi aid in the decay but since *Penicillium* breaks out and shows more prominently on the surface of the apple, it is often held responsible for more of the decay than it causes. There can be no doubt, however, that one or more species of *Penicillium* cause a large amount of the soft rot of stored apples. This is primarily a rot of ripe apples and does not cause decay of green fruit. The threads of the fungus cannot penetrate the uninjured epidermis of the apple but must gain entrance through injured places such as bruises, cuts, cracks, worm holes, spray injured places or scab spots. It spreads rapidly in ripe apples and complete decay takes place in one to two weeks. The tissues become soft and are light brown in color. Little tufts of mycelium which bear the spores break out on the surface of the decayed region as shown in Fig. 70. These tufts soon become light blue or blue-green, later gray-green to brownish in color. Apples rotted by *Penicillium* take on a characteristic moldy odor and taste.

Since the fungus enters the apple through wounds, any means of control of the rot must look to the prevention of injuries to the epidermis. Care must be taken to produce good, sound apples and then these should be picked and handled in such a way as to avoid cuts and bruises. The apples should be stored where the temperatures are as low as can be maintained with safety from freezing.

Bitter rot. This disease which does so much damage in some apple growing regions is caused by *Glomorella rufomaculans* (Berk.) Sp. & von Sch., and is found occasionally in Maine, but its occurrence is so rare that it is not necessary to recommend special means for its control. Moreover it does not seem that bitter rot will do great damage under Maine climatic conditions if the recommendations with regard to the removal of cankers and spraying are followed as are given for the black rot fungus. Where bitter rot is prevalent spraying later in the season is necessary. Fig. 71 shows the appearance of this rot. The fungus found here differs in certain characteristics from the form described from farther south and there is some evidence from our inoculations that it is not so actively parasitic.

Brown rot. The brown rot of the apple is caused by *Sclerotinia fructigena* (Pers.) Schroet., the same fungus which causes the destructive brown rot of peaches and plums. This decay of apples occurs to some extent in Maine and in some cases may do considerable damage. The fungus spreads through the apple rapidly and in the early stages the surface of the decayed region is smooth and brown. Later little tufts of fungus threads break out on the surface of the apple and these produce the spores as shown in Fig. 72. Often when this rot takes place in storage, away from the light, the tufts of spores do not break out on the surface and the skin assumes a shiny black color. The apples become shrunken and wrinkled as they dry and in some cases these mummied apples hang on the trees over winter. It is these mummied apples which carry the fungus over from one year to another and for that reason all decayed fruit both on the trees and on the ground should be destroyed. The spraying for apple scab will also help to control this fungus.

Pink rot. In some seasons, especially when it is warm and wet at the time of harvesting, scabby apples are attacked by a fungus *Cephalothecium roseum* Cda., Fig. 73. This is called pink rot on account of the appearance of the spots where the fungus grows out to produce its spores. The fungus, usually a saprophyte, occurs on a large number of dead parts of plants. Therefore, the material for the infection of apples is present whenever the conditions are favorable for the growth of this fungus. The fungus is unable to penetrate the uninjured epidermis of the apple and scab spots afford the chief means of entrance. To avoid loss from pink rot it is necessary to produce apples which are free from scab.

Alternaria decay. A decay of apples caused by a species of *Alternaria* was first described from Colorado by Longyear.* This fungus entered the apple at the blossom end and produced a cobwebby growth of mycelium around the seeds. An *Alternaria* has been found a number of times associated with apple decays in Maine. This fungus usually occurs on injured places such as the blossom end injured by insects or broken places in the skin. Associated with other fungi this *Alternaria* forms a rather thick, dry covering of mycelium over the injured place. The fungus does not usually penetrate very deeply in such cases but when ripe apples are inoculated from pure cultures, it is found to be capable of causing a complete decay. This fungus alone has been reisolated a number of times from decaying apples which had been inoculated, thus proving that it caused the decay. The apple decay *Alternaria* differs sufficiently from a species of the same genus which has been found repeatedly on dead spots in apple leaves and on dead parts of other plants so that the two fungi can be distinguished readily in culture. The *Alternaria* from apple leaves has not been found to cause decay of the fruit upon inoculation.

Botrytis decay. A species of *Botrytis* causes a part of the decay of apples in Maine. It has been found causing a rot of early apples on the tree and inoculations have shown that it not only attacks ripe fruit but that it is capable of causing a rot of

*Longyear, B. O. Col. Exp. Sta. Bul. 105, 1905.

green apples. The fungus spread, rather rapidly in the tissues of winter apples which were inoculated early in August so that in 2 weeks one-half of each apple was decayed. It causes a rapid and complete decay of ripe apples.

Phoma decay. This rot is caused by *Phoma mali* Schulz & Sacc., which is able to attack both wood and fruit. A more extended account of this fungus is given in Bulletin 170 of this Station. It causes only a slight decay of green apples but when ripe apples are inoculated the rot spreads almost as rapidly as in the case of some of the well known apple destroying fungi. When the fruit is thoroughly invaded the pycnidia break out on the surface giving somewhat the same appearance as in the case of black rot but there is usually considerable mycelium on the surface of the apple and this is white in color.

Hypochnus decay. Eustace* has described a decay of apples in New York caused by a species of *Hypochnus*. A fungus which agrees in certain characteristics with the one described by Eustace has been found here associated with a surface spotting or pitting somewhat like the Baldwin spot and *Cylindrosporium* troubles of apples. The fungus which we have had in culture for 3 years has never fruited, although it has been grown on a variety of culture media and so it is impossible to state positively that it is the same fungus which Eustace studied but it has the same kind of clamp connections of the cells of the mycelium and the fungus agrees in appearance with his description. Inoculations with this fungus caused only a small sunken spot of decayed tissue at the point of inoculation.

Fusarium decay. The examination of decaying apples from a large number of sources has frequently shown the presence of *Fusarium* spores. In some cases *Fusarium* has been found fruiting on the surface of decayed fruit, the rather thick masses of spores giving a pink color, in other cases the mycelium has been found in the cavity around the seeds sometimes destroying the seeds. In the seed cavity it is either white or reddish in color. The spores are produced in considerable numbers on this mycelium. *Fusarium* is sometimes found associated with other fungi forming a thick felt-like growth over injured places on the surface of apples. From such a growth on one apple one of us (L.) has isolated 8 different fungi, 4 of which, including one

*Eustace, H. J., N. Y. State Sta. Bul. 235, pp. 123-129, 1903.

species of *Fusarium,* caused complete decay of ripe apples upon inoculation from pure cultures. A study is being made of the apple decays caused by species of *Fusarium* and a detailed account will be published soon in a bulletin of this Station. A *Fusarium* decay has been described from Europe by Osterwalder,* but so far as the writers are aware no such decay has been reported in America. In this investigation 3 forms of *Fusarium* have been isolated from decaying apples, and have been found to cause decay of both green and ripe apples. These have been grown in pure culture from one to two years and show such differences in cultural characteristics as to make it seem probable that they are different species. One of these bears considerable resemblance to *F. putrefaciens* Osterwalder, but does not seem to be identical. One of the others has been found to cause not only a decay of apples but to cause decay of parts of a number of other plants, its occurrence on one of which at least practically insures the presence of spores of this fungus at the time when the infection of the apple would take place.

No special recommendations can be made for the control of these apple rots at this time. In a general way it may be said that the same methods which apply in the case of the well known apple decays will probably go far toward the prevention of loss from these fungi.

Verticillium decay. In 1908, a fungus was isolated from apples and tested by means of inoculations which, while it does not seem to be of very common occurrence, causes a distinct decay of both green and ripe apples on inoculation. This fungus spreads through the tissues of ripe apples at as rapid a rate as *Penicillium* but it produces a very different effect. The diseased portion is not soft but is rather hard and the affected apple keeps its normal shape for some time. The decayed tissue has an odor and taste which is characteristic and rather pleasant, not unlike that of dried cocoanut. Cultures of the fungus on prune agar give the same odor.

The causal fungus grows readily and spreads rapidly in plates of prune agar. It produces large quantities of spores. The masses of spores are white when young but become green with age. On the basis of the spores and of the manner in which they

* Osterwalder, A. Ueber eine bisher unbekannte Art der Kernobstfäule, verursacht durch *Fusarium putrefaciens* Nov. spec. Centralbl. Bakt. Zweite Abt. 13. 207-213; 330-338. 1904.

are borne in culture this fungus has been classified as a species of *Verticillium*. It is possible that this fungus, which is capable of causing a distinct decay, may be responsible for a part of the rot which is attributed to other fungi for when apples were inoculated with it, the fungus did not break out on the surface and produce spores.

Endomyces decay. In Bulletin 178 of this Station a new species of *Endomyces* is described which was found to cause a decay of ripe apples but which did not attack green fruit. This fungus is of interest not so much on account of its economic importance, but because it represents a genus new to America.

Rhizopus decay. A soft rot of over-ripe apples is sometimes caused by black mold. This rot may be recognized by the fact that the mycelium which grows out over the surface of the affected apple is composed of thicker threads than are found in other apple decay fungi. If apples attacked by the black molds are kept in a warm, moist place the mycelium forms a thick growth on the surface. The spores are borne in little capsules on the ends of long stalks. When the spores are mature the whole mass becomes black in color.

The black molds are regarded as saprophytes as they are able to attack only ripe apples. They may cause considerable loss, however. To prevent this loss it is necessary to use the same precautions that are taken in the case of blue mold.

Other apple rots. In the course of the study of apple diseases, fruit has been inoculated with a number of other fungi isolated from wood, leaves, or fruit of the apple in order to determine whether these fungi are capable of causing decay. *Coryneum foliicolum* Fckl., and a species of *Cytospora* from diseased wood, produced a small amount of decay; *Coniothyrium pirina* (Sacc.) Sheldon, *Phyllosticta limitata* Pk., *Cladosporium herbarum* (Pers.) Link, and 3 undetermined species of *Aspergillus*, showed a little growth at the points of inoculation but did not spread to cause decay. One fungus which has been determined as *Dematium pullulans* DeBary has been found constantly associated with diseased apple tissues not only of the fruit but also of the leaves and wood. On account of the constant association of this fungus with apple rots, it was tested by means of inoculations but it did not cause decay. It may be possible, however, that when associated with other fungi the decay is hastened by its presence.

DISEASES OF THE WOOD.

Canker and Twig-blight. The term canker has become such a general one as not to admit of easy definition. It is commonly used to describe the condition of branches of trees in which an area of bark has been killed and has broken away so that a portion of the wood is laid bare or is covered only by cracked and roughened bark which does not protect the wood. In the writers' opinion the term "canker" as applied to diseased areas on trees should be restricted to those characteristic lesions on the trunk and limbs which are the result of alternate attempts to heal, with the formation of new wood, followed by farther killing of the living tissue. In early stages of development, cankers show a region of sunken discolored bark and it is only in later stages that the bark breaks away. Cankers have been described as caused by frost, sun-scald, fungi, and bacteria. A considerable number of different fungi have been reported as causing canker of apple trees in different parts of the United States. These vary greatly in the amount of damage which they do in different regions. In some cases, a fungus which causes a great amount of injury to the trees of one region occurs rarely or not at all in another region.

The injury of apple trees through winter-killing is discussed on pages 384-387. Much of the disease of apple trees which Maine orchardists have been calling canker for the past 3 years had its origin in the severe winter of 1906-7. Some of the injuries resulting from that winter and the seasons following might possibly be properly classified under the term "frost canker." On the other hand, when whole trees were so badly injured that they died either that year or the year following, the injury was too widespread and acted too quickly to be regarded as canker. There are a number of forms of winter injury and the frost canker is only one of them. The frost canker is a local injury which tends to heal over under favorable conditions for growth unless the new growth is killed by another period of low temperature before it has become hardened. In this way the frost canker may spread, or in other cases the injured bark may serve as a place for the entrance of a parasite which may then spread in the bark and outer layers of wood and kill a rather large area in a single year.

So far as they have been investigated it has been found that the organisms which cause canker of fruit trees in Maine are, in a large measure, wound parasites. They are unable, as a rule, to penetrate the uninjured bark but must enter through wounds. In this sense, the places injured by freezing serve the same end as wounds of any other kind. However, it may be pointed out that cankers caused by fungi do not spread so rapidly as to kill trees in the short time which has been observed in the case of winter-killed trees in this State. In the case of young trees the fungus may in some cases girdle the tree in a few weeks and thereby cause its death. The same holds true of small branches of old trees, but in the case of large branches the fungus usually spreads but a few inches each year forming true cankers, and the rough, blackened areas that are frequently seen on large branches often represent a development of several years. The living tissues attempt to heal over the wound by the formation of callus and in some cases with considerable success. Often the parasite ceases to spread in the bark when the dry season of summer comes on and a crack forms between the healthy and diseased bark. The following year the diseased area may continue to spread or the callus may check it considerably. Often other fungi, some of them saprophytes, grow upon the dead bark. Thus it may be seen that while fungi which enter through winter injuries may spread and ultimately do great damage to the tree, there is no reason to believe that the death of large trees which was observed in Maine orchards immediately following the winter of 1906-7 was due to a parasitic organism because the trees died in many cases in too short a time for their death to have been caused by such organisms. On the other hand, there were many places injured by that winter, which became infected by fungi. Where these have been neglected the diseased areas have spread from year to year and have done much damage, often developing into true cankers.

There are many other wounds than those caused by freezing through which parasitic fungi may enter. By this it is not meant that every wound that is made in the bark will necessarily become infected and develop into a diseased area. Frequently small wounds in the bark of young branches heal over quickly, without infection and no serious damage is done. In many cases, however, the spores of parasitic fungi are carried to wounds. This is especially liable to be the case when diseased branches are allowed to remain on the trees, or old neglected trees in the neighborhood produce abundant crops of fungus spores from year to year. Some of the ways in which wounds are made are: Barking of trunk and branches by machinery in cultivating and caring for the orchard; injuries by ladders and by men in picking fruit; branches are sometimes injured by props used to support a heavy load of fruit especially when they are carelessly placed in position; in some cases hail-stones split the bark of small branches. Care should be taken to avoid any injury which is within the control of the orchardist. Wounds are sometimes kept from healing over by the woolly aphis which forms little cottony patches in wounds and by delaying the healing over process makes a favorable place for the entrance of a parasitic fungus.

Maine has only a few of the fungi which have been reported as causing canker in other parts of the country. Each section of the country seems to have one fungus which is responsible for a large part of the canker in that region. In this State, the fungus which causes the greatest damage is the black rot fungus, *Sphaeropsis malorum* Pk.; the bitter rot fungus occurs only very rarely in this region; *Myxosporium corticolum* Edgerton, is very common and apparently does some damage although it does not seem to be a very active parasite; *Coryneum foliicolum* Fckl., and *Phoma mali* Schulz & Sacc., have been described in Bulletin 170 of this Station as causes of disease in this State; *Cytospora* sp. may cause some damage but it is not extensive. The European apple canker caused by *Nectria ditissima* Tul. and the blister canker, *Nummularia discreta* Tul., may be present in the State but they have not been observed.

Closely associated with canker caused by fungi is the killing back of small branches and twigs caused by the same organisms. In searching orchards in the State for cankers we have found this dying back of the branches and water-sprouts much the more common of the two. The fruiting bodies of the same fungi have been found on both, and cankers on larger limbs have been found repeatedly which apparently started from the disease following back on a smaller branch or twig. Inoculations with canker producing fungi early in the spring show that they are capable of killing the young twigs very rapidly and run back a considerable distance in a single season. A twig blight may be caused by the pear blight bacillus, but pear blight is rather uncommon in Maine. Moreover the entire absence of the characteristic "fire blight" has been noted repeatedly on pear trees growing within and alongside of apple orchards affected with the fungous twig blight.

In many ways the dying back of small branches is like the development of canker. The fungus may spread back only a short distance each year for a number of years or, as indicated above, the spread is rapid and the branch is killed back a considerable distance in a single year. It is probable that in many instances the young wood is injured by freezing and the fungi gain entrance in this way.* We have observed the same thing where young nursery stock has become infected through wounds made in cutting back when set. Twigs and limbs affected in this way should be cut off well below the diseased portion and the wounds protected from farther infection.

Sphaeropsis canker. The canker caused by the black rot fungus, *Sphaeropsis malorum* Pk., is widely distributed in Maine. This disease is known as "The New York Apple-tree Canker," because it was first described from New York.** This fungus causes the black rot of the fruit and a leaf spot as well as the disease of the wood.

The appearance of different early stages of cankers caused by this fungus is shown in Figs. 74, 75 and 76. The dark colored, cracked bark of the older, central parts, some of the small, black pycnidia or spore bearing bodies, and the crack between the healthy and diseased bark are shown in Fig. 74. This also shows, somewhat indistinctly, where cracks have formed between the healthy and diseased bark at the end of each growing season for at least 3 years. In this and in Figs. 75 and 76 infection probably took place on a smaller twig or branch and followed back to the larger branch as suggested by the small, dead stubs. It is not always possible to see the extent of each season's growth on account of other fungi and lichens growing over the dead bark.

The fungus attacks either young or old branches and the amount of damage depends on the amount of bark and adjoining surface portions of the wood which is destroyed. In some

*The manner in which young twigs and fruit-spurs become infected by fungi is a matter which needs farther investigation.

**Paddock, Wendell, N. Y. Exp. Sta. Bul. 163, 1899.

cases a branch may be girdled in a short time and death of that branch results, but in other cases the canker spreads for years on one side of the branch before it is completely girdled. The other side of the branch in such a case may become somewhat enlarged.

To control this canker, the orchardist should remove all dead branches, and all old neglected trees such as one frequently sees along the roads and burn them. Branches which show bad cankers should be cut off back of the canker and burned. In the case of young cankers, the branch can frequently be saved by cutting away the diseased tissue down to healthy wood, disinfecting with a solution of copper sulphate, one ounce to one gallon of water, or corrosive sublimate, one part to 1000 of water, and then painting over with pure white lead in boiled linseed oil or coating with a good quality of grafting wax. The trees should be gone over carefully a number of times each year and developing cankers and wounds should receive attention. Spraying for apple scab will help to control the cankers by reducing the amount of material for infection and by covering wounds with the fungicide. All decayed fruit should be destroyed, since the black rot of the fruit and this canker are caused by the same fungus. The treatment outlined should go far toward controlling cankers caused by other fungi in this State.

Bitter rot canker. This canker caused by the fungus which causes bitter rot of the fruit is of rare occurrence in Maine. On the dead bark the fungus produces little black pustules from which, when they are mature, pinkish masses of spores exude. The spores from cankers cause much of the early infection of fruit on the tree each year. The appearance of the diseased bark of a young tree caused by inoculation with the bitter rot fungus is shown by Fig. 77.

Myxosporium canker. The fungus causing this disease has been much confused in the past with *Sphaeropsis malorum.* Edgerton's* study of the fungus has shown that the two are entirely distinct. This fungus is of very frequent occurrence in Maine, but its economic importance in this State is somewhat in doubt. So far as observed the damage which it does is con-

*Edgerton, C. W. Two little known Myxosporiums. Annales Mycologici VI: 47-52. 1908.

fined to killing outer portions of the bark on old limbs and the killing back of the bark on younger limbs and twigs rather than to the production of true cankers. On such branches the fruiting pustules are found on the part which was first killed. The dead bark is separated from the healthy bark by a sharp line and is sunken as is shown in Fig. 78. The appearance of these branches is very characteristic and they can be recognized by one who has become somewhat familiar with the various cankers and twig blights, without microscopic examination of the fungus. There is some reason to believe that the fungus is not a very active parasite and it may be possible that such diseased branches have been injuriously affected by some other agency before the attack of this fungus.*

Coryneum and Phoma cankers. In the examination of apple cankers the spores of *Coryneum foliicolum* and *Phoma mali* have been found of quite frequent occurrence. Inoculation experiments in 1909 proved that both of these fungi were capable of causing disease of healthy bark of apple branches. For a detailed account of the study of these fungi the reader is referred to Bulletin 170 of this Station. The appearance of different stages of *Coryneum* cankers is shown in Figs. 79 and 80.

Cytospora canker. A species of *Cytospora* has frequently been found on small branches which have been killed back but no true cankers have been seen. Those lesions observed have much the same appearance as has been described for branches on which *Myxosporoium* is found. After a little experience one can distinguish the two fungi on the bark without the aid of the microscope.

In Bulletin 191 of the New York Station it is suggested that a species of *Cytospora* found on diseased apple branches in that State is probably parasitic. The *Cytospora* which occurs on apple branches in Maine has been isolated, grown in pure culture where it fruits abundantly, and inoculations have been made in small branches in the orchard. The fungus made only

*The fungus has been isolated from such diseased branches and has been grown in this laboratory upon sterilized apple wood and bean pods for several months. Spores were produced in the cultures about one month after the fungus was transferred from plates to bean pod tubes. Some inoculations have been made and the results of these will be given in a later publication.

a slight development in the injured tissue at the points of inoculation, while inoculations made the same day on the same branches with *Sphaeropsis* developed well marked cankers. The indications are that the species of *Cytospora* which is found in Maine is very slightly if at all parasitic.

Pear blight canker. The canker of apple trees caused by the pear blight organism, *Bacillus amylovorus* (Burril) DeToni., which has been reported as causing a great amount of damage in apple orchards in other states, has not been found in Maine, though careful search has been made for it. Almost none of the characteristic twig blight or "fire blight" on the pear which is a good indication of the presence of the organism has been seen. If this disease occurs on the apple in this State, it is of very rare occurrence.

Crown Gall. Apple trees, particularly nursery stock, sometimes have galls or knots which are usually located near the surface of the soil in the region of the collar. These galls are often covered with many fine roots giving them a hairy appearance. Such growths have been reported on a number of plants which are closely related to the apple and also on other plants which are not closely related.

In the earlier studies of this disease the cause was not understood. Injuries to the roots and unfavorable conditions of soil and moisture were advanced as causes of the trouble. Experiments were carried on in a number of places, however, which demonstrated that the disease is communicable.

Recently Smith* and Townsend† have studied crown gall on a number of plants and they have been able to prove quite conclusively that the crown gall of the apple is of bacterial origin, caused by the organism *Pseudomonas tumefaciens* Erw. Smith and Townsend.

The organism was first isolated from galls on the Paris daisy and inoculations showed that it could produce the disease. Inoculations of tomato, tobacco, potato, sugar beet, grape, carnation, raspberry, peach and apple were also followed by the development of galls. This lead to the isolation of organisms

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* Smith, Erwin F. and Townsend, C. O. A Plant Tumor of Bacterial Origin. Science, N. S. 25: 671-673. 1907.

† Townsend, C. O. A Bacterial Gall of the Daisy and Its Relation to Gall Formation in Other Plants. Science, N. S. (Abstract) 29: 273. 1909.

from the galls of peach, hard galls of apple, hairy root of apple, hops, rose, and chestnut, which were found to be very similar if not identical with the organism from the daisy.

The fact that crown gall of the apple is now definitely known to be caused by a parasite which also causes galls of a number of other plants is of great importance in the control of the disease. It will be readily seen that young apple trees should not be set in land on which another plant affected with this disease has been grown.

In the apple, the greatest amount of infection is likely to take place in nursery stock, as the trees are grown rather closely in the nursery row. When affected trees are set in the orchard, new galls develop from year to year and in many cases the trees weaken and die. Little good is accomplished by cutting off the galls at the time of setting the trees, as it is practically impossible to remove all of the infected tissue and new galls develop. It is best to secure apple trees from nurseries which are free from the disease, but in case diseased trees are received they should be destroyed. In the cultivation of orchards in which trees affected with this disease are known to occur, care should be taken that healthy trees do not become infected through injuries near the surface of the ground.

Wood destroying fungi. It is a well known fact that the heart wood of apple trees is often decayed. In many cases the extent to which the wood has been destroyed is not realized by the owner of a tree until it is blown over by a heavy wind and it is found that only a thin shell of sap wood remains. Such a condition is shown in Fig. 82.

It is not so generally understood by orchardists that this decay is caused by the growth of fungi. In some cases the mycelium of a fungus may grow on the interior of a tree for years before there is much evidence of its growth on the outside. Then after the mycelium has stored up a sufficient amount of food, the fungus produces its fruit. In many cases these wood destroyers belong to the bracket or shelf fungi of which a number of species have been reported on the apple. Very frequently the wood of apple trees is badly decayed before the fungus fruits and then it is too late to apply a remedy to the tree.

Wood destroying fungi enter the wood of trees through wounds which may be caused in various ways. Some of the common ways are barking by machinery in cultivation and injuries by such animals as rabbits and mice, and by borers. Broken or improperly pruned branches make a good place for the entrance of fungi. A broken, splintered branch which will hold moisture makes an excellent place for the germination of spores and the mycelium after it has grown for a time under favorable conditions is able to penetrate the wood. Care should be taken to remove all such broken and splintered branches and in removing them long stubs should not be left which will be slow in healing over if they heal at all. In pruning the branch should be cut back as close to the larger branch or trunk as possible, and the surface of the wound should be parallel and as near as possible on line with the surface of the main trunk or branch. Such a wound if protected will heal over without injury to the tree, while even a short stub will never do this, although the wound made is much smaller. Much of the heart rot is caused by fungi which gain entrance through stubs left by improper pruning. When it is necessary to remove large branches, the wound should be painted or otherwise protected.

Wood destroying fungi may also enter the wood through places in the bark injured by canker fungi and by frost. Here again may be emphasized the necessity of attending promptly to the treatment of all wounds of whatever origin, as the control of wood destroying fungi must be a matter of prevention and not of cure.

GENERAL TREATMENT FOR APPLE ORCHARDS.

While the enemies of the apple are numerous and varied, by far the larger part of them may readily be held in check by spraying with the more common insecticides and fungicides, and often, by a combination of materials, several enemies may be met with one application. There should, however, be a definite purpose in view for every application. The mere fact of spraying is not enough. It is important that the orchardist know *why* and *how,* and *when* to spray or otherwise combat his enemies. Beneficial insects should be recognized when seen, and should be protected and encouraged.

While spraying is beneficial and should be practiced by all, it should be supplemented by thorough orchard sanitation. No dead or diseased limbs, cankers, or mumified fruit should be allowed to remain on the trees or in the orchards. Particular attention should be given to the removal and destruction, by burning, of all rubbish, litter, decaying wood or fruit which might serve as breeding places for fungi or for insects. The good effects of cultivation in the orchard are by no means confined to those which tend to make available the food supplies contained in the soil and to the conservation of moisture. It also assists materially in the control of the fungous and insect pests of the orchard, particularly the latter.

The time of spraying will depend upon the purpose in view, but in *no case* should spraying be done when the plants are in full bloom. Spraying at this time will often interfere with the fertilization of the flowers, and consequently reduce the crop of fruit, while there is much needless destruction of bees and other beneficial insects which work upon the flowers.

Insecticides and fungicides are more effective if applied in a liquid rather than in a dry form, since they adhere to the foliage better. *Sprinkling is not spraying.* The best results are obtained from the use of a fine spray or mist forcibly applied to the foliage; and so far as possible, it should reach the under side of the leaves. A fine mist is preferable to a coarse spray, as there is much less waste of material and much less danger of injury to the foliage. A single dash of the mist is better than continued soaking, as in the latter case the material gathers in drops and runs off or injures the foliage.

As has already been pointed out (p. 383), the vegetative portions of the fungi causing disease are deep within the tissues of the plant beyond the reach of destruction. Hence sprays are of value largely to prevent the entrance of parasites into the healthy tissues and not as agents to kill them after they have once gained entrance. To be successful the spray must be on the fruit or foliage in advance of the spore of the fungus.

For many years bordeaux mixture has been practically the only spray used on orchard trees for the control of fungous diseases. While it has proven in every way efficient in controlling most of the destructive fungous diseases of the orchard, it has been found that the fruit and foliage of certain varieties of apples are frequently injured by the spray. As a rule the beneficial effects resulting from disease control have far outnumbered the ill effects of spray injury. That certain varieties of apples are susceptible to spray injury, or bordeaux injury as it is frequently called, especially if rainy, damp or cloudy weather is experienced at or immediately following the application of the spray, has been held responsible in a considerable measure for the lack of more general adoption of spraying by Maine orchardists. In too many cases the fact that many varieties (see list on p. 389) are seldom, if ever injured by bordeaux mixture has been entirely overlooked. Neither has it been understood that the danger from bordeaux mixture can be minimized largely, in many seasons, by applying the spray only during periods of bright, sunny weather, and avoiding its use, if possible, when there are several, successive, cloudy, rainy days.

However, there has been and is a demand for a fungicidal spray which will control the various plant diseases and still cause no injury to the foliage and fruit of the more tender varieties. Experiments begun by Scott* in spraying apples and peaches, the latter being very susceptible to bordeaux injury, and later taken up by others in various parts of the country, indicate that in the different lime-sulphur sprays we have the promise of something which may control certain of our orchard diseases nearly if not quite as well as bordeaux mixture and if not used too strong be practically free from the production of spray injury.

Therefore, it is recommended that all orchardists who have experienced trouble with bordeaux injury in the past, and others who wish to spray varieties which are known to be susceptible to spray injury, give the lime-sulphur treatment a thorough trial. It will be noted, however, that lime-sulphur as suggested for summer spraying for fungous diseases is used in a much more diluted form than for winter spraying for insect pests. The more concentrated sprays are far too strong to be used on the tender foliage and fruit.

The above recommendation should in no way be construed as advising against the use of bordeaux mixture where it has always been used without injury in the past or with those varieties of apples which the experience of others indicates that there is little or no danger of bordeaux producing any injurious effects on the fruit or foliage. Apple scab is the greatest factor to be

* Scott, W. M. Self-boiled Lime-sulphur as a Promising Fungicide. Bureau Pl. Ind., U. S. D. A., Cir. 1, pp. 1-18. 1908.

considered in Maine orchard spraying for fungous diseases, and in the experience of the writers bordeaux is, as a rule, more effective than lime-sulphur in controlling this disease under the weather conditions which prevail in this State. There is no reason for discarding bordeaux for lime-sulphur except to attempt to avoid spray injury on those varieties of apples upon which it is likely to occur. Even with these it is recommended that bordeaux mixture still be used for the first spraying before the buds open, followed by lime-sulphur for the later sprayings upon the foliage and fruit. If, however, the orchard has received a spring application of the more concentrated lime-sulphur wash for insects before the buds begin to swell, the early application of the bordeaux is probably unnecessary.

THE PREPARATION OF SPRAYS.

There is no part of the management of an orchard which requires more intelligent and careful work than the preparation and use of sprays. If the owner cannot attend to this part of the work himself he should put it in charge of some thoroughly competent person. Many failures from spraying have resulted from the fact that the sprays were not properly made and applied. The formulae given should be followed with care, the operator first satisfying himself that he understands each step of the process before attempting to prepare a quantity of spraying material. All material should be carefully weighed and measured.

SUMMARY OF TREATMENT.

The treatment of apple trees at various times during the season and the purpose of the same may be briefly stated as follows:

A. Lime-Sulphur (Formula 4 dilute for winter strength, page 432), before buds begin to swell. For oyster shell bark louse or San Jose scale. (For apple scab alone use Formula 1, or 4 diluted as above.)

B. Tanglefoot, smear on bands of tarred paper about the trees early in spring. For canker worm.

C. Use combination Formula 16 (Lime-sulphur diluted to summer strength and lead arsenate) or combination Formula 15, or 13 (Bordeaux and Paris green), or 14 (Bordeaux and lead arsenate), as soon as the buds open, before blossoming. For apple scab, leaf spot, rot; and for bud moth, canker worm, tent caterpillar and forest caterpillar.

D. Repeat C as soon as the blossoms have fallen. For scab, leaf spot, rot, canker worm, tent caterpillar and codling moth.

E. Repeat D after about 10 days or two weeks. Formula 1 or 4 may be used instead if the insects have been controlled by the earlier sprays.

F. Bordeaux mixture (Formula 1), or Lime-Sulphur (Formula 3 or Formula 4 dilute to summer strength, p. 432), two weeks after the last treatment if the season is very wet. For scab, leaf spot and rot.

The tent caterpillar, forest caterpillar and canker worm must be met *early,* (just as soon as they appear), in order that spraying shall be effective.

Kerosene emulsion (Formula 7) applied in June, when the eggs first hatch, is an effective treatment for oyster shell bark lice. It is also destructive to plant lice when these appear.

For summer spraying of varieties resistant to spray injury use 3-3-50 bordeaux mixture, Formula 1. For more tender varieties self-boiled lime-sulphur, Formula 3; home-cooked lime-sulphur, Formula 4, diluted to summer strength, or commercial brands of lime-sulphur diluted to summer strength, are suggested. Where scab is very prevalent or spraying has been neglected in the past it is advisable to substitute for the first spraying with lime-sulphur an application of 5-5-50 bordeaux made a little earlier in the season before the leaf buds open. It is claimed by those who have experimented with home-cooked or commercial lime-sulphur diluted to winter strength and applied just before the leaf buds open that they are also very effective in killing the spores of fungi on the twigs in addition to destroying scale and other insects.

CULTURE.

If the *curculio* and the *apple maggot* are present practice clean cultivation, plowing about three times during the season, beginning in June if the curculio is present or in July if only the maggot is troublesome; the last plowing to be made after the fruit is gathered.

Gathering Windfalls.

As both the larva of the curculio and of the maggot are found in the small apples and later leave these to pupate in the earth, it is highly important to rake up frequently all windfalls and destroy them. This means not only the larger apples but even those which are no larger than a pea. Where sheep or hogs are pastured in an orchard the trouble of gathering windfalls by hand is avoided.

Materials Used in Fighting Apple Enemies.

CAUTION: *The following formulas are for use on the apple. In many cases they are not adapted for more tender plants. Keep all poisons carefully labelled and out of the reach of children and animals.*

BORDEAUX MIXTURE, FORMULA I.

Copper sulphate (blue vitriol)	3 pounds
Fresh stone or lump lime	3 "
Water	50 gallons

It will be noted that the bordeaux mixture here recommended is only three-fifths as strong as that commonly used on potatoes in this State and formerly recommended by this and other Stations for use upon the apple. This is because later work has shown that the weaker bordeaux controls the apple scab nearly as well and is much less likely to injure the fruit and foliage than the stronger. The 5-5-50 formula should still be used upon potatoes, and upon apple trees before the buds open.

Metal vessels should not be used in the preparation of bordeaux mixture. Empty kerosene barrels with one head removed (50 gal. capacity) are more commonly used, but larger wooden tanks are frequently employed. For convenience these should hold multiples of 50 gallons, or have the capacity in 25 or 50 gallon units indicated by tacking a short, thin strip of wood at the required height on the inside of the tank.

Slake the lime and dissolve the copper sulphate in separate barrels and then dilute each with half of the water. It is necessary to strain the milk of lime solution after slaking.* This is best done in making the dilution by using a separate barrel for this purpose and using the dilution water to wash the material through the strainer. If the lime is of good quality and well slaked most of it will pass through the strainer, but with the best there will be a slight residue which may be thrown away. If arsenate of lead is to be added to the bordeaux as an insect poison the required quantity may be wet up and washed through the strainer with the lime.

When ready to use the mixture, the dilute lime and copper sulphate solutions are quickly mixed together and thoroughly stirred. This may be done by rapidly dipping up a pailful of one and then a pailful of the other solution and pouring into the mixing or spray tank while a second person agitates the mixture. *Never pour concentrated milk of lime and copper sulphate solutions together.* The above procedure is recommended only where a single barrel or at the most only a few barrels of spray mixture are needed at a time. Where any quantity of bordeaux is required stock solutions and, if possible, the elevated mixing paltform should be resorted to.

Stock solutions. When lime and copper sulphate are combined in the form of bordeaux the mixture should be used with as little delay as possible on account of deterioration. On the other hand, as long as the solutions are kept separate and covered to keep out rain and to prevent evaporation they may be stored for an indefinite period. Hence concentrated stock solu-

* The most satisfactory strainer that the writers have ever used is constructed as follows: Make a box about 12-15 inches long, without ends and just small enough to slide easily inside the top of the dilution barrel. Then one end of the box is sawed off at a considerable angle, making one side much shorter than the other. No. 50 brass wire strainer cloth is then tacked securely over this end. (Pieces of discarded wire screen cloth used on the machines in paper mills are excellent for this purpose but are of somewhat finer mesh). Two pieces of board about 2 inches wide, and long enough to reach across the top of the barrel are then nailed to the sides close to the other end. The completed strainer is then placed in the top of the dilution barrel with the wire bottom down and the two cross pieces extending across the top of the barrel and serving as supports. With a little care such a screen never troubles with clogging as the wire bottom is placed at such an angle that the solid particles are continually washed to the lower side of the screen leaving the remainder unclogged.

tions of lime and copper sulphate may be prepared, at any convenient time, sufficient for one application to the entire orchard or for the entire season if the orchard is not too large. Stock solutions are made up so that each gallon when thoroughly stirred carries a known amount of lime or copper sulphate as the case may be—as a rule either one pound or two pounds to the gallon.

If it is intended to make stock solutions carrying one pound to the gallon place 50 pounds of fresh stone lime in a 50-gallon cask, slake, dilute to thin whitewash, strain while hot and make up to 50 gallons. If arsenate of lead is to be used with the spray the proper amount may be wet up and washed through the strainer with the dilution water. *Always stir thoroughly, taking particular care to get to the bottom of the cask, before dipping out any of this stock solution,* otherwise the first will carry less than a pound to the gallon and the last more. In another 50-gallon barrel suspend 50 pounds of copper sulphate crystals in a sack close to the top, and then fill the barrel with water. The copper sulphate suspended in this way will dissolve in a few hours, or over night, while if it is placed in the bottom of the barrel it will dissolve with difficulty unless the solution is constantly stirred. Some prefer to make stock solutions carrying 2 pounds of lime or copper sulphate to the gallon. In that case use 100 pounds of material instead of 50 in each 50-gallon barrel.

To prepare the mixture from the stock solutions, assuming that they carry a pound to the gallon and a 3-3-50 bordeaux is to be made, stir thoroughly and for each 50 gallons of spray dip out 3 gallons of the lime stock into one dilution barrel and 3 gallons of the copper sulphate stock into another, add water to make up to 25 gallons each, then quickly and thoroughly mix. If the stock solutions carry 2 pounds of material to the gallon use 1½ gallons of each to 50 gallons of mixture.

Elevated mixing platform. Much of the labor of making bordeaux may be avoided, and better facilities furnished for securing a perfect mixture by the use of the elevated mixing platform. This requires four solid posts resting on flat stones or set in the ground and extending above the surface somewhat above the top of the spray tank, to form the supports of the four corners of the platform. These posts should be solidly braced by means of crossed boards nailed from one to the other. To the tops of the posts on the outside around the four sides, pieces of 2x6 or equally strong material are spiked with the edges up—these to serve as sills. Other cross sills may be necessary for added strength, varying with the size of the platform. Lastly a floor of good sound plank is laid over the sills. The size of the platform varies somewhat with the location and needs of the user, but it should be large enough to accommodate the barrels for the stock solutions and dilution barrels, and leave sufficient room to move about; 10x12 feet is large enough for most places. Fig. 83 shows the platform in use at Highmoor Farm. The higher platform with the large tank is for water storage.

The dilution vessels should be large enough so that both together will contain enough liquid to fill the spray tank. That is, for a 100-gallon tank 2 50-gallon casks will be required for dilution purposes. For a 200-gallon tank 4 50-gallon casks may be used. The dilution barrels are placed on the extreme front edge of the platform. A hole should be bored in a stave close to the bottom of each of these barrels. This hole should be large enough so that at this point a piece of rubber tubing of an inch or more internal diameter can be attached. The attachment may be made by screwing a short piece of brass pipe into the hole in the stave and sliding the rubber tube over the portion that projects outside. For added security against leaking a brass lock-nut with rubber washer may be screwed up against both inside and outside of the stave if the hole is not too close to the bottom. The rubber tubing should be long enough to reach well above the top of the dilution barrels and while the latter are being filled the free end should be held by means of a string tied around the tube near the end and hooked over a nail driven into the top end of one of the staves.

When the dilution barrels are filled the spray tank is driven alongside the platform, as close to them as possible. Standing on the spray tank the operator removes the free ends of the tubes from their support and inserts them quickly in the opening in the top of the spray tank. In this way the tank is rapidly and easily filled, and the best possible conditions supplied to secure a high grade mixture. In Fig. 83 the hose from the two barrels on the right are let down as in filling the spray tank. On the next barrel to the left the hose is hooked up as already described. In place of the hose large iron or brass faucets may be screwed to the bottom of the barrels and so arranged that they will open into a common conductor leading to the spray tank. However, on account of the corrosive action of the mixture the iron faucets will soon rust out.

Where running water is available it may be conducted to the platform with a garden hose or a metal pipe may be used, so arranged that it may be taken down or emptied before cold weather. Where running water is not available the platform may be erected alongside of a well, cistern, stream or pond. A cheap iron pump is placed on the platform, high enough so it will deliver over the tops of the barrels and connected with the water supply with a lead pipe.

BORDEAUX MIXTURE WITH IRON STICKER, FORMULA 2.

Copper sulphate (blue vitriol)......	2	pounds
Iron sulphate (copperas)..........	2-4	"
Fresh stone or lump lime..........	4-6	"
Water to make....................	50	gallons

This formula is proposed and recommended by Dr. A. D. Selby of the Ohio Experiment Station. It has not been used by the writers in Maine, but Doctor Selby makes the following statement with regard to it: *

"In this spray the iron sulphate is added in order that it may be precipitated by the lime and serve as a more complete sticker than is provided by standard bordeaux mixture. It would appear possible by the weak solution as given for the copper compound and by this possible efficient sticker to make the reduced amount of the copper sulphate do the work as fungicide just as effectively and with less risk of foliage injury than with standard bordeaux mixture. Trials made up to this time upon apples in full foliage, upon grapes, and upon potatoes indicate that the spray is efficient. *The iron sulphate is not considered a fungicide.*"

Where spray injury upon apple trees is experienced and the orchardist does not wish to go to the trouble of preparing his own lime-sulphur sprays or go to the expense of purchasing the prepared brands of lime-sulphur, a trial of this modified form of bordeaux mixture is suggested.

* Selby, A.. D. Ohio Exp. Sta. Bul. 214, p. 358, 1910.

Lime-sulphur sprays. The orchardist who desires to use lime-sulphur compounds for summer spraying may choose one of the following: a self-boiled lime-sulphur, a home-cooked, or a factory-cooked concentrated material which must be diluted before it is applied. The first is comparatively easy to prepare but less effective than the other two. The home-cooked concentrated may be prepared some time before needed and later diluted as fast as required for use. It has the disadvantage of being somewhat more difficult to prepare, requiring some form of cooker and other pieces of apparatus. Of the factory-cooked concentrated material there are several brands on the market which seem to equal the home-cooked in efficiency and in freedom from the production of spray injury if used in sufficient dilution. On the other hand, the commercial brands of lime-sulphur are, of necessity, the most expensive. This is partly offset in the saving in time and trouble in preparing the material. All that is necessary to do with these commercial brands is to dilute and apply.

Self-boiled lime-sulphur. The self-boiled lime-sulphur is the least effective in controlling apple scab according to the experience at this Station, but to prepare it requires no more apparatus or skill on the part of the maker than in preparing bordeaux mixture.

SELF-BOILED LIME-SULPHUR, FORMULA 3.

Sulphur	10 pounds
Fresh stone or lump lime..........	10 "
Water	50 gallons

To be applied without farther dilution.

The following is the method of preparation as described by Scott* and as used by the writers in the experiments mentioned on p. 391:

"The mixture can best be prepared in rather large quantities—say 20 pounds, or even 40 pounds at a time—so as to get enough heat to produce a violent boiling for a few minutes. Place the lime in a barrel and pour on enough water (about 3 gallons to 20 pounds) to start it slaking and to keep the sulphur off the bottom of the barrel. Then add the sulphur, which

* Scott, W. M., Bureau Pl. Ind., U. S. D. A., Cir. 27, p. 5. 1909.

should first be worked through a sieve to break up the lumps, and finally enough water to slake the lime to a paste. Considerable stirring is necessary to prevent caking on the bottom. After the violent boiling which accompanies the slaking of the lime is over, the mixture should be diluted ready for spraying, or at least enough cold water added to stop the cooking. Five to fifteen minutes are required for the process, according to whether the lime is quick-acting or sluggish. The intense heat seems to break up the particles of sulphur into about the physical condition of precipitated sulphur and the violent boiling makes a good mechanical mixture of the lime and sulphur. Only a small percentage of the sulphur—enough to improve the adhesiveness of the mixture—goes into solution, but if the hot mass is allowed to stand as a thick paste the sulphur continues to unite with the lime, and at the end of thirty or forty minutes enough of the reddish liquid is produced to burn peach foliage in some cases. Hence the necessity for cooling the mixture as soon as the lime is well slaked. The finely divided sulphur in mechanical mixture with the lime is depended upon for the fungicidal action rather than the sulphide in solution, the latter being harmful to foliage except in very dilute form."

The mixture must be strained and particular care taken to wash all of the particles of sulphur through the strainer. The form of strainer, with the sharply inclined bottom, described in the foot-note on p. 425, is very satisfactory for this purpose. Maine lime is rather slow to heat up but slakes well and thoroughly after it is once started. Therefore, when employed for this purpose a few dippers of hot water may be used at first to start the lime off briskly. If all hot water is used there is some danger of bringing too much sulphur into solution and injury to the foliage results when applied to the more tender varieties. The diluted mixture may be kept for a week or more without deterioration. On account of the character of the mixture great care must be taken to see that it is constantly and thoroughly agitated while being applied. Otherwise much of the suspended sulphur will settle to the bottom.

Home-cooked concentrated lime-sulphur. For the average farmer using only a small quantity it is probably wiser to purchase the factory-cooked concentrated material for dilution than to attempt its manufacture himself. However, in the case of large orchards where the expense for the ready-made article would be large or where the user has had some experience or training in similar lines of work its preparation may well be attempted. Before doing so it would be well to obtain and read Bulletin 99 of the Pennsylvania Station, State College, Pa., and Bulletin 320 of the New York Station, Geneva, N. Y. A kettle or some form of cooker is necessary and, whether one prepares his own concentrate or buys the ready prepared, some form of specific gravity apparatus as the Baumé hydrometer for testing the strength of the concentrated mixtures is essential. These latter may be obtained from various dealers in scientific apparatus. Those used by this Station were purchased of the Bausch & Lomb Optical Co., Rochester, N. Y. A pamphlet describing their use comes with the instruments, or may be obtained free on request. The cost for the complete hydrometer outfit need not exceed $1.00 to $1.25.

Professor Whetzel and his associates at Cornell University as the result of their studies and experiments have done much to stimulate interest in this class of fungicides. The following method of preparing the concentrated mixture is adapted from a paper read by Professor Whetzel before a recent meeting of the New York State Fruit Growers' Association, and is based on the recommendations of Professor Cordley of the Oregon Station, who has probably done more than any one else to develop lime-sulphur spraying for fungous diseases, especially on the Pacific coast.*

HOME-BOILED CONCENTRATED LIME-SULPHUR, FORMULA 4.

Sulphur (best finely ground)	110 pounds
Fresh stone or lump lime	55 "
Water to make	60 gallons

Caution. *Must be greatly diluted for use on apple foliage, see below.*

Slake the lime in the kettle, make a paste of the sulphur with a little water, then add this paste and the remainder of the water to the lime solution in the kettle. Boil 30-45 minutes or until the sulphur is dissolved and then after the sediment has been allowed to settle pour off the clear, amber liquid which should be approximately 45 gallons and test about 30° Baumé. The

*Cordley, A. B. Oregon Exp. Sta. Bul. 108, p. 16, 1910.

liquid may test higher or lower than this, varying with the concentration, so it should always be tested. *The liquid should not be tested while hot but should be cooled to about 60° F.* The reading on the hydrometer should be taken at the general surface of the liquid at which it is supported.

If the concentrate is not intended for immediate dilution it should be at once stored in tightly closed containers till ready for use. The amount of dilution will, of course, depend upon the density of the concentrate. The following table supplied by Cordley gives the amount of dilution of concentrated lime-sulphur stock solutions of different degrees of density according to the Baumé scale for winter and summer spraying of apple trees. Only the dilutions indicated in the right-hand column should be used for trees in leaf.

TABLE FOR DILUTION OF CONCENTRATED STOCK SOLUTIONS OF VARYING DENSITIES.

Stock Solution Baumé Scale Reading.	Winter Strength Leaves Off. Dilution.	Summer Strength Leaves On. Dilution.
32°	1-12	1-30
31°	1-11	1-29
30°	1-10	1-28
29°	1-9½	1-27
28°	1-9	1-26
27°	1-8½	1-25
26°	1-8	1-24
25°	1-7½	1-23
24°	1-7	1-22
23°	1-6½	1-21
22°	1-6	1-20

Not counting the initial cost of the apparatus it is estimated that at the prevailing price of labor and materials home-made, concentrated lime-sulphur can be prepared for from $3.00 to $3.50 per barrel of 50 gallons. If the fact that 50 gallons of concentrated material will when diluted for summer use make from 1300 to 1500 gallons of spray, is remembered, it will be seen that home-cooked lime-sulphur is considerably less expensive than bordeaux mixture.

Commercial concentrated lime-sulphur. During the past two years several firms have placed on the market different brands of concentrated lime-sulphur similar to the home-boiled article. Quite a number of these have been tested experimentally and as a rule these have given quite favorable results when compared with the latter. While directions may be furnished with the commercial brands, they should always be tested with the hydrometer and the dilutions made on this basis, using the table given above.

"Variations in the degree of concentration of the commercial lime-sulphur mixtures may occur with different barrels of the same brand. Some companies compounding these sprays have apparently not been able to produce a wash of definite strength or have failed to realize the importance of maintaining a uniform grade for their product."*

All other things being equal, an article testing rather high and relatively free from sediment would be the more economical to buy. Hydrometers do not detect soluble impurities added to lime-sulphur concentrates for the purpose of increasing their densities. The national law against the adulteration of fungicides and insecticides will doubtless prevent this difficulty, but if there is any reason to suspect the character of any brand of goods a sample should be submitted to a chemical examination.

Before buying any of these concentrated sprays the purchaser should *make sure that it is a lime-sulphur compound.* At least one other concentrated substitute for bordeaux the name of which indicates that it is some sort of a soluble sulphur preparation has been known to produce disastrous results when applied to apple trees with arsenate of lead in even greater dilutions than recommended by the manufacturers.

FORMULAS FOR INSECTS WHICH CHEW.

Formula 5. PARIS GREEN.

Paris green	½ pound
Lime (unslaked)	3 pounds
Water	50 gallons

The standard remedy for the destruction of insects which eat

*Parrot, P. J., N. Y. Exp. Sta., Bul. 320, p. 423, 1909.

the foliage or fruit. The lime is added to prevent the Paris green from burning the foliage. Slake the lime in a little water, make into a thin paste and strain. Wet the Paris green with a little water and make into a thin paste. Mix the lime and Paris green and add the remainder of the water.

Formula 6. LEAD ARSENATE.

Lead arsenate	2 pounds
Water	50 gallons

Arsenate of lead acts slower as a poison than Paris green. It has the advantage, however, of remaining longer in suspension in water, of not burning the foliage and of adhering better than Paris green. Make a smooth thin paste with the poison and a little water and add the remainder of the water and stir thoroughly. In our own practice this is preferred to Formula 5.

FORMULAS FOR INSECTS WHICH SUCK.

Formula 7. KEROSENE EMULSION.

Hard soap	½ pound
Boiling water	1 gallon
Kerosene	2 gallons

To prepare, dissolve one-half pound of soap in one gallon of soft water by boiling; when well dissolved and still boiling hot, remove from the fire and add two gallons of kerosene, and agitate at once as briskly as possible. The emulsion is more readily made if the kerosene first be heated by immersing the vessel containing it in a larger vessel of boiling water. *Never* heat the kerosene over a direct fire.

If large quantities are being made, a good way to emulsify is to use a force pump and spraying nozzle and pump the mixture as forcefully as possible back into the vessel containing it. If the emulsion is properly formed, the whole mass will appear much like whipped cream and will mix readily in water without a film of oil rising to the top.

As soon as emulsified, add twenty-seven gallons of water and use at once. This will make thirty gallons of the mixture, and such an emulsion will be one-fifteenth oil (or a 7% emulsion).

This is the strength ordinarily used for the destruction of insects upon plants. For larger or smaller quantities, prepare in the same proportions.

Sometimes the emulsion is not perfect and a little oil rises to the top. In such cases, if the last in the barrel or tank is pumped out upon the foliage, it is likely to burn it. So it is advisable, unless the emulsion is of good quality, to throw out the last few gallons, making no use of it.

It is best to dilute and apply kerosene emulsion as soon as it is prepared.

Avoid using alkali or any hard water in making the emulsion, as it will cause the oil to separate and rise to the top. Any clean, soft water will usually give good results.

Formula 8. MISCIBLE OILS.

There are several miscible oils upon the market which may be added directly to water forming a milky emulsion at once. In the preparation of any of these, such as "Scalecide," or "Target Brand Scale Destroyer" or "Killoscale," add the oil directly to the water with a little stirring. One gallon of the miscible oil in 30 to 50 gallons of water will make a mixture, which in most cases will be strong enough to kill plant lice, if thoroughly applied.

Formula 9. WHALE-OIL OR FISH-OIL SOAPS.

The so-called whale-oil or fish-oil soaps which are quite extensively used for the destruction of plant lice, will usually be effective if thoroughly applied in the proportion of one pound of the soap to each six or eight gallons of water. There are numerous brands of these soaps upon the market. Among those that have been used quite successfully are Good's Whale-Oil Soap and Bowker's Tree Soap.

Formula 10. SOAP SOLUTION.

Washing powder	½ pound
Water	3 gallons

The soap dissolves readily in the water.

Formula 11. TOBACCO DECOCTION.

Tobacco stems or tobacco dust......	2 pounds
Water	4 gallons

Put the tobacco in the water, enough to cover, which may be either cold or hot. Place over the fire and when the water has reached the boiling point, remove some of the fire and allow the water to simply *simmer* for fully one hour, when the liquid is ready to be drained off, diluted to the above proportions and applied. Boiling violently drives off the nicotine.

If whole-leaf tobacco is used, prepare as above, using one pound of tobacco to each four gallons of water.

No lime or other alkaline substance should be added to the tobacco while cooking. Apply at once, or within a few days after making if possible.

Black Leaf.—There is nothing to do in the preparation of Black Leaf except to thoroughly stir the contents of the can before pouring out any quantity for dilution. In most cases one gallon of the Black Leaf will be found sufficient for each seventy gallons of water. But if in the treatment of any louse this does not seem sufficient it may be used in proportion of one gallon to sixty or sixty-five gallons of water. Careful sprayers have usually succeeded in killing plant lice with this preparation in the proportion of one gallon to each one hundred gallons of water. Thoroughness of application is of as much importance as the strength of the material used.

Formula 12. CAUSTIC SODA.

Caustic soda	1 ounce
Water	2 gallons

The soda dissolves readily and may be used in any amount desired. It is a strong caustic, however, and must be used with care, and only when the trees are dormant.

FORMULAS FOR COMBINED INSECTICIDES AND FUNGICIDES.

Make a smooth paste of the poisons and a little water, add to the Bordeaux mixture and stir thoroughly. Apply at once.

Formula 13.

Paris green	½ pound
Bordeaux mixture (Formula 1)....	50 gallons

Formula 14.

Lead arsenate	1–3 pounds
Bordeaux mixture (Formula 1)....	50 gallons

Formula 15.

Lead arsenate	1–3 pounds
Self-boiled lime-sulphur (Formula 3)	50 gallons*

Formula 16.

Lead arsenate	1–3 pounds
Home-boiled lime-sulphur (Formula 4 diluted to summer strength, p. 432)	50 gallons*

HOW TO SPRAY.

To do really good and effective work in orchard spraying requires constant care and watchfulness on the part of the operator, and also requires a certain amount of practice to secure the best results. Thoroughness is very essential, but by thoroughness is not meant drenching the tree. The spray should be delivered with a constant, strong pressure, issuing from the nozzle in a fine mist, the finer the better. The operator after a little experience will find that if he moves the extension rod carrying the nozzles at the proper rate and the right distance removed from the leaves he as enabled to cover them thoroughly with a fine mist-like coating, provided the proper type of nozzle is used, and there is no tendency for the mixture to gather together in large drops on the leaves or drip off from the edges. While avoiding applying enough of the spray to cause dripping care should be taken to reach the foliage and limbs on all parts of the tree. It is impossible to do thorough spraying in trees which have not been properly pruned and in which the tops are filled with water-sprouts and interlocking branches. In large orchards three men can usually work to advantage,—one to drive the team and work the pump, the others to handle the nozzles.

* Paris green should never be used with lime sulphur. Lime sulphur and arsenate of lead should not be used in gas sprayers in connection with carbon dioxide gas, since by chemical action of these ingredients upon each other arsenic is set free which may injure the foliage.

SPRAYING APPARATUS.

Pumps: Regardless of the style or size of the pump all working parts which come in contact with the liquid should be of brass or bronze. To do good spraying it is necessary to have high pressure, 100 pounds or more per square inch, hence it is essential to have a pump of sufficient capacity to do the required amount of work with ease.

Barrel pumps: For small orchards, and particularly where general farming is carried on, the barrel pump worked by hand is probably the most satisfactory. It may be mounted on a two-wheeled cart and with slight alterations in hose connections may be used for spraying potatoes and other field and garden crops. The pump should have a large air chamber to maintain a constant, steady pressure. Good barrel outfits complete for orchard spraying may be obtained for from $20 to $30 or even less. For larger spraying operations where it is desired to avoid the expense of power machines a large size, double action, two cylinder hand pump may be obtained at somewhat greater expense. These are operated by either one or two men and are usually mounted on a four-wheeled wagon with a 150 or 200 gallon tank.

Geared or traction sprayers: Sprayers with the pump actuated by a gear attached to the axle or by chain gear from the wheel of the cart as the apparatus is drawn along are quite generally and successfully used on Maine potato fields. Certain makes of this type of machine are equipped with an orchard spraying attachment. They are not recommended as practicable for orchard work, particularly on large trees, on account of the tendency for the pressure to run down when in use and not in motion.

Gasolene sprayers: For the large orchardist where some thousands of trees must be sprayed in a very short time some form of power sprayer capable of furnishing two or four leads of hose with constant high pressure is absolutely essential. They are economical in time, labor and material. While each style of power sprayer has certain advantages, the gasolene type with the engine, pump, and tank mounted on a frame on low wheels is most generally used where the land is not too rough. Improvements in engine construction have removed many of the former objections to this type of machine. Both air and water cooled engines are said to be satisfactory—the writers prefer the latter.

Compressed air and gas sprayers: While not power sprayers in the sense that the gasolene machines are, sprayers run by means of compressed air or gas answer the same purpose in that they provide a constant pressure without the aid of hand labor or traction power.

The compressed air type consists usually of two horizontal cylinders which may be closed air tight.* One is for the liquid and the other for the compressed air, and the two are connected with a pipe having a shut-off. This valve is closed and air pumped into the air chamber till a pressure considerably greater than that desired for spraying is reached. In use the valve is gradually opened allowing the pressure to escape into the chamber containing the spray and thus force it out through the hose and nozzles. Apparatus of this nature is adapted to steep, rough land. Some of the objections to it are that the mixture is as a rule not properly agitated, and it is necessary to purchase an air-compressor to be run either by a gasolene engine or some other power.

Compressed gas machines run on the same principle as the compressed air sprayers, but in this case the power is supplied in relatively small cylinders of compressed gas under very high pressure. These cylinders must be sent away to the factory to be recharged. One of the chief advantages claimed for this type is that there are no "engine troubles" or breakdowns and anyone who can drive a team of horses can run them. This is largely offset, however, on account of the necessity of having to either keep a considerable stock of charged cylinders on hand or run the risk of unexpected delays in transportation at a critical time in the spraying operations.

Agitators: Successful spraying requires that the mixture in the tank is kept constantly agitated while being applied. The intending purchaser should satisfy himself that the machine in question is so constructed that the mixture will be well stirred up from the bottom of the tank at each stroke of the pump.

Hose extension rod and nozzles: To stand the high pressure required only the best grade of hose should be purchased. This

*One chamber may alone be used and filled partly with liquid and then the remainder with compressed air.

should be in 25 or 50 foot lengths, varying with the height of the trees and the distance they are set apart. If the operator stands on a tower built on the spray cart shorter lengths of hose are necessary.

A bamboo extension rod carrying the nozzle and with a non-corrosive metal tube in the center should be used on the end of the hose. The end of the rod nearest the operator should be provided with a shut-off which can be easily manipulated, and at the farther end the tube should be slightly bent or be provided with an elbow which will incline the nozzle somewhat out of the straight line of the rod. This latter will better enable the operator to direct the spray where it will do the most good.

All types of nozzles which throw a coarse or relatively coarse spray should be avoided. The ideal nozzle delivers the spray in a fine mist or fog. The Vermorel type has long been a favorite but in recent years several improvements on this have appeared. These are constructed on the same general plan but some of them are larger, simpler in construction and give equally as fine or finer mist, cover a larger area and for that reason are better adapted to rapid work with power machines.

Care of spraying machinery: After each time using all spray material should be washed out of the pump, pipes and nozzles by pumping a quantity of clean water through them. This not only materially adds to the life of the apparatus but trouble from clogged nozzles from particles of the dried sediment will be avoided when needed again. In summer when not in use the tank should be kept partly full of water. When through for the season the tank and pumps should be entirely freed of water to avoid damage from freezing in cold weather.

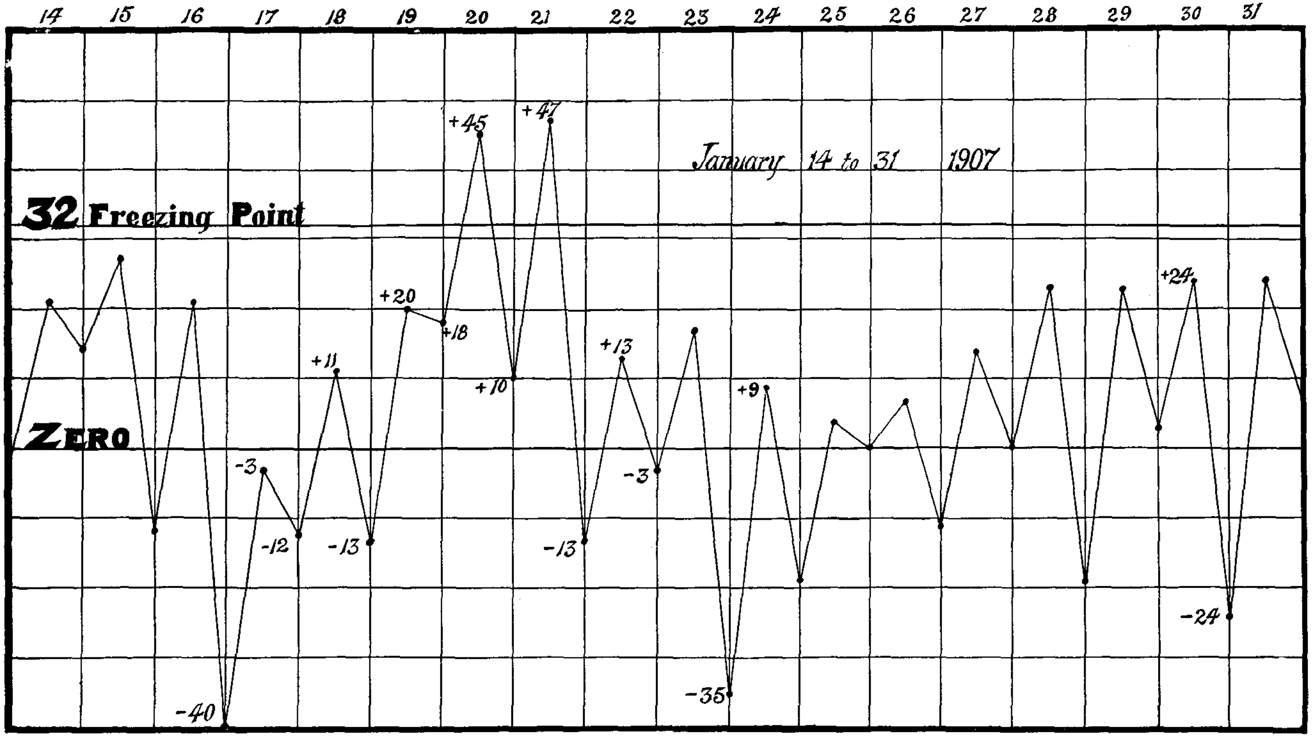


Fig. 56. Maximum and minimum temperatures in degrees F., Orono, Me., Jan. 14-31, 1907

Fig. 57. Crotch injury of apple tree.

Fig. 58. Spray injury on fruit.

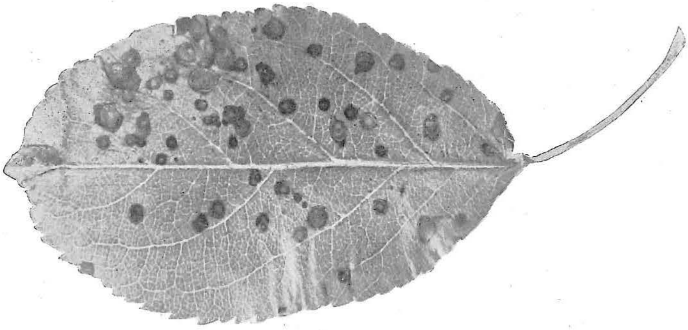


Fig. 59. Spray injury on leaves.

Fig. 60. Spotting of leaves by fungus.

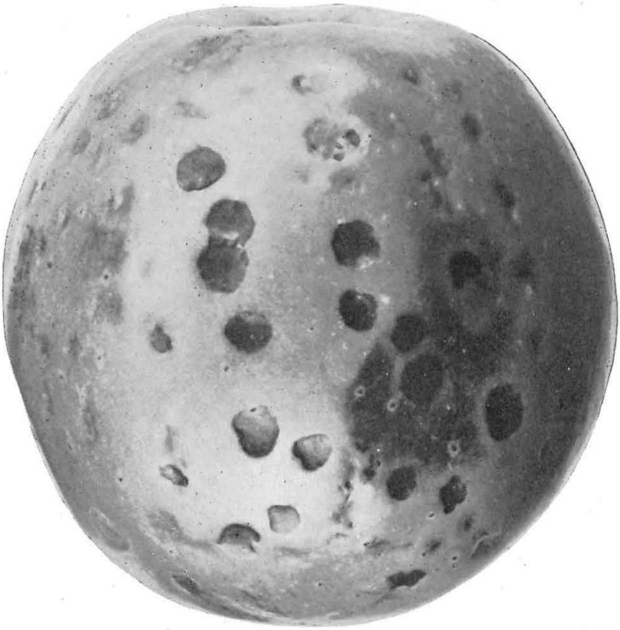


Fig. 61. Baldwin spot.

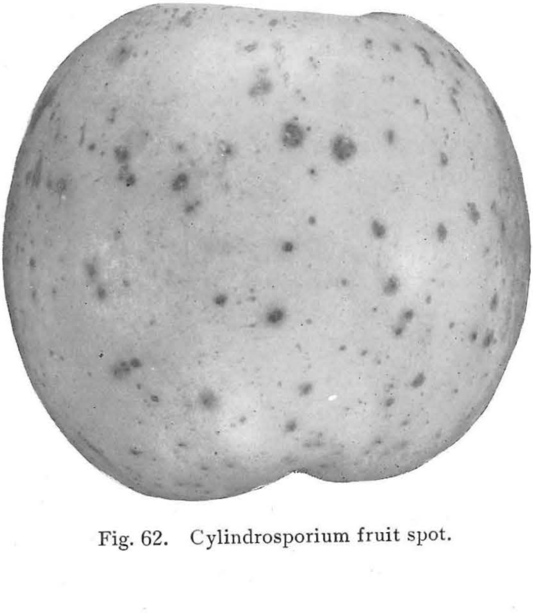


Fig. 62. Cylindrosporium fruit spot.

Fig. 63. Lichens on an apple branch.

Fig. 64. Malformation and cracking resulting from a bad attack of scab. The surface of the fruit is nearly covered with scab spots.

Fig. 65. Scab developed in storage.

Fig. 66. Scab on apple leaves.

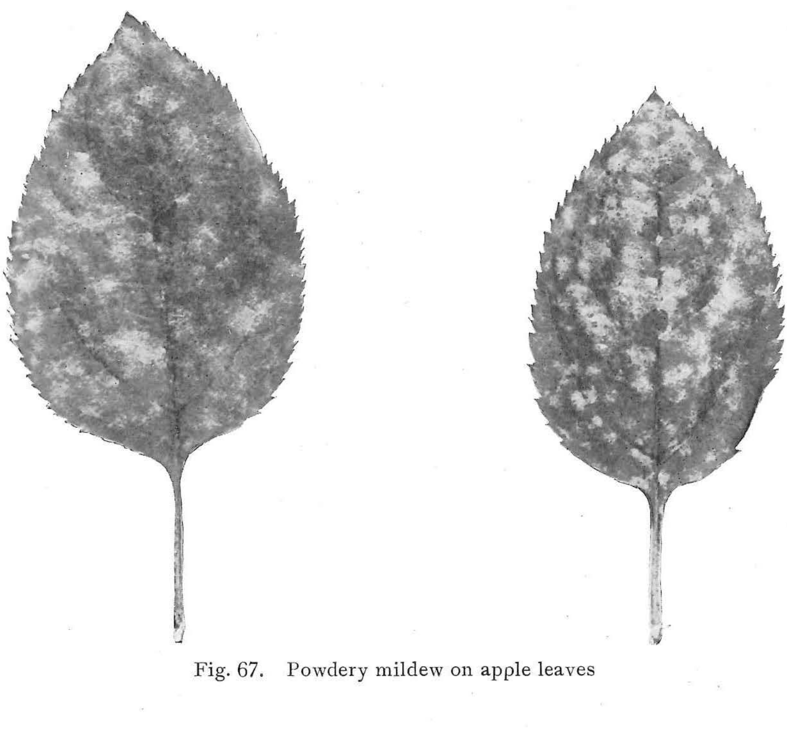


Fig. 67. Powdery mildew on apple leaves

Fig. 68. Sooty blotch.

Fig. 69. Black rot.

Fig. 70. Blue mold decay.

Fig. 71. Bitter rot.

Fig. 72. Brown rot resulting from artificial inoculation.

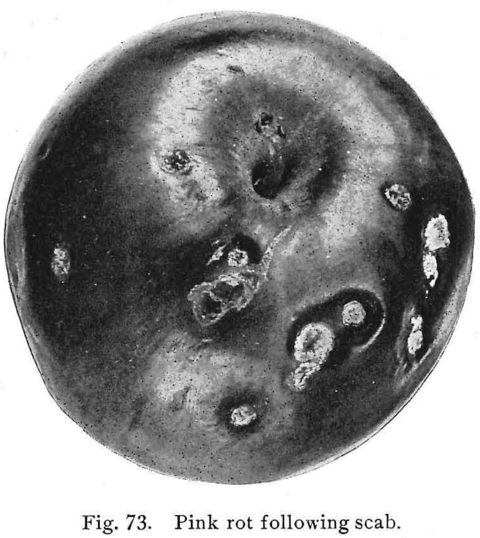


Fig. 73. Pink rot following scab.

Fig. 74

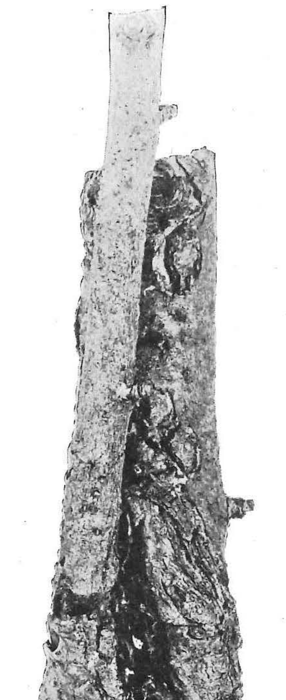


Fig. 75

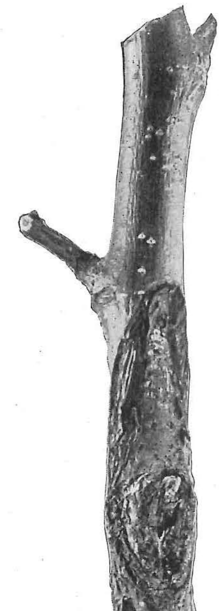


Fig. 76

Different stages in the formation of Sphaeropsis limb cankers.

Fig. 77
Bitter rot. Stem of young tree, one month after inoculation with fungus.

Fig. 78
Myxosporium twig-blight

Fig. 79

Fig. 80

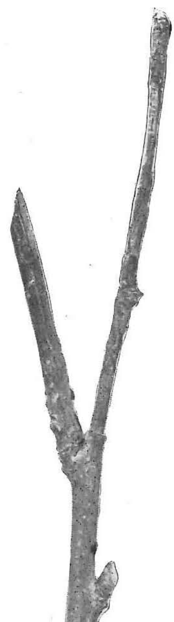


Fig. 81

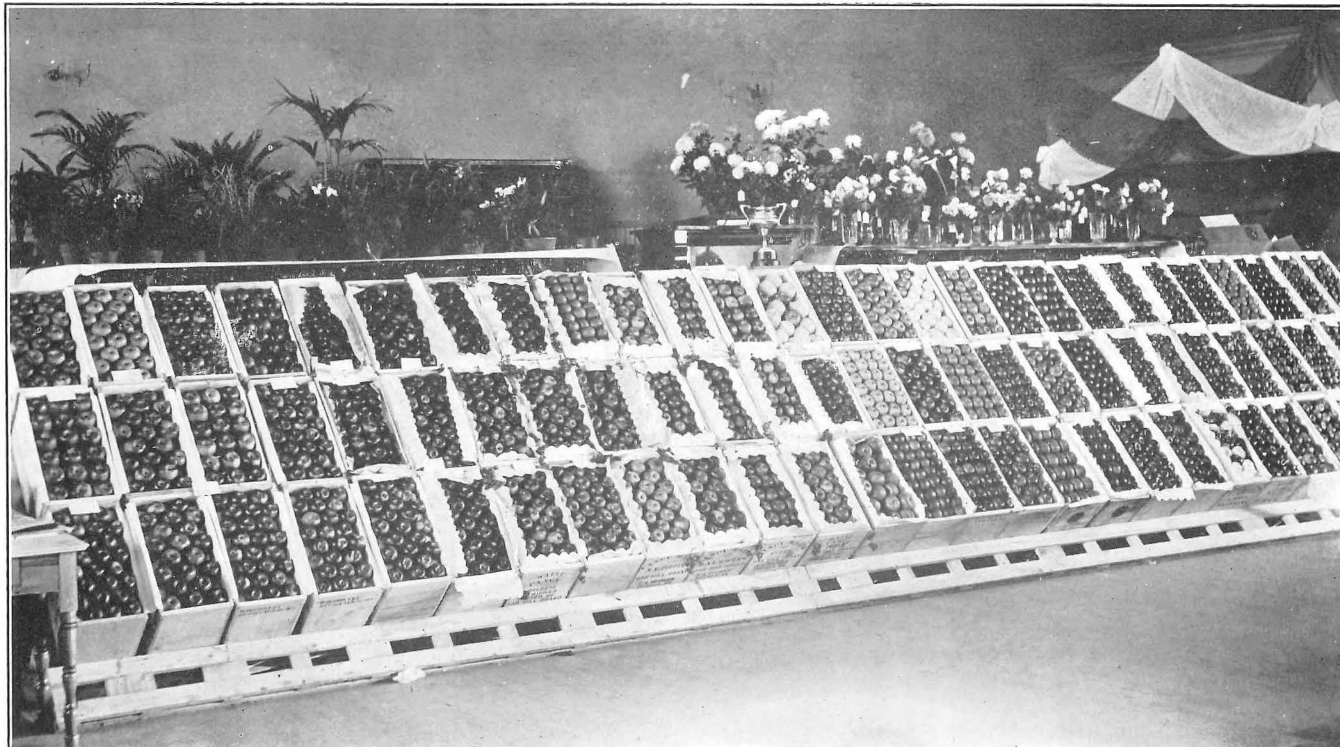
CORYNEUM

Fig. 79. Branch 3 months after inoculation
Fig. 80. Young canker produced naturally
Fig. 81. Twig blight, caused by Coryneum

Fig. 82. Decay of the heart-wood resulting from fungus infection of surface wounds.

Fig. 83. Elevated platform, at the right, for preparing Bordeaux Mixture. The larger tank on the higher platform is for water storage.

SUBJECT INDEX TO MAINE APPLE DISEASES.



Portion of Box Exhibit at Annual Meeting, Maine State Pomological Society, Auburn, November 8-10, 1910.

APPENDIX.

Annual Report of the State Pomological Society

1909-1910.

OFFICERS FOR 1910.

President,
DR. G. M. TWITCHELL, Auburn.

Vice Presidents,
H. L. KEYSER, Greene.
G. L. PALMER, So. Livermore.

Secretary,
E. L. WHITE, Bowdoinham.

Treasurer,
E. L. LINCOLN, Wayne.

Executive Committee,
WILL E. LELAND, Sangerville.
F. H. MORSE, Waterford.
E. F. HITCHINGS, Waterville.

Member of Experiment Station Council,
C. S. POPE, Manchester.

Trustees,
Androscoggin County—Silas A. Shaw, Auburn.
Aroostook County—Edward Tarr, Mapleton.
Cumberland County—John W. True, New Gloucester.
Franklin County—E. E. Hardy, Farmington, R. F. D.
Hancock County—William H. Miller, Bar Harbor.
Kennebec County—E. A. Lapham, Pittston.
Knox County—Alonzo Butler, Union.
Lincoln County—H. J. A. Simmons, Waldoboro.
Oxford County—W. H. Allen, Buckfield.
Penobscot County—A. A. Eastman, Dexter.
Piscataquis County—C. C. Dunham, Foxcroft.
Sagadahoc County—J. H. King, Bowdoinham.
Somerset County—Frank E. Nowell, Fairfield.
Waldo County—
Washington County—D. W. Campbell, Cherryfield.
York County—J. Merrill Lord, Kezar Falls.

CONTENTS.

MEMBERS OF THE SOCIETY.

LIFE MEMBERS.

Allen, Wm. H. ....Buckfield
Andrews, A. Emery..........Gardiner
Andrews, Charles E...........Auburn
Atherton, Wm. P...........Hallowell
Atkins, Charles G...........Bucksport
Averill, David C.............Temple
Bailey, W. G...............Freeport
Bennoch, John E...............Orono
Bickford, Lewis I.....Dixmont Center
Bisbee, George E............Auburn
Bisbee, Stanley........Mechanic Falls
Blanchard, Mrs. E. M.......Lewiston
Blossom, O. E.........Turner Center
Boardman, Samuel L.........Bangor
Briggs, John.................Turner
Burr, John.................Freeport
Butler, Alonzo ....Union
Chadbourne, C. L......North Bridgton
Chandler, Mrs. Lucy A......Freeport
Chase, Henry M., 103 Federal Street, Portland
Chase, Homer N. ....Auburn
Conant, W. H..............Buckfield
Corbett, Herman .... Farmington
Craig, William ....Abbotsford, Quebec
Crowell, Mrs. Ella H.......Skowhegan
Crowell, John H.........Farmington
Cushman, Chas. L............Auburn
Dana, Woodbury S..........Portland
Dawes, S. H...............Harrison
DeCoster, Virgil P...........Buckfield
Denison, Mrs. Cora M.......Harrison
DeRocher, Peter ....Bradentown, Fla.
Dirwanger, Joseph A.........Portland
Dunham, W. W..........North Paris
Dyer, Milton ....Cape Elizabeth
Emerson, Charles L.....South Turner
Farnsworth, B. B............Portland
Felch, Chas. E.............Limerick
Frost, Oscar F.............Monmouth
Gardiner, Robert H.........Gardiner
George, C. H................Hebron
Gilbert, Z.. A...........North Greene
Goddard, Lewis C..........Woodfords
Grover, Franklin D.............Bean
Gulley, Alfred G. ......Storrs, Conn.
Hackett, E. C.........West Gloucester
Hall, Mrs. H. A...............Brewer
Hanscom, John ....Saco
Hardy, E. E..............Farmington
Harris, William M............Auburn
Heald, U. H..................Paris
Herrick, A. A................Norway
Hixon, A. A..........Worcester, Mass
Hoyt, Mrs. Francis..........Winthrop
Jackson, F. A.............Winthrop
Keene, Charles S.............Turner
Knowlton, D. H...........Farmington
Lapham, E. A...............Pittston
Leland, Will E.......East Sangerville
Lincoln, E. L................Wayne
Litchfield, J. H...............Auburn
Litchfield, Mrs. L. K.........Lewiston
Lombard, Thurston M.........Auburn
Lord, J. Merrill..........Kezar Falls
Luce, Willis A.........Columbia Falls
Macaulay, T. B.........Montreal, Can
Mayo, E. P................Waterville
McAllister, Zaccheus......West Lovell
McCabe, George L.......North Bangor
McLaughlin, Henry ....Bangor
McManus, John............Brunswick
Merrill, Oliver F............Gardiner
Mitchell, Frederick H.........Turner
Mitchell & Co............Waterville
Moody, Charles H.............Turner
Moore, William G..........Monmouth
Moor, F. A...............Waterville
Morse, F. H...............Waterford
Morse, W. J...................Orono
Moulton, Dr. John F.......Limington
Newell, G. E.................Turner
Page, F. W.................Augusta
Palmer, George L.....South Livermore
Parsons, Howard G.....Turner Center
Patten, Mrs. E. C...........Topsham
Prince, Edward M...West Farmington
Pope, Charles S..........Manchester
Pulsifer, D. W................Poland
Purington, E. F...........Farmington
Richards, John T............Gardiner
Ricker, A. S................Turner
Ricker, Fred P...............Turner
Roak, George M..............Auburn
Sanborn, Miss G. P.........Augusta
Sawyer, Andrew S.....Cape Elizabeth
Saunders, Ernest............Lewiston
Seavey, Mrs. G. M...........Auburn
Simmons, H. J. A.........Waldoboro
Skillings, C. W.........North Auburn
Smith, Frederick O....New Vineyard
Smith, Henry S............Monmouth
Snow, Mary S................Bangor
Stanley, H. O...............Winthrop
Staples, Geo. W., 904 Main St. Hartford, Conn.
Starrett, L. F..............Warren
Stetson, Henry ....Auburn
Stilphen, Asbury C..........Gardiner
Supt. Maine Sanatorium Farm, Hebron
Taylor, Miss L. L.(Lakeside) Belgrade
Thomas, William W.........Portland
Thomas, D. S...........North Auburn
Thurston, Edwin....West Farmington

LIFE MEMBERS—Concluded.

Tilton, William S.......Boston, Mass.
Townsend, Mrs. B. T.........Freeport
True, Davis P...........Leeds Center
True, John W.........New Gloucester
Turner, E. P...........New Vineyard
Twitchell, Geo. M..............Auburn
Vickery, James ....Portland
Vickery, John ....Auburn
Wade, Patrick..............Portland
Walker, Charles S...............Peru
Walker, Elmer V.............Oxford
Waterman, Willard H...East Auburn
Waugh, F. A.........Amherst, Mass.
Weston, Joseph ....Gardiner
Wheeler, Charles E.......Chesterville
White, Mrs. Annie......Bowdoinham
White, Edward L.........Bowdoinham
Woods, Chas. D...............Orono
Wright, Frederick..............Bath
Yeaton, Samuel F...West Farmington

ANNUAL MEMBERS FOR 1910.

Bailey, R. G...............Wiscasset
Bass, Lizzie E................Wilton
Bass, Mary A................Wilton
Bearce, Harry W............Hebron
Black, H. C.................Augusta
Bonns, Prof. W. W........Monmouth
Clement & Taylor...........Winthrop
Cummings, R. L..........West Paris
Day, H. L..................Auburn
Dolloff, D. W...............Standish
Drinkwater, E. A...........Sabattus
Dunn, F. G..................Norway
Edwards, M. O.............Lewiston
Frost, H. L........Arlington, Mass.
Gardner, Prof. V. R............Orono
Gee, Albert H., 261 Webster St., Lewiston
Gould, Rev. William H.......Portland
Gray, Ralph..................Dover
Hammond, Herbert P..........Paris
Harlow, E. L................Turner
Harlow, Harry G...........Buckfield
Hitchings, E. F...........Waterville
Hobart, H. O................Auburn
Ingraham, William M., 396 Congress St. Portland
Irish, H. D................Buckfield
Keyser, H. L................Greene
King, John H...........Bowdoinham
King, Mrs. John H.......Bowdoinham
Knowlton, Geo. H.........Vassalboro
Lang, Ivan E...........Bowdoinham
Leavitt, Leonard C...... Kezar Falls
Lee, Fred W................Augusta
Lee, Lyman K..............Foxcroft
Leland, Walter E.....Mechanic Falls
Libby, E. H..................Auburn
Lincoln, Mrs. E. L...........Wayne
Littlefield, Harry W..........Brooks
Macomber, John H..............Jay
Marston, David ....Monmouth
Maxwell, J. W..............Sabattus
Merrill, A. L................Auburn
Merrill, C. A................Auburn
Merrill, H. H...............Hebron
Millett, C. R............West Minot
Mudgett, D. G................Albion
Newbury, F. Prescott.........Carmel
Nichols, Dr. Estes............Hebron
Nowell, F. E................Fairfield
Paine, C. D. ....Dover
Paine, Horace...................Jay
Palmer, W. R.................Orono
Pollard, D. A. 461 Court St., Auburn
Pulsifer, H. B. 122 Seventh St., Auburn
Ricker, F. A................Turner
Ricker, W. J................Turner
Sawyer, J. W........Reading, Mass.
Shaw, Silas A...............Auburn
Shorey, L. T. .... Monmouth
Smith, Geo. S. .... Monmouth
Smith, Dr. Owen., 692 Congress St., Portland
Smith, Woodbury A.....So. Newcastle
Sweetsir, Fred R.....Cumberland Ctr.
Tarr, Edward...............Mapleton
Thayer, Jarvis M.............Paris
Tucker, Benj................Norway
Tucker, Herbert M...........Canton
Washburn, C. C......Mechanic Falls
Wood, H. O................Lewiston
Wood, Mabel V..............Lewiston
Wyman, F. L.............West Paris
Yeaton, Geo. A..............Augusta

REPORT OF TREASURER.

E. L. Lincoln, Treasurer, in account with the Maine State Pomological Society for the year 1910.

RECEIPTS.

Cash on hand from the year 1909	$ 79 86
January 1, interest on Stock First National Bank, Farmington,	12 00
January 1, interest on Bonds First Mortgage	22 50
July 1, interest on Stock First National Bank	12 00
July 1, interest on Bonds First Mortgage	22 50
State Stipend	879 04
70 Annual Fees	70 00
12 Life Fees	120 00
Total Receipts	$1,217 90

Note. In January 1911, $74.27 was received on the 1910 Stipend which will appear in the 1911 report.

EXPENDITURES.

January 13.	Paid	E. F. Hitchings, order No. 1	$ 2 06
		Will E. Leland, order No. 2	5 00
		E. L. Lincoln, order No. 3	3 70
		Elm House, order No. 4	3 00
January 21.	Paid	Permanent fund life fees, years 1908-1909	80 00
November 11.	Paid	Maine Farmer Pub. Co.	14 75
		Maine Farmer Pub. Co., No. 7	5 75
		Maine State Bookbinding Co.	28 40
		Lewiston Journal Co.	48 00
		E. L. White, order 12	8 00
		Fred W. Adams, order 13	5 16
		Lewiston Journal, order 14	2 00
		Mrs. Mabel Boothby, order 15	1 00
		C. E. Hardy, order 16	13 36
		G. M. Twitchell	7 65
		Loring, Short & Harmon	1 50
		Will E. Leland	6 71
		F. H. Morse	2 95
		E. L. Lincoln	34 00
		E. L. White	150 00
		E. F. Hitchings	75
		E. L. White	32 95
		Wilfrid Wheeler	28 30
		John C. Woodrow	4 72
		Palmer Press	17 00
		Premiums for the year 1910	336 00
		E. F. Hitchings	2 06
November 11.	Paid	T. M. Lombard	6 00
		Elm House	68 25
		George T. Powell	48 12
		V. R. Gardner	7 53
		W. R. Bartlett	1 00
		Harry L. Plummer	1 15
		Merrill & Webber	2 12
		E. L. White	5 92
		Miss L. B. Raynes	56 55
Total Expenditures			$1,041 41
Cash on hand			176 49
			$1,217 90

PERMANENT FUND FOR THE YEAR 1910.

December 31. By members as reported for the year 1909	$,1790 00
Fees received for the year 1910	120 00
Total	$1,910 00

PERMANENT FUND INVESTED AS FOLLOWS.

Four shares stock First National Bank, Farmington	$400 00
Two bonds Stockton Springs Water Co	970 00
Deposit in Savings Banks	420 00
Due permanent Fund from year 1910	120 00
Total	$1,910 00

ELLIS L. LINCOLN, *Treas.*

ANNUAL MEETING, AUBURN,

November 8-10, 1910.

TUESDAY EVENING, NOVEMBER 8.

The meeting was called to order by the president, Dr. G. M. Twitchell.

Invocation by Rev. F. M. Preble, Auburn.

Music.

ADDRESS OF WELCOME,

By HON. I. L. MERRILL, Mayor of Auburn.

Mr. Chairman, Ladies and Gentlemen:

It is always a privilege and a pleasure for me to extend Auburn's welcome to any visitors from whom we may expect to derive a benefit, either financially, religiously, socially or morally. It is also a pleasure to perform the same official courtesy if we may expect that the visitors are to be benefitted by their tarry with us. This is the first time, I believe, that I have had the pleasure of extending a welcome to an organization whose end and aim is the promotion of agriculture in its most fascinating branch, that of fruit growing. And inasmuch as my own private business is dependent upon the progress and developmen of this great industry, you can readily understand that it is a double pleasure to me tonight to welcome you here, first as an official and second as a private citizen.

It is an inspiration to look into your faces tonight, and upon the splendid display of the products of your orchards and vineyards, and to think that, although perhaps indirectly, I have had some small part in bringing into prominence this most important industry. It is eminently fitting and proper that you chose Auburn as the place in which to hold this great meeting. For various reasons is this true. First, because it is the home of your distinguished, honored and respected president. Second, because Auburn has a larger rural population than any other city in Maine, a large contiguous territory in which agriculture in its varied forms is the leading industry. Last, and not least, because Auburn is a good city in which to hold any meeting which has for its end the promotion of good.

Auburn is the largest city in Maine, and with few exceptions in all New England, when regarded from a territorial standpoint. We have a population of about 15,000 people, and an assessed valuation of over eight millions of dollars. We have located here quite a variety of industries. We have a cotton mill of no mean proportions, giving employment to some five or six hundred people annually and putting out a product which is recognized for its quality throughout the world. We have located here one of the largest institutions in the country engaged in the manufacture and the handling of dairy products, the Turner Center Dairying Association, having an output of more than a million dollars annually. We have here one of the largest meat packing establishments east of Boston. We have another large food producing institution here in the T. A. Huston Company, noted far and wide for their fine biscuits, crackers and confectionery. We have one of the largest last manufacturing establishments in the country, and in that institution may be found machinery which is the product of the inventive skill and industry of the proprietors. And we have many smaller industries.

While we are proud of these industries, the principal industry which has made Auburn famous throughout the length and breadth of the land is the manufacture of boots and shoes. Here we have nine large modern and up-to-date shoe-shops in which are manufactured shoes enough annually to give us fourth or fifth rank in all the world in this important industry. While we are proud of our industrial prominence, and perhaps satisfied with our commercialism, we are proudest of all, I believe, of the high moral plane upon which Auburn has ever stood, making it the ideal place of homes, in which to rear and educate our children. We have here eight urban churches, we have ten suburban churches, all supplied by pastors of recognized ability, and well attended by liberal and intelligent parishes. We have a high school of which we are justly proud, four grammar schools, eight primary schools, one parochial school and fifteen mixed. We have a fine library in our midst.

I not only bring you the greetings of our people, but I wish you a pleasant sojourn in our midst. I invite you to visit our public buildings, our schools, our homes, and I hope that your stay here will be so pleasant that you will come again and again to us, not only as an organization but as individuals, and you will ever find the latch-string out and a hearty and a cordial welcome. I wish you a pleasant sojourn and a safe return to your homes and firesides, and that you may carry with you pleasant remembrances of Auburn and its people.

WORDS OF WELCOME FROM THE BOARD OF TRADE,

By the President, Mr. L. E. Flanders:

Sometime ago, when your genial president, Dr. Twitchell, announced that your society would meet in Auburn if suitable arrangements could be made, it gave the members of the Board of Trade great pleasure to do all we could to further these plans. We fully realize that your organization is composed of men from all parts of the State who represent the vocation in life that has been the strength and sinew of this good old Pine Tree State from the time it was organized until the present time. The farmers are the backbone of the State, and we note with interest the way they are forging ahead. The daily press and magazines are continually reporting new ideas and progress along the line of fruit growing. In the western states of course there is a greater variety of fruit grown, but we are glad to see Maine take notice and realize that with a little care and effort she may stand second to none in the product of her apples. A great many of the orchards in years past have not received much attention. They have been sort of a side line. But we are told by good authority that if as much time were devoted to that part of the farm as to the other parts Maine could easily stand first along this line.

Ladies and gentlemen, it gives me great pleasure to extend to you, as president of the Board of Trade, a most cordial welcome, and I trust that this meeting here will not only be pleasant but profitable as well, and that as you return to your different homes you will carry with you pleasant recollections of our city.

Again, in behalf of the Board of Trade I extend to you a most cordial welcome.

RESPONSE.

By H. L. Keyser of Greene, First Vice President of the Pomological Society.

If any doubt existed as to whether our executive committee had made a wise selection for our annual meeting place of this year, when they accepted the invitation of the City of Auburn, that doubt must have been at once dispelled after listening to the cordial words of welcome from your Mayor, and on behalf of the Maine State Pomological Society, I thank you, Mr. Mayor, and thank the citizens of Auburn.

To make a success of the meetings of any society, requires much detail and hard work, of which the members who do not take an active part, have very little conception. The "hundred and one" little things, take time and patience. In all of the work, we have been so ably assisted by your Board of Trade, that for whatever good fruit these meetings bring forth, a large portion of the credit they can take unto themselves with the sincere thanks of this society.

One of the speakers at our last meeting remarked: "We are entering upon a new age." We are not entering it, it is upon us and this society has a great work to perform. We want the large and small orchardists of this State to join our ranks. We want their help and experience, and want them to profit by the knowledge they gain from our meetings.

We have passed the "go-as-you-please" period of growing fruit; the procession is moving on and to merit and meet success we must keep to the front where we can hear the music.

This society has been a great education to the growers and its reward can be seen today in the gradually improving conditions of many orchards, the interest displayed and the questions asked regarding culture and spraying; but to my mind the greatest incentive to improve all of these conditions, and put the apple of the State of Maine where it belongs, second to none and the peer of many, is co-operation.

To a man who had spent all his life in mercantile business, it was amazing to learn the volume of the fruit industry of this State and the loose method of its disposal. Of three evils we can choose the least: the Boston commission man, the speculator at our door, and the foreign market with all its "ifs" of chilled, slack, wet and bad order. This is not business, it is merely producing and taking what you get. We are surely big enough and strong enough to do what the Danes have done, and they have accomplished much in the marketing of their products, by co-operation.

Permit me once more, Mr. Mayor, to thank you and the citizens of Auburn and carry the additional message to your citizens that by the active co-operation of your Board of Trade they have proven their deep interest in the welfare of your beautiful city, and shown that its business interests are in safe hands.

PRESIDENT TWITCHELL: There is no state in all the Union which has a governor more honored than is the Governor of the State of Maine; there is no state in all the Union which has a chief executive, tonight, who is more thoroughly committed to the development of his state and the building up of its resources than is Hon. B. M. Fernald, the chief executive of the State of Maine, whom I now have the pleasure of presenting to you.

ADDRESS,

By His Excellency, Gov. B. M. Fernald.

Mr. Chairman, Ladies and Gentlemen:

I have rarely been so complimented as I have been this evening in your introduction, Mr. President, and I thought as I listened to my old friend, your Mayor—for we were boys together—that I wished I was a resident of the city of Auburn.

As I look about this hall and into your countenances, and at the fruit and flowers and potted plants before me, I am prompted to say this to you,—that to achieve success is the desire and duty of every man, woman and child in the State of Maine. What is success? That man who stands at or near the head of any profession or business in which he is engaged is a successful man. And judging from this standpoint, where can you find, Mr. President, in the United States, more successful fruit growers than we have in the State of Maine. I doubt if there is another state in the whole Union that could produce fruit of such beautiful color and such excellent flavor, as you see before you this evening.

What is success? I have already said that that man who stood at or near the head of any profession or business with which he was associated was a successful man. And if there is any one business that a young man who is willing to work, who is willing to have patience, who is willing to put effort into his daily life, can go into with almost a certainty of success, it is that of farming. And where can there be anything more beautiful in life than to see the elderly gentleman, who has set out the fruit trees in his boyhood it may be, grow up and ripen into old age with the fruitage about him, with the trees that he set in youth, seeing his children coming up and enjoying the benefit of the fruits and the fruit trees he set in early life.

Now I am engaged in all kinds of farming. I am not particularly engaged in fruit growing more than in stock growing and in other lines of farming. And in the State of Maine we have, right here in this county and in the adjoining counties, the best country on earth to farm in, and I have been in every state in the Union, Mr. President, but two. Now there are fruits grown in some sections of this country that are equally beautiful with our Maine fruit. In the State of Michigan they raise apples that to look at are as fine, and perhaps larger than ours; but they have not the flavor. They have not the keeping qualities that our fruit may have with proper care. And the one thing for the farmers of Maine is to educate themselves, and the young men particularly, that their fruit shall be properly cared for. We are living in an age when quality counts, whether it is in fruit or men. And within a few years we have learned that we can not only raise apples in the State of Maine, but grapes as fine, as sweet, as can be produced anywhere on earth. We are just beginning to learn something about these things, and I want to say that now in the State of Maine farming is not only the most profitable but it is the most popular business on earth. If a young man wants to select a business that will be profitable and popular, he wants to stay right at home on the farm, and begin where his father has left off or is still laboring. As I look into the audience this evening I see before me some of these elderly gentlemen who have made such a success. I see Mr. Tucker right before me tonight, and you will pardon me, Mr. Tucker, for mentioning your name. If you should go to his farm, to his homestead, and see the blooded stock that he has raised—he has forty head of pure-bred Holstein cattle, he has cows that he wouldn't take $4000 for today—you would see what a profitable business he has. He is successful as a fruit grower, as a breeder of blooded stock. We are having a change, and I am glad to see that the young men are coming back to the farms. The old pioneers, those sturdy old gentlemen who during the last thirty or forty years have reared families and educated them, have remained on the farms themselves, but too many of the boys and girls have gone to the cities and to the states farther west. That is the cause of the high price of food stuffs. Now there seems to be a return to the farms and I want to say to you that the time now is when a young man can start on a farm and work up as profiable a business, and live as clean, moral and successful a life as in any other business on earth.

Now I realize that I am not the only speaker this evening. There are other speakers, but I want to say to you, my friends, that I believe in farming, that I love it as a work, that I want to see more young men remain on the farms in Maine. Take the boys who remain on the farms in our State, and compare them with those who have gone west, and you will find that those who have remained here have been more successful. The Grange has done a great work. People get together that represent different kinds of business. And it is essential, Mr. Chairman, that farmers get together and talk over the best way to do things, exchange ideas, each one giving his experience of how he has raised a beautiful apple. It is a wonderful work you are doing, and I want it to go on. I want the 59,000 farmers in the State of Maine to double in the next ten years, as they have nearly doubled in the past ten years. I want on the 59,000 well kept farms—and we have but three thousand unoccupied, untilled farms in the State of Maine, and those are rapidly being taken up—I want on every farm that can raise an apple tree to have hundreds set the next spring. We will never be able to supply the demand for fine fruit. It is bringing more money every day. Ten years ago you never saw an apple in a box as you see them here tonight. And many different ways can be provided, by discussing these matters, whereby you can place your product on the market. And always have in mind that one word and one thing,—*quality*.

Now, Mr. President, I bring you the greetings of our entire people. I am glad to be here. I am proud of the farmers of the State of Maine. A more intelligent people cannot be brought together than the men and women representing the farms of the State of Maine.

ADDRESS.

By Hon. Payson Smith, State Superintendent of Schools, Augusta.

Mr. President, Ladies and Gentlemen:

If you were to go into one of the grammar schools of this city tomorrow and ask of the boys and girls there what the leading industry of the city of Auburn is, I fancy that every hand in the room would go up and every boy and every girl would be immediately prepared to answer, the making of boots and shoes. And if you were to go across the river into one of the grammar schools of the city of Lewiston and ask the same question, I suppose there would not be a moment's hesitation. The boys and girls there, having been well taught. would say that the leading industry of the city of Lewiston is the making of cotton and woolen goods. And if you were to go down to Portland and ask the same question, the boys and girls there would be prepared to answer that the leading industry of the people of Portland is that of commercial pursuits. And if you were to go to Bath and ask the same question, the boys and girls there, equally well trained, would tell you that the leading industry of the people of Bath is the building of ships. And in the larger field, if you were to ask the boys and girls of any well taught school in this State, what the leading industries of Maine are, I suppose the children would answer that the leading industries are agriculture and manufacturing.

Now, my friends, as state superintendent of public schools, I suppose I ought not to dispute all of this good teaching, yet I shall be compelled to say to you tonight, that the leading industry of none of these places is the industry that has been named. The leading industry of this city of Auburn is not the making of boots and shoes, the leading industry of the city of Lewiston is not the making of cotton and woolen goods, neither is commerce the leading industry of Portland, nor the building of ships the leading industry of Bath, nor manufacturing and agriculture the leading industries of this State of Maine. The greatest industry in this State, the greatest business in which our people engage, is the great business of education.

The object of this great educational system of ours, the object of our support of this industry of education, I maintain, is the production of a high type of citizenship. That is the reason why we are supporting a system of education, in order that we may have the right kind of citizenship. And I want to state to you just briefly three of the qualities which I think we ought to aim for.

In the first place I believe that this citizenship must be an intelligent citizenship. I wonder if we realize that we are trying here in this country the greatest experiment that has ever been tried in the history of all the world. We are trying to see whether ninety millions of people, representing all races, and all conditions of society, can govern themselves. You and I both believe that this great experiment is to succeed, but I say to you, my friends, tonight, that if this great experiment is to succeed it will succeed on one, and on only one condition, and that is that we shall have an intelligent citizenship. We sometimes hear it said that it is very important in a democratic form of government that we should have wise leadership. So I say very likely it is important that we should have wise leadership, but vastly more important is it that we should have a common people able to do its own thinking, able to make up its own mind, able to face and solve its own problems, able to stand on its own feet.

But it is not enough that it should be correctly intelligent citizenship. It must likewise be responsible. We must cultivate in our body of citizenship a sense of personal responsibility. We must have our boys and girls trained in the school of responsibility. We must make them feel that they are themselves to be responsible for the getting of things done, and I feel that we ought to impress upon them through all the days of their school life, a sense of this responsibility. But these are not the main points that I want to make, because I think the schools are doing these things very well.

There is another quality that this citizenship must have, and it is the virtue that I propose to name last, and that is the quality of service. We must have a useful citizenship. We have happily come to that stage of our civilization when we regard that man as in disgrace who does not contribute something to the welfare of society; whether it be the millionaire at one end of the so-called social scale or the tramp at the other, we rightly regard any man as in disgrace if he is not doing something for the benefit of the world. Now, then, if this public school system of ours is to make for service, we must have in mind two things: First, the individuals who are being trained, and second, the society for which those individuals are being trained. I went into a little country high school in our State about a year ago, and as I went in I noticed nothing especially unusual about it, but after I had been in a little while I noticed up on one side of the room a table fitted out with various electrical apparatus; and I was a good deal interested to note, as I examined the room more carefully, that a system of electric bells had been installed, and I was very much interested to find out how these things came to pass in this common country high school and I asked the teacher about it. The teacher said "I must introduce you to the boy who will tell you about it," and he introduced me to one of the older boys. This boy had become so absorbed in this subject and he had acquired so much information regarding it, that he was able to organize a class in electricity in that high school, and there was a class of boys, five or six of them, who were very much interested in the subject. Now the point which I want to make to you tonight is this, that if that boy had happened to be interested especially in Latin, there are more than 220 institutions in this State supported by the people, in any one of which he could have taken a four years' course in Latin. If that boy had happened to have an interest in Greek, there are more than 100 institutions in this State supported at public expense wherein he could take a course of three years on that subject. And if he had been interested in abstract science, or in higher mathematics, or in ancient history, in any one of these subjects he could take a full course of four years in any one of more than 220 high schools. Now I am not going to say that the courses offered in these 220 high schools are not wise, but I am going to say to you tonight, my friends, that there are hundreds and hundreds and hundreds of boys coming up in our State who are interested in material things, who are going to enter into the great productive industries, and it is the business of our school system to adapt itself to the needs of these boys and girls, so that the boy who has a trend toward electricity, or toward farming, or toward any other of those interests which engage the attention of our people will have a chance to discover that and will not by and by find himself stranded in some profession that is already overcrowded.

We realize, I think, better than we used to, that we are not going to need a large number of presidents, we are not going to need a large number of statesmen, but we are going to need millions and millions and millions of every day people to do the every day work of an every day world. And the thing which I want our school system here in Maine to do is to show these boys and girls that there is an honorable work to be done outside of the so-called learned professions. We realize that the great majority, more than ninety per cent of our people, are to be engaged in the handling of material things; they are to work in our mills and factories, on our farms, and I believe, my friends, that we ought not to have a system of education that shall all the time be saying to our boys and girls, "Get off the farm, get out of the shop, get out of the mill, get out of the factory, shun hard work." No. We want a system of education which will point out to those boys and those girls that the object of getting an education is not to avoid the necessity of work. The object of an education is to enable one to find his work and to do that work in the best possible way after it has been found. It has been very well pointed out here tonight by the Governor of our State, that this State of ours has met with great losses in men and women. I don't like to think of the responsibility that may rest upon our schools for this state of affairs. I don't like to think that may be our schools here in Maine have been saying to boys and girls, "Get an education that will fit you for a profession, get an education that will enable you to keep a starched collar position and avoid the kind of hard work that your fathers have had to do." We often have a great deal to say about the crops of our State. I have heard the saying, and so have you, that other states may boast of their fine crops in one way and another, but Maine always has one great boast, and that boast is that her best crop is the crop of men and women. It is true that our best product is men and women, but I want to say that I wish we hadn't been raising quite so much of our best crop for the export trade. It means a great deal to the community, it means a great deal to the State of Maine, whether we have the kind of educational system that shall point in the right direction. It has meant a great deal to other countries. Why, do you realize that immigration to our country from Northern Europe has almost entirely ceased? And why is it so? Because those countries of Northern Europe have begun to train their boys and girls for home industries.

Now I realize that I have been theorizing a good deal, although I believe this theory is right and is going to come to pass in action, and I want to bring you down to a matter of hard fact for just a minute. You people who are assembled here are interested in rural education. I know that wherever there is an apple tree there are boys. I know that because there is an apple tree in my back yard, although there are not very good apples on it, there are boys around it, and I know that you people who are interested in the raising of apples are likewise interested in the raising of boys, and you are interested, a great many of you, in raising boys who are being raised on the farm, who are being educated in country schools, and I want to present to your consideration a very practical problem. I wonder if you can imagine this hall so extended that it will hold an audience on the floor of seven thousand people, and I wonder if your imagination would picture to you that hall with the teaching force of the State of Maine seated in four equal sections. Then out in this quarter section away out here we will imagine the city teachers are seated and they will not occupy a whole section even. There will be a lot of seats in the rear of the section that will be empty and those seats we will fill in with village teachers, and by village teachers I mean teachers who teach in villages having schools that may be graded so as to employ two teachers or more, up to twenty or twenty-five as some of our larger villages have to employ. Our village teachers will begin to fill in and they will take the next section and then they will take some of the third, but nearly one-fourth of that great auditorium will be seated with teachers who are teaching in country schools. And I want to say to you, my friends, that we are not going to have the kind of educational system that we ought to have until every one of those seated in those sections shall be trained for the kind of teaching that the country school needs, and we are not going to have that kind of teaching until we people who are interested in rural education shall demand of our teachers in rural schools superior qualifications, and shall be prepared to pay for those qualifications. There are two great needs of our country schools today. I realize that the country school is the basis of the whole system, and there is little use to talk about scientific agriculture, or agricultural teachings in the schools, or any of the rest of it unless you have a good country school at the basis of the whole, and the people who live in the country in Maine ought to place emphasis on a good country school. And so I say it is the duty of the people of the State, not only those who live in the country but those who live in the cities and villages as well, to insist that these teachers who are to teach in the one-room country schools shall be well trained, shall be qualified for their places, and that they shall be paid so well that we shall be able to keep them there. I found the other day in looking over the figures that of our entire teaching force last year less than half stayed in the same schools for one year. And those are figures that I didn't like to read, and they are figures that I don't like to give you, because I am not proud of them, but they are figures that I think I ought to give you, because I believe that the boys and girls of this State are entitled to good teaching, and I feel that they are entitled to permanent teaching. And I shall not be ready to say that Maine has an altogether good system simply because it has a good school system in cities and larger towns, or larger villages, or wealthy places—I shall not be content until I shall be able to say, and the citizens shall be able likewise to echo, that every last school in Maine is placed under the instruction of a competent, well-trained, well-qualified teacher. That is the aim, I believe, which we should seek. And I trust, my friends, that we shall understand that this thing is something which must come to pass if we are to make our farms what it has been said tonight we ought to make them, because men and women, we have learned very often, will leave the farm if it is necessary to do so in order to educate their boys and girls. Let us not make it necessary for any father or any mother to leave the farm in order to educate his son or his daughter. Let us make it possible for them to get near the farm the education that the country boy and the country girl ought to have.

Portion of Best General Collection, winning, for 1910, Maine Central Railroad Loving Cup, at annual fruit exhibit, Maine State Pomological Society, Auburn, November 8-10, 1910.
Exhibit made by Maine Sanatorium Farm, Hebron, Maine.

ANNUAL ADDRESS.

By PRESIDENT G. M. TWITCHELL.

Members of the Maine State Pomological Society, Ladies and Gentlemen:

Another year in the history of our organization has passed and we meet to bring together the choice products of the orchards and homes and discuss the complex problems facing the grower and producer. The year has brought varied experiences to us as individuals and forced back the conviction that in seeking to push forward this industry we are constantly meeting problems we cannot yet solve, every one of which bears an important relation to our prosperity.

I wish here and now to express in behalf of this society our appreciation of the untiring efforts of Maine's Commissioner of Agriculture and his co-laborers in promoting interest in pomology in every way possible, the citizens of Auburn and Lewiston who made certain this increased exhibit of fruit through special prizes and the Maine Central Railroad who so promptly set before the apple growers of Maine a prize, the winning of which will insure life-long satisfaction to any orchardist. As officers and members we must be profoundly grateful for whatever adds to the volume of influence, looking to the increase of fruit products. Today no orchard can successfully be developed unless the grower is a student of great subjects and in fellowship with his trees.

In discussing briefly the situation, I desire to present some specific questions calling for careful consideration, that, in their solution by you, the whole fruit industry may be benefited.

Maine is a natural apple growing State and trees spring wild in every locality. This being so, the first thought with the future orchardist will be to avail himself of the strength, vitality, and enduring power of selected native stock. If this leads to the establishment of nurseries in Maine, a long step will be taken towards results now impossible. Supplied as the farms through the fruit section are so generally with bearing trees, I am forced to the conviction that before we urge further increase we should emphasize better treatment of what we have. The man who fails to care for his old trees will never give proper attention to a new orchard. The steady increase of pests and diseases, brought here largely on fruit stock, forces attention to the trees now standing and their protection in every way possible. Beyond this there is call for an organized movement to cut down and burn every worthless tree or those so situated as to be of no earning value. These harboring spots for all pests and disease spores must be reduced to the utmost that the cost of protection for growing orchards may be minimized. It is desired that this end be reached without drastic legislation, but the protection must in some way be insured. The development of the industry outweighs the wishes of any individual and must be the sole standard of action. Today the apple industry is worth to Maine from two to three million dollars yearly. If the trees now standing, and of bearing age, were looked after and also protected from insect pests and diseases, this total would be more than doubled. Through the generosity of a life long friend of Maine, Hon. J. J. H. Gregory, and the earnest continued efforts of the Maine State Department of Agriculture, a grand total of prizes has been secured, to be distributed in 1915 and to compete nearly five hundred acres were set the past season. This means that in the not far distant future, Maine's apple crop will be greatly increased, or that, through failure to care for the trees, the industry will be lost. More than one hundred thousand apple trees were set in Maine in 1910 and well will it be if the owners thereof demand protection from neglected trees and rigid methods of treatment for growing orchards.

One of the most pernicious pests and one beyond the reach of spraying solutions, a pest which, this year, has rendered worthless thousands upon thousands of barrels of otherwise choice fruit, is the familiar railroad worm. We urge the destruction of this pest by frequent picking and burning of all dropped fruit or the feeding of the same to the hogs or sheep, but unfortunately the men who pick are at the mercy of neighbors who will not, or of native trees growing wild along the highways. The man who does not pick and destroy should be required to do so by law that the industry may be protected and fostered. The end must be reached and you members of this society may well outline the policy of action.

The place the bee occupies in the economy of apple production is not appreciated. If we would have complete fertilization of the blossoms the friendship of the bees must be cultivated. The reason for their absence in many localities calls for investigation. Whether due in part to the continued use of arsenical preparations in spraying or not, the cause should be found and removed.

In the decrease in number of song and other birds seen about the homes, fields and orchards, there is another cause for anxiety. From a purely economic standpoint the presence of these friends of the farmer, in largest possible number, becomes a necessity.

Why have they failed to appear? What can we do to call them back? Here again we touch the problem of spraying solutions and it is one to be critically considered. The chief competitors of the New England orchardist in the next ten years will be the growers of the extreme West. After that the field of competition will broaden as the middle South and West increase their fruit crop. Certain climatic conditions and the geographical location naturally give the New England grower an advantage. He is, and always will be, from one to two thousand miles nearer the best European markets than the large growers of the West. At the same time as improved methods of caring for and shipping fruit multiply this natural advantage will become of less and less significance under methods now prevailing.

Stringent laws rigidly enforced in the extreme West, coupled with methods of care and fertilization peculiar to that section have resulted in putting upon the markets of the world fruit of remarkable size, beauty and uniformity. That it lacks in texture and flavor is as yet a minor consideration. What pleases the eye satisfies the purchaser. The lesson must be self evident. New England fruit can be grown as smooth, as sound, as uniform as that from the arid and irrigated regions and the measure of color we can insure is still an undetermined factor. Let us not forget to carry in mind the fact that we can supply in quality what can not be equalled in warmer latitudes. The great problem facing the Maine orchardist is this: By what means can the standard of our fruit, as it goes upon the market, be raised to the level reached by certain individual growers, and uniformity in size and freedom from defects be insured? This proposition is before us and I desire to submit to you certain specific recommendations for your deliberate consideration before this session closes, in order that there may be unanimity of action in the future.

The general estimate of an apple tree is not commensurate with its earning capacity. The appreciation of the value of the fruit grown is not on the level necessary to insure rigid protection. Two dollars per barrel marks the average estimate for a series of years and this calls for only two dollar care and fertilization. There's a wide field for educational work and it should be fully occupied. Beyond there are steps to be taken which will necessitate legislative action and this society should outline the policy and secure the legislation.

1st. A stop must be put to commercial packing and by this I mean the grading according to individual conceptions of what the market will accept.

2nd. The distinction between No. 1 and No. 2 fruit must be made more pronounced. To do this the No. 2's must be eliminated by spraying and feeding as in the West.

3rd. Already I have hinted at what now becomes necessary, the amending of the law governing the grading, packing, and branding of fruit. When this law was first being discussed the Director of the Experiment Station suggested that its enforcement be placed under his direction stating that he had funds available, under the pure food act, with which to enforce the same. As the bill carried no appropriation for expenses and the State Department had no funds available for this purpose under the law it was decided to frame the law as we did. Later by decisions at Washington this expense could not be so covered. This explanation is but just in view of some criticisms made.

That the law we now have is moderate and inflicts no burdens on any honest packer is a self evident fact, yet reliable information has reached me that a combination of packers has been formed to ignore its simple requirements and also secure, if possible, its repeal. For these reasons I urge consideration of the question of amending the present law, (a) to require that, in addition to present specifications, the name of the grower and also the packer, in plain, legible letters be placed on a card, inside of every closed package; (b) that an appropriation be secured to cover the expenses of enforcement; (c) that an amendment be secured to provide for the inspection, by proper officers, of closed packages, barrels or boxes; (d) that legislation be obtained to make obligatory the removal of all dead and worthless trees and the spraying of all orchards and living trees.

The character and uniformity of the fruit here exhibited furnish the best possible proof of what would become general all through the fruit sections of the State under the wise enforcement of such measures. The cry that these are drastic and burdensome fails utterly when we remember that the sole purpose is to lift the standard of all Maine fruit to a level where uniform quality will be guaranteed and a higher and more uniform price insured. There is no hardship, no oppression, no extra expense imposed upon any individual. Such a law would simply require of a man that he do what is for his own best and permanent good. This much the friends of the industry have a right to demand. No individual or number of individuals can in justice jeopardize the best interests of others or the permanent development of the industry. The day has gone for individual standards to govern in grading or packing fruit. The battle royal to regain and hold the markets of the East, and to the East, can never be successful until the growers of the East stand with united front to grow, to grade, and to pack the best fruit which can here be produced and to eliminate all which fails to come up to this standard. The most difficult step for the New England farmer to take is that wherein he surrenders his individuality, yet that is the universal law of business. The individual is lost in corporate interests. That this applies as tenaciously with the man on the farm as he of the mill must be recognized. Because of this individuality of work there is no means by which the interests of the industry as a whole can be safe guarded. Individual shipments of fruit remove all control and put every man's product on the market against his neighbor's. Today we are bidding against each other for business. The West has fought the fight and learned the lesson;

the South stood for individual shipments until growers became convinced that they were at the mercy of dealers at the big centres, at home and abroad.

"Truck growing which is spreading over the whole South is becoming an industry of national importance. Around Norfolk trucking is of such great extent that the value this year is estimated at $15,000,000. Some 40,000 to 50,000 packages (crates and barrels) are daily shipped north from that port. The sweet potato producers of Eastern Virginia who formerly grew poorer on almost every crop because of the lack of organization and the glutting of some markets while others were bare, are now getting rich, raising annually hundreds of thousands of barrels, which are all marketed through a growers' association. Every carload is closely followed and ordered to market according to daily reports as to the supply and demand in different cities. The peach industry of Georgia is now being handled the same way, although the growers' association is comparatively new, while Florida orange growers last year perfected a similar plan for handling their crop. Under better handling methods the vast trucking and fruit industry of the South is daily becoming of more importance to that region as well as to the whole country which now depends so largely upon the South for early fruits and vegetables."

Organization by growers and shippers has brought relief from over competition wherever tried and will do the same in Maine. The sooner we get into line to handle our fruit in the best business-like method of today, the better will it be for each individual and these sessions should not close without initial steps being taken to protect the interests of every grower and shipper as well as final consumer. The multiplying cases of gross injustice both abroad and in markets here render absolutely necessary definite and positive action. The gross injustice inflicted upon shippers who have no representative in the great centres can be overcome only by and through such organized movement as has been indicated, where the entire shipments of a state can be handled by a single representative who can direct and divert his shipments to the best market, something impossible to individuals.

Too many orchardists are at the mercy of the market because of lack of proper storage room for fruit and this forces the suggestion, so often presented, that this society, or its members, initiate a movement looking to the construction of storage plants at central shipping stations for the convenience of growers, the protection of fruit and the control of the industry, by those directly interested in its promotion.

The rallying cry must be Maine for Maine, and to insure this every barrel and box of fruit should bear a richly colored lithographic label, carrying the seal of the State and space for name of variety, owner and residence. These labels the full size of the barrel heads, or end of box, can be furnished at a cost of not more than one cent each. I leave these suggestions in your hands for such action as may be deemed best for all interested.

Experience is forcing the conviction that a richer nitrogenous fertilizer is demanded for the making of fresh wood. Trees lacking this growth yearly cannot resist spraying applications as can normal, healthy growing trees. The natural vigor of a tree becomes of importance when spraying solutions are to be applied and good health insures resistance not to be obtained in any other way. There is no combination of food elements better adapted to trees not making eight or more inches of fresh wood growth yearly, than what is familiarly known as Fisher's formula, one prepared by Dr. Jabez Fisher, a lifelong orchardist of Fitchburg, Mass. It carries:

700 lbs. of Nitrate of Soda.
300 lbs. of Sulphate of Ammonia.
460 lbs. of Sulphate of Potash.
440 lbs. of Acid Phosphate.
100 lbs. of Kainit.

The excess of nitrogen is intended to make wood growth, to put fresh energy into the tree, and ten pounds scattered out where the branches drip is enough for a mature bearing tree.

I know of no combination of chemicals so valuable in reclaiming an old orchard or putting energy and life into neglected trees. The verdict of many confirms my own experience.

The only standard which will endure is that which makes the brand true to the contents and hold good in any and every market of the world. The next twenty years will witness a tremendous increase in commercial orchards all over the fruit sections of Maine. Our deliberations cannot be narrowed to the conditions of 1910, else we shall fail signally when the day for larger opportunities arrives. Now is the time for us to put our houses in order and establish the fact that a barrel of apples from Maine, no matter where found or by whom packed, represents just what the label indicates. Years come and go but the measure of the man will always be determined by the character and quality of the work he does.

God has massed his blessings on these hills and up and down these valleys, and it remains for us to utilize every one for our profit and the future glory of the Pine Tree State. Uniting to insure these results, the fruits of your labors will be found in increasing quantity in all the mouths of a grateful community.

A statistical address of value on "The United States Department of Agriculture and Agricultural Education Extension," was given by Prof. J. M. Stedman, Office of Experiment Stations, Washington, D. C.

A TALK TO THE PUPILS OF THE AUBURN SCHOOLS.

By Hon. Geo. T. Powell, Ghent, N. Y.

It certainly gives me great pleasure to be able to drop in here this morning.

Your president has asked me to say a few words upon the subject of education which will be of particular application to the school children, the pupils of your public schools, who have come in here to attend this session of the Annual Meeting of the Pomological Society this morning. I think it speaks well for Auburn, that your educational department finds itself today in sympathy with the line of educational work which this society is doing. It speaks well for the present and the future, when the young people of this vicinity come here and attend this special session this morning, to get, if possible, some new thought, or perhaps some broader thought, in connection with their educational work.

We are confronted at the present time with some of the most momentous problems which have met our country at any time in its history. We see throughout the length and breadth of our land a phenomenal growth of cities, and at the same time there is a somewhat diminishing population in the rural districts. In some sections the rural population has fallen away very largely. Now this brings up some momentous problems. What is to be the future of the young people when they find themselves, perhaps, forced into our cities to find occupation, business, support in life? Inevitably the future means that the great majority, the masses of young people, to secure employment must go to our cities to find it. Now, in the meantime, is there opportunity yet, are there fields promising to young people in the country, on the farms, in general agriculture and particularly along the lines of fruit culture? There is no question or doubt but that one of the reasons why the cost of living is so high at the present time is because of the concentration so largely of people in the cities, with the diminution in the productive power of the country. The producers have been growing less, the consumers have been increasing steadily, and as a natural result, when the demands on production are greater than the production itself, prices must inevitably advance. So we find at the present time the cost of living in every manufacturing town and in every city in the land has very largely increased, because there is a deficiency along certain lines of production.

Take, for instance, fruit. All this beautiful display of fruit here is prohibitive in price to large numbers of consumers.

Now, it seems to me that there is a place for those young people who have a love for country life, that here is a field that is as promising as any field of which I know at the present time for them to enter. But it is important before they enter it that there shall be some opportunity for acquiring the knowledge and the information which is necessary to enter this field of agriculture successfully. It has been a too common thought that almost anybody could be a successful farmer. If a man failed at every other undertaking in the world the general impression has been that it was only necessary for him to go upon a farm and he might succeed. The fact is very different. The man today, or the woman, who attempts to handle a given number of acres of land to be successful in the management of that land has got to be equipped with a breadth of knowledge, with a degree of intelligence, with a degree of skill, that is second to that required in no calling, no profession, no line of business in this country. When young people understand this, and understand that they must have special preparation and prepare themselves for it, they undoubtedly can enter the field of farming and fruit culture with every prospect of splendid success.

Now what is the need? As has already been indicated by Professor Stedman's paper this morning, the principles of agriculture should be taught in our public schools; in our high schools, as he has already stated, there should be technical instruction in agriculture.

At one time it was my duty to make a special investigation into the rural conditions of New York State. Along in 1896-7 I was called upon by a committee of New York people, to make a special investigation into the rural conditions. In my report to this New York Committee one of my recommendations was that there should be some systematic plan followed by which there should be the teaching, if not of agriculture itself, of nature subjects. That is, the natural sciences should be taught in every public school, with their application made to common life.

The recommendation was at once accepted and I was authorized to put the suggestion into practical operation. I chose the county of Westchester, which is contiguous to New York City, one of the most difficult counties in the State of New York in which to test this line of work in the public schools. I thought the test there, if it should prove successful, would be the strongest and best proof we could have of the value of this kind of teaching. So I arranged with school boards and school superintendents and went all through Westchester County and had instruction given on two or three different topics. For instance, on the soil, and its relation to the prosperity of the school district; on insects; on the study of plants. I chose the best teachers that I could get from Cornell University and also from Columbia University of New York City. Assisted by those exceedingly able teachers, I went from school to school, giving only about fifteen or eighteen minute talks upon the subject, explaining to the teachers and to the boys and girls how to study these subjects relating to the life that surrounded them in the country. Now what was the result? Time after time we entered those schools the first impression that struck us was the condition of mental tiredness in that whole school. It was marked that in the midst of a session the teachers were careworn and tired, every boy and girl in the school looked tired. One of my first observations was that there is a great deal of time spent in our public schools with the present curriculum where teachers and students are mentally and physically exhausted before the end of their session each day. My suggestion was this,—not to put new burdens upon teachers, but in the midst of an afternoon session break up the course of study in such manner that fifteen minutes could be given to some nature topic—throw the entire school out of its regular channel of working. Because it is a fact that when mental weariness comes over a boy or a girl, that boy or girl is incapable of doing the best work. The suggestion was to introduce incidental work of fifteen minutes at a time, take up a special subject, and out of it would come rest and change in the work, and at the same time very important and valuable information.

Everywhere we went this suggestion was heartily accepted by the pupils and teachers and boards of education. After fifteen or twenty minutes, sometimes more, given along these lines of nature study teaching, the children from those schools would go out from the adjournment with a bound because of the difference which had come over them during these sessions. Instead of going out physically or mentally tired, the change of work, the change of thought, sent them out from that school building in very much better condition.

The result was this: Before this work was finished in Westchester County, there came applications from thirty-five counties in the State of New York from school superintendents and boards of education, to bring the same kind of work to them.

I will give you one or two illustrations of what was the result of this teaching in Westchester County. In dealing with plants I very often chose the clover plant because I know so much the value of that and realize its importance everywhere. There were farmers who came to these schools, and said that for the first time in their lives did they understand how and why clover benefited the land. They said that if they could have had such instruction as that when they were boys, their whole history of farming would have been much different from what it had been. They hadn't realized its importance and hadn't been persistent enough in trying to cultivate it.

Another lesson which I gave was on the strawberry, and I made this offer to the children,—that to every boy and girl who would be interested to study further the strawberry plant, I would agree, if they would write me the following spring, to send a half dozen strawberry plants for them to put out, care for, and study about. Then they should bring to the public school a composition on what they had learned about that plant. I sent out over 25,000 strawberry plants to the public school children that year.

What followed the sending out of these plants? I received from the teachers of the schools some of the essays upon strawberry culture, little essays or compositions written by children not more than seven years of age, and from that up to seventeen. And in some of those compositions there was some of the best language used, there was some of the best instruction given—such as would grace any of the horticultural journals published at the present time—so clearly had they taken in the instruction in the schools, so closely had they followed it in the planting of these plants, so closely had they studied the habits of growth of the plant, that when they came to write about it they wrote exceedingly interestingly as well as giving very correct information as to what they had done.

I think the standard today of education in our country is exceedingly high, but I do believe that it is not being pursued in the right direction entirely, that our methods are not entirely wholesome and healthful. I believe the tendency today is too much of rushing and crowding, too much of pushing our children forward intellectually, and not enough of developing real thinking, independent power of thought, within themselves. I think that the criticism today of our public system of education is that there is too much anxiety to pass children through examinations and not enough that they shall have a thorough knowledge of what they are studying. And so I believe that it is possible for us to so modify our curriculum that in the course of study there shall be more of that kind of work which shall lead our boys and girls along independent lines of thinking. We need today as we have never needed before, correct thinking. Now what we need is a line of educational work that shall make possible a wider dissemination of population, not so great concentration in our cities, and there are hundreds and thousands and millions of acres of land that ought to be occupied with an industrious population. Our cities are growing to such an extent that when labor agitations and riotous proceedings begin because of employers and laborers being unable to agree upon certain measures in their occupation and work, we shall see in the future the most dangerous times that this country has ever seen unless we can have more of a dissemination of population and not so much of concentration as is the present tendency in our great cities. And so I believe our public schools are to solve these great problems in the future. We have got to look to the education of the boys and girls and give them qualifications that shall enable them to go out and choose a broad line of work, such as is represented in agriculture and horticulture.

I did not expect to make a speech here this morning, but it certainly has given me great pleasure to be present at a time when the public schools of Auburn have been dismissed for one session to have their pupils come here and attend this session of the Maine Pomological Society. I trust as the result of this action there will be a new interest in the work of this society which is doing so much for the State of Maine. I trust it will result in both teachers and pupils getting some new thought that will help them in their study. And certainly I am very glad to meet you here this morning and to have the honor of speaking to you upon an important subject like this.

CARE OF THE ORCHARD.

By Edward Van Alstyne, Kinderhook, N. Y.

With all our great shows in New York—and we are proud of our horticultural meetings, we have two of them where the people gather by thousands, every man having paid his dollar or two dollars before he enters the door—and with all the enthusiasm, and our good program, we never have put up a show that even approximated to this. We have our exhibits that are excellent, and at our state fairs our two great societies show varieties running up into the thousands of plates, beautiful, instructive—but it is a great deal easier to get five individual specimens than it is to get a box, and to obtain a hundred boxes is harder still. And so I want to emphasize what that means and to say to you people that any state which can put out such an exhibit as that need not fear the competition of the world around.

Before I take up my special topic, the care of the orchard, I want to say a word or two in relation to the situation as a whole.

In order to care for the orchard one must first have one to care for, hence, I want to say a little about the importance and the value of orchards, and second, as to the varieties. If I could impress upon any young man, or any man just starting out in the orchard business, the possibilities in a financial way, I should feel that my visit to Maine had not been in vain.

The apple area over the United States is limited. I have little fear of competition from the Pacific slope. First, because many of the orchards in the West are short lived; next, because of transportation charges, only the very best can afford to be shipped out, and while they raise fruit beautiful in appearance it can never compare in quality with that grown in the East.

Realizing exactly what I say, I would say very emphatically that I should rather have ten acres of bearing apple orchard on land adapted to this fruit than a hundred acres devoted to the most profitable farm crop grown in Maine or New York.

Again, those who are consuming this fruit are rapidly increasing. Apples are no longer a luxury but a necessity. And let it be borne in mind that those to whom we must look to consume the major part of our crop are not the people of wealth who buy a dozen apples, or a box at a very high price, but the rank and file, who are willing to pay a fair price for a good article.

Then too, the cold storage facilities that prevent the crop being put on the market within a limited time, and also the refrigerator cars which allow it to be distributed over a large range of country, together with low ocean rates and excellent steamship facilities are giving us new and better markets every year. With these few suggestions I will now turn to the practical points of my theme.

VARIETIES.

As to varieties, I never specialize except when near my own home where I know exactly the condition, but I would say this: Select those varieties—of which there are many—which are known to do well in your locality; such as are strong, hardy growers, with good foliage, plenty of bearing surface, other things being equal; annual rather than biennial bearers; for the most part red fruits, of good size, and good shippers. It is well, too, to avoid those varieties with short, thick stems, that must always be bad droppers. I would have as much of quality as possible, but there must be a distinction made between varieties for a commercial orchard and those for family use. To illustrate: I grow the Jonathan and Spitzenberg. I want nothing better in my cellar, but I no longer set them in the commercial orchard. A Baldwin or Greening of the same age and with the same treatment will produce nearly three times the amount of fruit, and although the former varieties will bring a higher price, the net return to the grower will be very much less than from the last named varieties if they are adapted to his conditions.

I would avoid novelty. Many varieties are excellent in the place where they originate, but taken into a new country, particularly a southern variety brought north, it is extremely doubtful whether they will be profitable at all. Then, too, I would select those varieties that are best adapted to the markets, most accessible to the grower, and apples that are good handlers.

With the exception of such varieties as the Tompkins County King and Twenty Ounce for example, which are not hardy on their own roots, and if grown at all must be grown on some strong stock like the Spy or the Tolman, I would set the varieties that are wanted rather than try the plan of setting strong growers and top working. In the latter case, the trees are apt to be misshapen and come into bearing less early than where they are rooted, budded or grafted. The only advantage is, that one is able to take his buds or scions from bearing fruits of known merits.

LOW HEADED TREES.

When I say a low headed tree, I do not mean a dwarf, but any of the standard varieties with the first branches from two to three feet from the ground. These are very much longer lived, more vigorous, and altogether more satisfactory than any dwarf possibly can be.

The claim is made that one can set very many more dwarf trees on an acre, which, of course, is true, but he will have many more trees to care for, and really less bearing surface than on half the number of standards. A further objection, fatal in itself, is that they have a shallow root system, and as the top grows, are inclined to blow over on the strain, breaking the feeding roots, which materially injures or destroys them. If they are set so deep as to overcome this, in a very few years they cease to be dwarfs, and become standards by rooting from the stock grafted in.

The advantages of the low headed tree are these: First, the branches protect the trunk.

Next, such a tree suffers very much less from wind, and fruit which falls can be gathered, and is as valuable as any on the tree. The apples can be picked at very much less expense, and with varieties like the McIntosh, often as they ripen can be put directly into a box and so easily graded. These trees, experience shows, come into bearing at an early age, and over and above all can be thoroughly and economically sprayed.

All these reasons doubtless appeal to you as good, but I know you will be saying: How are you going to cultivate such a tree? The point is well taken, but the objection is more seeming than real. I have done my large trees more harm than good by deep cultivation close up. As a matter of fact, before these low-headed trees come into bearing they can be worked as deep as need be with a one-horse reversible beam plow, and after the limbs get too low with the modern orchard tools one can do all the cultivation that is necessary, and do it well.

PRUNING.

This really is a subject that demands a lecture by itself, and I can only emphasize a few vital principles. I would lay this down as the first: Prune just as little as possible to keep the trees shapely, sufficiently opened that the sun can penetrate and spraying can be well done, and to remove all diseased or broken wood. Whether to prune when the tree is dormant, or in full leaf, is wholly dependent on conditions. If the work is done in the first case in winter, when the sap is stored in the roots in proportion to the top that the tree had the fall previous, and a portion of this top has been removed, when the sap rises in the spring, it must either force an undue growth of the wood remaining, or produce a lot of suckers, both indicative of wood growth rather than the development of fruit buds. To prune at this seasen, then, means to encourage growth rather than fruitfulness.

If the tree is pruned when in full leaf, after the sap has been distributed through the top, a portion of this top then being removed will leave only the right quota to each branch, and the shock to the tree—for it is a shock—will tend to produce fruitfulness.

CULTIVATION.

When one sets an orchard he must register a vow to care for it according to the laws of trees, and of nothing else, or in other words, one cannot expect results and make the orchard a grain field or a meadow. I do not believe it necessary to give up the land entirely to trees during the first years of the orchard's life. Hoed crops, such as corn or potatoes, may be planted between the rows, keeping a good distance away from the trees. The ground can then be cultivated early in the season and the growing crops shade the land later on. This, I believe, is better than "fillers" for ordinary man, who is carrying on his orchard work in connection with ordinary farm operations. He had better take a little more land and set only the trees for the permanent orchard rather than to attempt to set fillers to be taken out later on. The average man will leave them just "one year more" and seriously injure the permanent trees. The orchard may be seeded down occasionally with clover, and perhaps one crop of hay removed; but no grain crop should ever be grown and the orchard never left in sod more than one year.

SHALLOW PLOWING IN SPRING.

I should recommend shallow plowing in early spring, followed by cultivation of the ground often and thoroughly enough to prevent the loss of moisture and the destruction of all weeds. In midsummer sow the ground with a cover crop. If the trees are bearing heavily, such crop should not be put in until quite late, say the early part of August. If there is no fruit and the trees will bear a little checking it may be sowed two or three weeks earlier. What the crop shall be depends wholly on the growth of the trees. If they are growing very rank, so that the foliage is dense and the sun cannot penetrate, fungi will flourish. I would then not sow a leguminous crop, but buckwheat, oats, rape and turnips, or rye. All but the last named will die before winter, but the latter will provide a green crop which is in itself desirable, but it must be plowed in the spring at least by the time the rye begins to head, or it will do more harm than good.

If tree growth is desired, then I should use peas, or clover. We are feeling quite confident that the winter vetch is going to be an ideal crop for this purpose, although it is a little difficult to get it established. We frequently use what might be called a combination made up of a pound of rape, a pound of cow horn turnips and two pounds of red clover per acre.

AGAINST THE SOD ORCHARD.

I want to go on record as most emphatically denouncing the sod orchard. I have some myself in which there has been no plow for more than 30 years, pastured with small stock, and they have been exceedingly profitable, but they belong to a past generation, and without question the profitable orchards the country over, are those that are cultivated from their youth up and continue to be so until the end of the chapter.

FERTILIZERS.

I should never put any manure or fertilizer of any kind about the roots of the young trees when planted. A mulch of coarse manure above the ground may be a very good thing. Apply just enough manure to keep the trees growing and thrifty until they come into bearing and then usually it may be applied with a liberal hand. Of course, there can be too much to induce the rank growth spoken of above, but of this there need be no danger if one will observe his trees and refrain from applying the manure when there are indications that there is too much wood growth. To put a lot of fertilizer—as is often done—right about the trunk of the tree and nowhere else, is as sensible as it would be to tie four quarts of oats about a horse's leg, and expect it to get any benefit from it. As to the matter of commercial manure, I am not so clear. I have used very much of such in my own orchard, and know of its extended use in others, and in either case there was no direct benefit to the tree, although there was an indirect one, through the growth of the cover crop. This will not apply to all conditions, and I can only advise each orchardist to experiment for himself in a limited way with various chemicals, to determine whether for him it is a profitable investment.

WHAT ABOUT SPRAYING?

I have said nothing about spraying, because I propose to treat that by itself tomorrow but for the benefit of any one who may not hear me at that time, I would say that after all these things have been faithfully carried out, there must be thorough, timely and intelligent spraying.

Mr. Bailey of Wiscasset: Situated near the seashore we have a great deal of rock-weed and thatch. Now what kind of a scheme is it to put on a good supply of rock-weed in the fall, let it stay through the winter, and then put on 8 or 10 inches of thatch, and a salt hay which we can get in large quantities around the shore, and let it stay till fall again?

Mr. Van Alstyne: Theoretically that is all right, if it is not carried too far. I should be afraid, in putting any large amount of vegetable matter into the soil, that you could not turn it under thoroughly enough so but there would be danger of its drying out the soil. I would rather put on smaller doses at more frequent intervals. If you have a good coating of the weed that you speak of, I should think that would be all that was necessary, if you are going to plough it under. If you are going to mulch, your method is all right. There are orchards in my State, and in Ohio, in which the mulch system has been carried through with a good deal of success. But I would not recommend it except on land that could not well be cultivated. In such a case your plan would be admirable. The more material you can put on to make a mulch the better.

Mr. Cummings of Paris: I understood you to recommend having the first branches about two feet from the ground?

Mr. Van Alstyne: Yes, sir.

Mr. Cummings: Well, with a wide-spreading tree like the Baldwin, when that tree is bearing won't you have your limbs upon the ground, so that the lower limbs will be in poor shape?

Mr. Van Alstyne: Yes, that will come about eventually, just as it will come about eventually if you head the tree as we used to so as to drive a horse under it. In the latter case the time will come when those lower limbs will come down and we will have to take them off. On the other hand, the low-headed tree seems to have a greater tendency to grow upright than the high-headed tree. But the time will doubtless come when the limbs will be on the ground. I have got some now that are pretty near the ground. Now then, those limbs will either have to be shortened up, or some of them possibly will have to be removed altogether, but even then I will have a better shaped tree than if the tree were way up.

Question. How about the deep snows? Do they affect it any?

Answer. That would probably be a more serious objection with you here than with us, and yet I have an idea that that is more seeming than real, because with the more stocky branches that you grow by that method, I think they would perhaps resist the snow more than a wide-spreading tree. I say to you frankly that where you are troubled with these deep snows, I would head higher than I would in my State, where we have less snow.

President Twitchell: During the past few years the State has purchased a farm in the town of Monmouth. It has been my good fortune to spend six or seven months yearly within a mile of that farm and know what the workers were doing there. I believe the State has been extremely fortunate in the man it has placed there as horticulturist. He comes to us with earnest and honest desire to do the very best he can for that farm, for the proving out of the great problems which now confront us. It gives me pleasure to present to you Professor Bonns, Horticulturist at the Agricultural Experiment Station, who is now to speak to you along the line of the work which he has been carrying forward on the farm at Monmouth.

SOME ORCHARD SPRAYING PROBLEMS AND EXPERIMENTS.

By W. W. BONNS, Horticulturist, Maine Agricultural Experiment Station.

Mr. President, Members of the Pomological Society:

According to the program, I am to lead a discussion under the heading "The Care of the Orchard." I shall take the liberty of qualifying that announcement by confining myself to one phase of orchard management, and discuss briefly some orchard spraying problems and experiments.

This subject was selected for several reasons: First, to emphasize the continuation and extension of intelligent, timely and thorough spraying as a vital factor in the improvement of Maine's orchard industry. Second, to put before you an account of one phase of the work being carried on at Monmouth at the experimental farm, the acquisition of which was due in no small degree to the interest and efforts of your members.

It seems appropriate to me that at meetings of this nature we should come before you with an account of what is being done in the experimental field, rather than dwell upon distinct ways and means of orchard practice already well established and understood. The work of the Maine Station, as you know, is distinct from that of the Agricultural College. The latter is the means of spreading agricultural gospel from the foundation of determined facts and principles. The function of the Station is to attempt the solution of new problems and the discovery of underlying principles, so that these when solved and discovered can be transmuted into rules for practice and spread through the College and the other agents for agricultural extension work.

The time has long passed when the necessity and value of spraying for the control of insect and fungus enemies of the orchard has to be proved. In the large regions devoted to fruit growing in the Middle, Central and Pacific Coast States spraying has long been an accepted part of the annual orchard treatment by all men who look to their fruit for an important source of their revenue from the land,—and rightly so. For every year has shown them that spraying properly done means healthier trees, cleaner and better fruit, and, in consequence, better returns.

Spraying in its extension has also brought with it problems for solution. For many years bordeaux mixture has been the standard fungicide for orchard spraying, with Paris green or arsenate of lead used in combination with it as the insecticide. Paris green has in recent years been largely superseded by arsenate of lead, because the former has a great tendency to burn and injure foliage, whereas lead arsenate has been found equally effective in destroying leaf-eating insects without the injurious effects upon the leaves.

The increasing use of bordeaux mixture has, however, been accompanied by reports of injury to fruit and foliage. Such injury appears to vary in degree and in different seasons. On the peach and Japanese plum it has long been known that bordeaux cannot be used with safety when the tree is in leaf. On the apple and pear the injuries have manifested themselves in two ways—burning or spotting of the leaves and russeting or corking of the fruit. The leaves so affected show dead brown spots similar in general appearance to some fungus leaf spots, generally circular or roundish, but often irregular. Frequently the areas are large, as though a number of smaller ones had united. Occasionally the margins of the leaves show the characteristic dead blackened areas. Such foliage injury is very frequently followed later in the season by yellowing and premature leaf fall. This occurs early or late in the growing season according to the severity of the injury. Sometimes it does not occur at all. Whether such yellowing is actually the result of bordeaux spraying is a mooted point among investigators, but it is an acknowledged fact that it is a frequent accompaniment of leaf injury from this source.

On the fruit the injury is first seen as small, dark, fly-speck like spots. These are not to be confused with scab spots. The former are regular, smaller and not sunken. The final appearance of the injured fruit is well known to most of you. The skin is washed with a rusty or russet colored coat which materially detracts from its appearance. In more severe cases the apple has been stunted in growth and has suffered malformation, while the russeted surface may be greatly roughened or even corrugated. In very severe cases the skin may crack and show V-shaped splits on the surface of the fruit.

The following points seem fairly well established:—

1st. Bordeaux injury is a definitely recognized trouble.

2nd. Improperly made bordeaux is not the sole cause of injury, and excess of lime does not seem to have an appreciable effect in preventing it.

3rd. Bordeaux appears to be aggravated in its injurious action by unfavorable weather conditions following the time of spraying. Wet weather so following is especially conducive to injury.

4th. Agencies such as frost and other factors not accounted for may produce a characteristic russeting on fruit, entirely independent of any spray.

5th. Varieties vary greatly in susceptibility to injury.

6th. The severity and general occurrence of injury in certain seasons of untoward weather conditions make it probable that weather is an important factor in causing injury. Even small differences of local atmospheric conditions may account for entire difference of results.

Let me pause here to emphasize this point—that injury from bordeaux was not, and is not, a regular or annual occurrence; that up to a very short time it was the best fungicide known for orchard spraying and that in spite of the occasional injury no orchardist could afford to take the chances of exposing his crop to the certain ravages of insect and fungus enemies by abandoning the spray pump.

We find that in 1907 Professor Cordley of the Oregon Station began his series of experiments with lime-sulphur as a summer spray for the control of apple scab. These experiments he has conducted every season since, with decided success.

Three kinds of lime-sulphur preparations were employed: The so-called self-boiled, the home-boiled and commercial or factory boiled solutions. The nature of these we will consider more fully hereafter.

In general, the results obtained by these men were highly encouraging. Self-boiled lime-sulphur appears to be an essentially safe and effective fungicide for the control of peach brown rot and scab, two of the greatest enemies of the commercial peach grower. As a means of control for apple scab it was fairly good, but not to the same degree as either the home-made or commercial concentrated forms. In addition to the action of these sprays as fungicides was the encouraging fact that they appeared to have little or no injurious effect upon the foliage when used at proper dilutions, and no injury to the fruit appears to have been reported. Both Paris green and arsenate of lead were used, with the results in favor of arsenate of lead.

For the literature bearing on this subject and the details of the experiments just mentioned those who may be interested will find references thereto in two bulletins soon to be issued by the Maine Experiment Station, one on apple diseases and their control, the other on the results of this season's spraying with lime-sulphur sprays in the orchards at Highmoor Farm.

When the Station took charge of the farm last summer, its first attempt at orchard renovation was a thorough spraying of all the trees, which were badly infested with insects and fungi. Bordeaux mixture was used, and although the pests were brought under control considerable injury, ascribed in part to the spray, was noticed on the leaves. For a large part of such injury, however, the weakened condition of the trees may be held responsible. It is not too much to assume that a tree of weakened vitality is more susceptible to causes of injury of any sort, as it has less natural resistance to them.

As you know, nearly all our trees of any promise are Ben Davis, and this variety is notably susceptible to spray injury. It was, therefore, decided to test out through a series of seasons some of the forms of lime-sulphur solutions which had been so favorably reported on in other places.

THE PROBLEM.

The questions to be asked by this experiment might be stated as follows:

1. Are self-boiled, home-boiled or commercial lime-sulphur sprays now on the market in Maine equal in efficiency to bordeaux mixture for the control of apple scab?

2. May the damage from spray injury on susceptible trees like the Ben Davis be eliminated by such sprays?

3. If lime-sulphur sprays do not injure fruit or foliage and yet are not equal to bordeaux as a spray, is their use commercially profitable?

4. Can arsenate of lead be as safely and effectively used with these sprays as with bordeaux?

THE NATURE OF LIME-SULPHUR SOLUTIONS.

What are these lime-sulphur mixtures, and how do they differ from one another? Briefly, self-boiled lime-sulphur is a chemical and mechanical combination of calcium and sulphur obtained by adding sulphur to an equal weight of lime when that lime is slaking. The means of effecting this union is the heat of the slaking lime; no other heat is employed. The spray so made is not as strong as the boiled preparations, and has less sulphur in solution. Probably for this reason it has been found less effective for apple scab.

The boiled lime-sulphur solution is made by slaking good lime, and after slaking boiling with an amount of sulphur double in weight to that of the lime used. Actual boiling is continued from 30 to 60 minutes, according to the recommendations of various experimenters.

It is known that calcium and sulphur will combine in different proportions and form different compounds; the greater the amount of sulphur present, up to a certain point, and the longer the time of boiling, up to about an hour, the greater the amount of sulphur in solution. The home-made preparations have, of course, a considerable amount of sediment left, which is strained off before using.

The commercial solutions are usually clear, but have not been found essentially different from the properly prepared home-boiled preparations.

THE EXPERIMENT.

For this experiment 25 rows of Ben Davis trees, about 20 to 25 years old, were selected in our thriftiest orchard. These were divided as follows:

Rows one, two and three, contained a total of nine trees. The balance of the plats consisted of two rows of six trees each, except the plot sprayed with the home-boiled solution, which had 11 trees. The trees were fairly alike in size and condition.

Some had been more thoroughly pruned and thinned out the preceding fall than others, and in consequence could be sprayed a little more effectively, but in general the conditions were reasonably uniform.

Treatment was as follows:

Row.	Treatment Sprayed With.	Manufactured by.	Amount used in 50 gallons water.	Amount lead arsenate (insecticide) added in 50 gals. water.
1, 2, 3	Checks, not sprayed			
4, 5	Lime-sulphur	Niagara Sprayer Co ...	1½ gallons...........	3 lbs.
6, 7	Lime-sulphur	Bowker Insecticide Co.	1½ gallons...........	3 lbs.
8, 9	Lime-sulphur	Sterling Chemical Co..	1½ gallons...........	3 lbs.
10, 11	Lime-sulphur	Grasselli Chemical Co.	1½ gallons...........	3 lbs.
12, 13	Lime-sulphur	James A. Blanchard Co	1½ gallons...........	3 lbs.
14, 15	"Sulfocide"	B. G. Pratt Co	⅓ gallon.............	3 lbs.
16, 17	Self-boiled lime-sulphur.	Home made.	10 lbs. lime, 10 lbs. sulphur...........	3 lbs.
18, 19	Boiled lime-sulphur	Home made...........	2½ lbs. lime, 5 lbs. sulphur...........	3 lbs.
20, 21	Bordeaux mixture......	Home made...........	4 lbs. copper sulphate, 4 lbs. lime.	3 lbs.
22, 23	Bordeaux mixture......	Home made...........	3 lbs. copper sulphate, 3 lbs. lime.	3 lbs.
24, 25	Checks, not sprayed			

The Sulfocide used on rows 14 and 15 is a proprietary article advertised as a soluble sulphur spray, not lime-sulphur. The first two applications of this were as stated above, the last one was diluted to three-sixteenths of a gallon to 50 gallons of water.

Arsenate of lead was used with all solutions at the rate of two pounds to 50 gallons in the first application, and three pounds in the succeeding ones.

The applications, as careful and thorough as it is possible to make them with a hand pump were applied:—

1st. When the fruit buds began to show pink at the tips,—May 13 to 16.

2nd. Just after the petals fell,—June 7 to 9.

3rd. July 15 to 18.

The weather at the time of the first application was most favorable. The days were bright, mild and calm. Between it and the second application no injury could be found on any of the plots.

The second application was interrupted and followed by weather of the kind most favorable for the production of spray injury according to previous experiences with bordeaux. Showers interrupted and followed the spraying and the temperature and humidity changes were great and rather sharp. Cold, rainy periods were followed by bright, hot, humid ones. If spray injury were to be done, these were ideal weather conditions for producing it.

Observations made two to 15 days after the second spraying showed a comparatively small amount of leaf injury on all the sprayed plots except the self-boiled lime-sulphur. On those least affected it was found only by the closest observation. On others it was more readily seen, but on all the lime-sulphur plots which were affected the injury was so slight as to be entirely negligible as far as the general health and functions of the foliage were concerned. The foliage was spotted to a vastly lesser degree than the bordeaux plots, and although the spots averaged larger in size than those from bordeaux injury, the individual leaves showed on an average fewer injured areas per leaf. The application of the third spraying had no ill effects upon any of the lime-sulphur plots.

As the season advanced it was evident that so slight had been the foliage injury from lime-sulphur, even in the most severe cases, that to the general observer it passed unnoticed, and had no noticeable effects whatsoever upon the functions of the trees in developing fruit or wood. The leaves developed well, were thrifty and green and although scab could be found it did not develop to any appreciable extent. No yellowing whatsoever was seen on these trees, and the leaves remained on them until long after the fruit was harvested.

The self-boiled lime-sulphur plot suffered no leaf injury at any time during the season. The foliage was notably thrifty and green. On the other hand, leaves as well as fruit seemed to be considerably more affected with scab, showing that the self-boiled preparation is not as effective against this fungus as the boiled sprays.

Coming now to the fruit from these lime-sulphur sprayed trees we find it notably larger, cleaner and of better color, on the average, than that from either bordeaux or check plots.

So far, therefore, as foliage injury and fungus control are concerned, the lime-sulphur sprays showed themselves for this season to be a success on Ben Davis trees.

In regard to the fruit, none of the lime-sulphur sprays, not even the self-boiled, were entirely successful in preventing russeting or even malformation. In all cases, however, the percentage of deformed fruit was very small, and be it noted, *this percentage was in all cases but one no greater in amount or less than that found on the unsprayed trees*, where deformity was doubtless produced by natural causes. Hence it is difficult to say exactly how much of this deformity was actually due to the spray, and how much to agencies that caused russeting and malformation on unsprayed trees. We shall see, however, that it was only one-third as great as on the bordeaux plots. Of one thing we may be reasonably certain, judging by past experience. When conditions are right for producing such injury to unsprayed fruit by natural agencies we cannot hope to escape it on the sprayed trees. Spraying at such times may, and probably does, aggravate the condition, but that is neither reason nor excuse for abandoning spraying operations entirely.

The bordeaux sprayed plots showed the characteristic effects on leaf and fruit. The leaves were badly spotted and the fruit russeted and severely deformed to quite an extent. The foliage very evidently suffered in thriftiness, as could be noted by the casual observer comparing bordeaux with lime-sulphur, making due allowance for difference in color of the two kinds of sprays. Moreover, there was a slight amount of yellowing and some leaf fall during the season, neither of which, as already stated, appeared on the lime-sulphur plots. No noticeable differences were seen on the 3-3-50 bordeaux trees compared with those sprayed with the 4-4-50 strength.

All in all, the lime-sulphur sprays showed to decided advantage over the bordeaux, both in their effect on foliage and fruit. We shall see that their effectiveness in scab control was even a trifle better.

We come now to consider one other sprayed plot—that treated with Sulfocide. The injury done in this division was extreme. After the second spraying the leaves showed very great and widespread injury two days after the second application. The tissues were in cases thoroughly scorched or burnt. Defoliation was severe and the growing processes of the trees appreciably hindered for this season. Not only was the fruit very badly damaged after the second application, but more injury was done it after the third, which was applied at the rate of but three-sixteenths of a gallon to 50 gallons of water,—a dilution greater than the weakest strength recommended by the manufacturers. The fruit was stunted in growth, deformed, badly cracked and blackened at the calyx or "blow" end. The nature of this injury varied. In some cases the calyx end was sunken, in others a similar burning of the tissues was found on the side of the apple, sometimes accompanied by splitting of the skin. Almost 50 per cent of the fruit was so affected to some degree.

It is only fair, however, to state that it has not yet been shown that this injury is due to the Sulfocide itself. It is possible,—and we are at present somewhat inclined to this view,—that the injury may be due to a combination of Sulfocide with lead arsenate whereby arsenic is set free in a form capable of doing the damage. Very similar injuries due to Paris green used with bordeaux have been noted at the Missouri Fruit Station. This is a point to be more fully determined, and for that reason we give you our observations and not conclusions. The speaker saw the orchard of Dr. J. F. Moulton of Limington last September, and the trees, sprayed with Sulfocide and Paris green with some lime added, were in excellent condition. This much, however, may be said at present; if lime-sulphur sprays, either commercial or home made, plus arsenate of lead, will give at least as good results as Sulfocide plus Paris green, then the balance is in favor of lime-sulphur, for Paris green is too unreliable to use, considering its capacity for burning foliage.

Coming now to the check or unsprayed rows, of which there were two plots, one at each end of the experimental block, we find that scab played havoc on both fruit and foliage. In addition to this, these divisions were the only ones where insect depredations occurred to any extent at all. Codling moth was here at work, and several of the leaf-eating caterpillars, including the voracious "yellow-neck." The fall web worm was here in full force, not confining itself to leaves, but making meals off the fruit itself.

In striking contrast to these plots was the appearance of all the sprayed trees. Not even the first sprayed row next the check plots had a sign of web worms or other leaf-eating insect. The entire effectiveness of lead arsenate with the lime-sulphur solutions was evidently well demonstrated in this year's results. What insect injured fruit was found on the sprayed plots was almost entirely the work of the curculio. Since this is not a leaf or fruit devouring insect, and arsenicals are acknowledged to be of practically no use in combating it, the performance of lead arsenate for this reason may be estimated at very close to one hundred per cent.

The following table gives a comparison of results on the basis of fruit. Under scabby fruit was classed every apple that had the faintest trace of scab, even as small as a pin head. Of all the scabbed fruit considerably less than 50 per cent would be classed as badly scabbed. This should be borne in mind in examining the table.

Row.	Number of apples.	Per cent clean.	Per cent scabby.	Per cent deformed.	Per cent wormy.
1-3 Check	3,102	58.3	41.6	1.9	13.7
4-5 Niagara	7,736	92.7	7.2	2.2	0.6
6-7 Bowker	5,040	93.3	6.6	3.5	1.5
8-9 Sterling	7,765	89.9	10.0	1.3	0.8
10-11 Grasselli	9,563	88.5	11.4	1.8	0.5
12-13 Blanchard	7,699	91.0	8.9	1.6	1.0
14-15 "Sulfocide"	3,660	94.4	5.5	44.3	0.1
16-17 Self-boiled	3,181	84.5	15.4	2.1	1.0
18-19 Home boiled	6,551	85.2	14.7	1.3	1.2
20-21 Bordeaux 4-4-50	7,185	83.2	16.7	6.7	1.5
22-23 Bordeaux 3-3-50	5,215	85.9	14.0	5.7	1.9
24-25 Check	6,092	59.2	40.7	2.4	7.3

FINAL OBSERVATIONS.

From these results we observe:

1st. Spraying with either lime-sulphur or bordeaux vastly increased the per cent of clean fruit and was decidedly a profitable operation.

2nd. Of the five commercial lime-sulphur preparations there was little difference in effectiveness. For an absolute test of this point the use of these brands over a series of years would be necessary. All of them this season were satisfactory as fungicides.

3rd. Leaf injury from lime-sulphur with lead arsenate was so insignficant as to be entirely negligible.

4th. Russeting of fruit and malformation was not entirely avoided on lime-sulphur sprayed trees. Whether this is due to the spray, to weather conditions or to a combination of both, is a point still to be discovered.

5th. Home-boiled lime-sulphur was slightly less effective in scab control than the commercial preparations. We believe that a part of this difference may be accounted for by the fact that in rows 17 to 25 inclusive the trees were somewhat larger than in those preceding, and had been pruned less severely. In consequence, the same amount of spraying would have somewhat less chance of being as effective as on trees more open to spray, sun and air. Even so, the differences are not great. Other experimenters have found the home-boiled solution very satisfactory.

6th. The self-boiled lime-sulphur was less effective in the control of scab on fruit and foliage. This coincides with the results obtained by previous experimenters.

7th. Sulfocide combined with arsenate of lead was a most undesirable spray to apply to Ben Davis trees.

8th. Arsenate of lead was eminently effective with all lime-sulphur sprays in the control of chewing insects.

9th. A comparison of bordeaux and lime-sulphur *for this year* shows a small balance of scab control in favor of the latter and a somewhat greater balance in favor of the same in the case of spray injury.

These, be it noted, are our observations of the facts; they are not our conclusions, for the latter are not ready to be made. No man in the experimental field is warranted in staking his reputation on the results of one year's work. This much may be said: The results obtained are encouraging, and, taken into consideration with those of former experiments at other stations, point to the future solution of our spraying difficulties along the lines being worked upon. The use of lime-sulphur to date appears to be attended by desirable results as great as, and by undesirable results somewhat less than, those following the use of bordeaux, even under conditions making for spray injury. Whether such injury will ever be totally avoided with any spray when the atmospheric conditions at the time of use are unfavorable is a question that remains at present unanswered.

There are many questions still waiting to be solved in connection with this problem. One of these is variation in susceptibility to injury of different varieties. In this phase of the work the Station is handicapped by the fact that our orchards are practically confined at present to one variety for experimental purposes. We have no means of testing the effects of lime-sulphur upon different varieties, and this should be done. We know that there is a great difference in susceptibility to bordeaux injury: we must know more about it in relation to these newer sprays. It is greatly desired that some of you men interested in advancing horticultural knowledge co-operate with us by using lime-sulphur on small blocks of one or two different varieties, spraying thoroughly and noting carefully the effect upon foliage and fruit, both as to fungus control and possible injury. We should be glad to hear from members of this society who are willing to undertake such a piece of work and to follow our directions.

There are other questions to be solved. One is the minimum strength of spray that will be effective. Another concerns the chemical nature of the lead arsenate that is best to use in conjunction with the fungicide. These are some of the points which we hope to attack in the future. For the present we would say lime sulphur is worthy of a trial, but the end of the knowledge regarding it will only come from such trials.

HOME MADE VS. COMMERCIAL LIME-SULPHUR.

In conclusion let me say a word relative to home made vs. commercial lime-sulphur preparations.

Concentrated stock solutions, properly made and stored, have been found entirely satisfactory. Does it pay, then, for the orchardist to make his own spray? That depends largely upon the amount of spray to be used. The commercial preparation is a convenience, requiring nothing but a knowledge of its density before diluting with water. On the other hand these proprietary sprays cost from three to four times as much as an equal volume of home made material. The home-boiled concentrated stock solution if properly made and barreled, can be cooked in winter and stored for future use. It is largely a question of the man and his willingness to save money by using his own time, labor and care. Lime-sulphur sprays must be correctly made and correctly diluted when using. This point must be emphasized.

Another advantage of concentrated lime-sulphur solutions, either commercial or home made, over other fungicides, is that the same preparations are used as insecticides on dormant trees. These lime-sulphur sprays, used in greater strengths, are effective in controllng sucking insects which cannot be fought with arsenicals. At such strengths they are used when the leaves are off the trees and no injury to the latter results.

DIRECTIONS FOR MAKING SPRAYS.

The materials needed for making either of the home made sprays are good stone lime, free from grit or dirt, containing the least possible amount of magnesium, and sulphur. Do not use a magnesium lime. Sulphur may be either in the form of flowers of sulphur or sulphur flour.

SELF-BOILED LIME-SULPHUR.

The directions for making this so-called self-boiled preparation are adapted from several publications of Mr. W. M. Scott of the Bureau of Plant Industry, United States Department of Agriculture, who first devised and used it.

Use 8 lbs. of sulphur and 8 lbs. of good stone lime to 50 gallons of water. The amount of lime and sulphur may be multiplied by any amount, provided the volume of water finally used is likewise increased. Thus, 40 lbs. of lime can be used with 40 lbs. of sulphur and diluted at the end of the process to a total of 250 gallons of water.

"Place the lime in a barrel and pour on enough water (about 3 gals. to 20 lbs.) to start it slaking and to keep the sulphur off the bottom of the barrel. Then add the sulphur which should be worked through a sieve to break up the lumps and finally enough water to slake the lime into a paste. Considerable stirring is necessary to prevent caking on the bottom. After the violent boiling which accompanies the slaking of the lime is over the mixture should be diluted ready for spraying, or at least enough cold water added to stop the cooking. Five to 15 minutes are required according to whether the lime is quick acting or sluggish. The intense heat seems to break up the particles of sulphur into about the physical condition of precipitated sulphur and the violent boiling makes a good mechanical mixture of the lime and sulphur. Only a small percentage of the sulphur—enough to improve the adhesiveness of the mixture—goes into solution, but if the hot mass is allowed to stand as a thick paste the sulphur continues to unite with the lime and at the end of 30 to 40 minutes enough of the reddish liquid is produced to burn peach foliage and even apple foliage in some cases. Hence the necessity for cooling the mixture as soon as the lime is slaked.

The mixture should be strained through a sieve of 20 meshes to the inch in order to remove the coarse particles of lime, but all the sulphur should be worked through the strainer.

The amount of water required to make the best mixture depends largely upon the lime. Some grades of lime respond quickly and take a large quantity of water, while others heat up slowly and are easily "drowned" if too much water is added at once. Hot water may be used to good advantage in preparing the mixture with sluggish lime, but with quick acting lime hot water is not necessary and is more likely to bring too much of the sulphur into solution. If desired the mixture may be kept for a week or more without deterioration but should be thoroughly stirred before using."

In applying the self-boiled mixture the spray pump should be equipped with a good agitator as the mixture settles to the bottom of the tank. In order to be evenly applied it must be kept well agitated.

HOME BOILED CONCENTRATED LIME-SULPHUR.

In making this solution a large kettle or iron cooker of some sort is necessary. A stock feed cooker of large capacity will answer. Cookers well adapted for this work can be obtained of the Farmers' Supply Co., Philadelphia, Pa.; Montgomery, Ward & Co., Chicago, Illinois, or the Wagner Mfg. Co., Sydney, Ohio.

We give here the formula of Prof. A. B. Cordley of Oregon as the one best to recommend in view of our present knowledge of the subject.

Sulphur	110 lbs.
Lime, best grade	55 lbs.
Water sufficient to make	60 gallons.

Slake the lime, mix the sulphur into a thin paste with a little water, add it to the lime, add sufficient water to make 60 gallons, bring to a boil and boil vigorously for 30 to 45 minutes. The sediment is then allowed to settle, after which the clear dark amber-colored liquid is drawn off and may be stored in 'casks for future use."

DILUTING CONCENTRATED SOLUTIONS FOR USE.

With our present knowledge, the strength of lime-sulphur to use—that is, the amount of water to add to a gallon of the concentrated solution—depends upon the density or specific gravity. This may be determined by a cheap and simple instrument called the hydrometer. This consists of a hollow glass tube, its lower end terminating in a weighted bulb. Placing this in a liquid, it sinks until the liquid displaced equals its own weight. In light solutions, therefore, it will sink deeper than in heavy or dense ones. The graduations to be read are marked on the scale on the neck of the instrument, and are in degrees Beaumé or in terms of specific gravity. In some hydrometers both scales are given, but the Beaumé is the one most generally used. These instruments, costing from $1.25 to $1.50, may be had of Bausch & Lomb, Rochester, New York; Eimer & Amend, New York, N. Y., or any dealers in scientific apparatus. They are absolutely necessary for the proper use of lime-sulphur solutions, as not only may the product of one manufacturer differ in different casks, but home-boiled solutions will vary considerably even when the same amounts of material and time of cooking are employed.

The following is adapted from Cordley's tables for dilution:

Hydrometer reading.	Number of gallons water for one gallon solution.	
Degrees Beaumé.	Summer Strength (Fungicide).	Winter Strength (Insecticide).
32	1-30	1-12
31	1-29	1-11
30	1-28	1-10
29	1-27	1-9½
28	1-26	1-9
27	1-25	1-8½
26	1-24	1-8
25	1-23	1-7½
24	1-22	1-7
23	1-21	1-6½
22	1-20	1-6

The advantage of the concentrated home-boiled solution is that it can be made when other work is not pressing and stored in casks or barrels for future use. When so stored the barrels should be entirely filled to exclude air. If this is not possible, or when a part has been withdrawn for use and the balance is to be held for a considerable time it should be protected from the air with a thin oil coating of paraffin oil or other heavy oil.

Arsenate of lead should not be added until the solutions are diluted and ready for use.

A word more and I am done. What is to be the attitude of you orchardists in the light of our present knowledge? Will it be one of hesitation or timidity? If you have sprayed in the past are you going to lay aside your spray pump for the present? If you have been thinking of spraying for the first time next season are you going to give up the idea and wait until experiments have shown you something still more definite? If you do, let me assure you most emphatically that you can make no greater mistake. Remember that scab, leaf spot, fruit spot, pink rot, black rot, sooty blotch and canker; codling moth, bud moth, web worm, yellow-neck, blister mite, bark louse, aphids and dozens of other injurious insects are, like the poor, always with us. We can never escape them entirely, but we can keep them under control. Keep right on spraying this year, next year, every year.

We have still much to learn, but we know enough even now so that we can go ahead. We have today knowledge which if properly applied means success in our orchards and dollars in our pockets. Use bordeaux or lime-sulphur according to your judgment from the results so far known. The Station itself proposes to use lime-sulphur on all its orchards next season.

If you have varieties especially susceptible to scab, a good plan would be to use bordeaux for the first application, before the blossoms open, and lime-sulphur for the other two. Do not be afraid to experiment yourselves; all of us will benefit by it, and you cannot lose if you do the work with care and intelligence. Get the bulletins telling you what you have to fight and how to do it. Study them carefully. Know what you are spraying for, and then spray in time and thoroughly and you will win out in the end against both insect and fungus enemies.

COMBATING INSECT PESTS AND DISEASES.

By E. Van Alstyne.

No man can expect to raise fruit which will compete satisfactorily in the world's markets, unless it is thoroughly sprayed, and freed from the depredations of insects and the marring by disease. Some may say, Why is this necessary today more than formerly? There are several reasons. First, the standard of excellence is higher, and buyers are discriminating against fruit which because of injury from one or the other of the above causes, is not only unsightly but unprofitable. Next, because as we increase our planting both insects and disease multiply; just as we find typhoid and other fevers rampant in the crowded districts of the cities, and rarely of a serious import in the sparsely settled country. The destruction of the wild plants and trees, on which many of our native insects fed, has driven them to the cultivated plants, which being more numerous and often apparently more to their liking, cause them to multiply exceedingly. Then, too, in most cases the parasites, which in their native state held them in check, have either not followed them into civilization, or have not found the same congenial surroundings. Again, as we are bringing into the country products from the ends of the earth, we will bring in the future, as we have in the past, unknown insects, such as the gypsy and brown-tail moths and San Jose scale, all of which must be reckoned with. While this, at first glance, may seem discouraging, yet it is after all what makes our fruit growing profitable. It puts a premium on the product of the man who will grow and market his article in spite of these difficulties. I am very sure, were it not for the San Jose scale—which, fortunately, you Maine growers have not yet had to contend with—our fruits would not be bringing the present high prices. Spraying is not a summer day pastime, or a job which one may crave. It is disagreeable and expensive at best, but must be done if success in orcharding is to be attained, and when properly done no day's work in the orchard or on the farm will yield so large a return.

Simply to spray because it is fashionable, or when one has an odd moment, will avail little. One must spray for a definite trouble, do it at the right time, and do it thoroughly, or he had better not do it at all.

I am no entomologist or plant doctor, so do not propose to go into a description of the life history of insects or diseases, other than is necessary to bring out a few vital points. One must distinguish in the first place between insects which eat with their jaws, such as the potato bug or tent caterpillar, and can be controlled by poisoning the leaf surface, and those that suck their food from the leaf tissues and to which no poison does any harm, such as the various families of plant lice. These can only be destroyed by covering them with some sticky substance to stop up their breathing pores which are in the sides of their bodies. The various soap and oil emulsions, as well as the lime and sulphur washes, are all effective, but unless they can be applied when the insect is in the egg state, not always very satisfactory, for most of these insects are winged, and unless they are hit with the material they soon return, and in a few days rear up a large family to destroy the plant or to be destroyed by the orchardist. Fortunately, such are usually migratory in their habits, and have a large number of parasites that prey on them, and only do serious damage in occasional years. It is pretty thoroughly demonstrated, too, that the lime and sulphur washes will destroy a large portion of the eggs if the application is made early in the season. There is always a vulnerable time in the life of all these pests when they can be most easily combated, hence the importance, as I have suggested, of timely spraying. The fungus troubles are in a class by themselves, and only as the various arsenical poisons have fungicidal properties will they have any effect at all in holding these diseases in check. It must be remembered, too, that they can be prevented, seldom if ever cured. Let us take specific cases. I will say nothing about the San Jose scale, or the Blister mite, which is causing us such expense in our New York orchards, but confine myself to the codling moth and contemporary insects, with the apple scab.

The codling moth lays her egg when the weather is warm enough to start the buds, usually about the time the petals have fallen from the blossoms, when the embryo fruit stands upright with the calyx leaves open. This is a convenient depository for her egg. If at this time the poison is put on, so as to fill these little cups, even though the leaves may close, the poison is secreted where the worm hatching out will get his first meal well seasoned with arsenic and goes to that bourne from which no insect ever returns. The apple scab fungus winters over in the dead leaf, and when the weather is moist and warm, which is usually about the same time as the blossoms fall, these spores shoot out into the air and attach themselves to the foliage and twigs, and if wet weather prevails, multiply at an enormous rate, living on the tissues of the leaves and later spreading to the fruit, marring its beauty and making it illshapen. If at the same time we are applying the poison for the codling moth, as well as the tent caterpillar, and sometimes canker worm, that are active at this period, we add to it a fungicide, this one spraying done just at the right time and done thoroughly, will give, in most years, clean fruit.

Without question the best poison to use is arsenate of lead. This is superior to Paris green, first because it will not injure the foliage, second, because it is adhesive, and third, united with lime and sulphur, it increases the effectiveness of the latter as a fungicide. This can now be bought in quantities for ten cents a pound or less, and comes under a guaranteed analysis of the per cent of arsenic oxide it contains. This runs from 14 to 20; usually about three pounds to fifty gallons of liquid is sufficient to destroy insect life. The bordeaux mixture has been for many years the great standby as a fungicide, and I bear testimony to its worth for that purpose, but as we have used more powerful spray apparatus and consequently done a more thorough job, we have found increasing difficulty with the fruit being rusted. This was not as serious, of course, as the scab, but it was a serious objection, and such varieties as the Greening, McIntosh and Ben Davis were particularly susceptible. The experience of the last two years has fully demonstrated that the commercial lime and sulphur mixtures testing about 32° Beaumé, diluted with 30 gallons of water, are as efficient as the bordeaux in controlling scab, and at that strength will not harm the foliage, and even at greater strength there is no rusting of the fruit.

To illustrate the importance of thorough spraying at the right time, I will cite the work of Dr. Felt in my orchard the season of 1909. Many will remember that Professor Melander contended that in order to destroy the codling moth, there must be a coarse spray, thrown with a sufficient force to penetrate the lower calyx cavity of the apple. He asserted that it was necessary to have 200 lbs. pressure at the pump in order to do this, and his work showed clearly that such spraying done just when blossoms had fallen gave better than 90 per cent of worm-free fruit. If it were true that this pressure was necessary, it was very important that orchardists should know it. With an unbiased mind, only desirous to determine the facts, Dr. E. P. Felt, State Entomologist of New York, undertook to prove or disprove the truth of this contention, by very careful experiments in my own orchard, as well as those of Mr. W. H. Hart at Poughkeepsie, N. Y. With the exception of some minor detail, the work was substantially the same in both orchards, and being familiar with that in my own, I will describe it. The trees were 17 years set, bearing for the most part a full crop, and the orchard had been thoroughly sprayed for a dozen years. In fact, we could find very few of the parent moths early in the season, and the doctor was in some doubt as to the wisdom of carrying on his work in this orchard, but the year previous, in spite of spraying, we had too large a proportion of wormy fruit, and I was satisfied that there were plenty of the parent moths to give us an abundant crop in a favorable season. The orchard was divided into blocks of 42 trees. The first two were Greening, the last two Baldwin. In the center of each of these blocks six trees were selected for the test. The surrounding 36 were all treated in like manner. In the first case the pressure was from sixty to eighty pounds with a Vermorel nozzle, throwing a very fine spray. The trees were thoroughly covered, but examination showed little poison in the lower cavity. On the next six center trees the same pressure was used, but a bordeaux or coarse nozzle. Just as thorough work was done, and very much more material was used to cover the tree, and a *few* of the lower cavities were filled. In the next block, from 100 to 125 pounds pressure was used, with the same coarse nozzle. There was not very much difference in the amount of material, in fact a little less than with the smaller pressure, and a larger proportion of the lower cavities were filled. In the fourth block the pressure never went below 160 pounds, and most of the time was at 200 with the same coarse nozzle. A *large* portion of the lower cavities was filled with this heavy pressure and the coarse spray. It is interesting to note that in this last block of trees, there was one tree for which the speaker is responsible, that while in his eyes from the tower apparently it was well covered, was pronounced by the entomologist on the ground to have a less thorough coating than any of the checked trees. This was noted and the results will appear in the summary. There were also three trees in the orchard left entirely unsprayed. The spray material in every case was three pounds of arsenate of lead with 50 gallons of bordeaux mixture, 3-3-50 formula. In the fall, all the fruit was counted, including the very small amount which fell to the ground, even those stung by plant lice, with the result that on all the trees, in all the blocks, there was from 97 to 98 and a fraction per cent of worm-free fruit, and there was no perceptible difference whether the spray was coarse or fine or the pressure high or low, so long as the tree was thoroughly covered. The one tree referred to above, had the largest per cent of wormy fruit so that it brought the average of that block down about one per cent below the rest. The three unsprayed trees in the midst of the orchard thoroughly sprayed, showed 30 per cent of wormy fruit, as against less than three on the sprayed trees. Where the coarse spray was used, particularly on the lower limbs, even the Baldwins were badly rusted from the bordeaux. The results in the Hart orchard were almost an exact parallel of these just stated. In both cases, wherever there was a worm-hole in the side, examination was made to find whether the worm came from the first brood working from the center out, or was the work of a later brood entering from the outside, and showed that only in a few cases did the insect enter after the first spraying. The summary of the above would plainly indicate that so long as the trees are thoroughly covered, at this critical time, with an adhesive poison, like arsenate of lead, one thorough spraying is sufficient to make the fruit practically worm-free; that the coarse spray is of no advantage and much more expensive because wasteful of material; that the high pressure is desirable because the work can be more rapidly done, but by no means vital for good results; that the bordeaux mixture, although controlling the scab, reduced the market value of the fruit. In my own orchard the work was all done with a hand pump but power size; in Mr. Hart's the power came from a gasolene engine.

This experiment was repeated by Dr. Felt in orchards of Mr. Hart and of a neighbor of mine the past season (my own Baldwin orchard having so small a crop that the test would have been unsatisfactory) and his results were practically the same as in 1909. The results obtained by the speaker this past season—although no accurate account was kept—were as satisfactory as those of a year ago, but instead of the bordeaux we used commercial lime and sulphur, one to 30, with the three pounds arsenate of lead, and we had neither apple scab nor rust, nor was there the slightest injury to the foliage at any time. The Ben Davis packed this year were the only ones that I ever barreled of which I was proud, for hitherto, however free they might have been from worm or scab, or however large, their beauty—for that and their productiveness is all they have to commend them—was always marred by Bordeaux rust.

Further comment from me I think is unnecessary. An application to Dr. Felt at Albany, N. Y., will doubtless bring his last year's report, with this matter carefully tabulated, and illustrated with photographs, showing the piles of apples, wormy and free; all of which should convince the most skeptical of the value of a spraying so long as it is done at the right time with the right material and thoroughly.

SOME ESSENTIALS IN THE PLANTING AND BRINGING INTO BEARING OF SUCCESSFUL APPLE ORCHARDS, CONSERVATION OF SOIL FERTILITY, AND THE PROPAGATION OF MORE PRODUCTIVE TREES.

Address by Hon. George T. Powell, President of the Agricultural Experts' Association, New York.

With the great acreage that is devoted to apple culture, it is a surprising fact that the production of this great staple fruit, and the best of all fruits, does not keep pace with the demand for it.

So short has the supply of apples been for several years, so high has been the cost in recent years, and so much greater has been the increase in population than the increase in the supply of the fruit, that they have been beyond the reach of the great mass of consumers.

In 1900, the orchard products of the United States were worth $83,571,840. Of this amount California produced $14,526,786, and New York $10,542,272. Of the total number of fruit trees planted, the apple represents 55%.

In 1896, our apple crop reached 69,879,000 barrels. In that year Maine produced 2,419,000 barrels, but in common with all other apple-producing states, the yield has been greatly lessened since.

For this condition of a great shortage of apples, year after year, there are three principal causes—depleted soil, non-productive trees, and injurious insects.

While after two centuries of production, the soil of New England is by no means exhausted of its fertility, it is to an extent depleted, and to a degree that the orchards are not maintaining their old-time yields.

Every bushel of apples, potatoes, corn, and grain produced, takes out of the soil nitrogen, phosphoric acid and potash, and unless some return of these is made, the time must come when there must inevitably be a reduction in yield.

Every ten years, 35 bearing apple trees will take out of an acre of soil, 619 pounds of nitrogen, 140 pounds of phosphoric acid and 716 pounds of potash, and if this is continued over a long period of years, without ploughing in green crops and adding some new plant food, soil and trees alike will fail to produce paying crops.

THE SOIL.

The apple will grow in a variety of soils. Even on a poor soil it will struggle to maintain its life and to reproduce through its fruit, as reproduction is the real object of all life, animal and vegetable. There are, however, certain kinds of soils that are much better adapted to the development of apple trees than others. A soil that contains a certain amount of clay in its composition is excellent. Trees will grow in a stiff clay, but such soil is often over-saturated with water and trees will not do their best with too much water about their roots. Air which is necessary for the roots of trees and for all plants, is frequently shut out by the water in a clay soil. Such soil should be well underdrained, before trees are planted in it.

A soil that is made up of a mixture of clay and sand, and is known as a clay loam, is excellent for apple trees.

Trees will grow in a sandy soil, but they will not grow so large, neither will they produce so much fruit. The trees and the fruit on sandy soil are more subject to insect attack, for insects thrive better in a dry soil than in one that holds water for a long time.

There are, however, variations in sandy soils, that produce not only good trees, but an abundance of excellent and beautiful fruit.

The subsoil is an important factor in the planting of trees, and its quality and character should be understood. It is closer and more firm than the top soil, and retains moisture longer, but it may be made up of such fine particles of clay, and with so little vegetable matter in it, as to be impervious to water, and this constitutes what is known as hard pan, and if this lies up to within a foot of the top soil, trees will not thrive in it, neither will they produce much or good fruit.

Such formation near the surface prevents the water in the soil below from rising to supply the needs of vegetation, through long periods of drought. Where a hard pan formation may exist from six to ten feet below the surface, it is of great value, for there a certain moisture supply is assured through dry seasons, especially where frequent cultivation is given to the surface soil.

SOIL FERTILITY.

One of the great problems before our country now and for all time, is the conservation of the plant food of the soil, and its economical increase.

This may be accomplished in two ways,—by tillage, and by the growing and ploughing in of leguminous crops. There is yet a great amount of plant food in the soil, but much of it is in unavailable form. More and better tillage will improve any soil. Too generally, ploughing is hastily and poorly done. The real object of ploughing is not alone to prepare the soil for a seed bed or for the better planting of trees, but to get at the plant food that is essential to the growth of vegetation.

Every atom of soil contains plant food, and the greater the division, and the finer the particles of soil are made, the more readily may the roots of trees and plants get from them the plant food they require.

After more than six thousand years of production on the soil of the older countries of Europe, crop yields are larger and steadily increasing, and this is due to the more intensive tillage that is done more than to any other one cause.

At Orchard Farm, for a period now reaching over sixteen years, I have been growing clover and ploughing it in, as a means of improving the soil, and have the evidence of a marked increase in production and general improvement. The first efforts in the use of crimson clover were most discouraging; but few plants grew after the germination of the seed, but by persistence in repeated sowing of the seed on the same ground, a steady increase in the growth of the plants was secured, until at the present it is only necessary to sow the seed, when a strong growth is obtained.

After a season of over five months of protracted drouth, with only occasional very light showers, there is on one hundred acres of orchard of 10,000 trees a luxurious growth of clover which has added not only all of the nitrogen the trees require, but a large amount of humus which for years has been built up in the soil by the continued ploughing in of the clover crops. The orchard land is ploughed in the early spring, and harrowed weekly, until early July, when eighteen pounds of clover seed per acre are sown, one-half of which is Crimson and the other half Mammoth Red clover.

By this method, any soil, however poor, may be in time greatly improved and its productive power largely increased. To be successful in obtaining the regular growth of clover, there must be present in the soil the bacterial life that is essential to the nourishment of the clover plant, and if this is deficient, as is the fact in much of the older soil of the East, it must be supplied by artificial inoculation. The growth of clover may often be much improved and aided by a liberal application of lime, and by a few hundred pounds of potash and phosphoric acid per acre.

Where the soil is not in the best condition at the time of planting an orchard, this method of soil improvement may be adopted and the soil and trees both benefited at the same time, and while they are growing.

THE PROPAGATION OF THE TREES.

Next in importance in the establishment of a productive orchard is the right propagation of the trees. A mushroom may complete its growth in twenty-four hours, but an apple tree not in a century, hence in planting this most desirable of all fruit trees, it is of vital importance that the best condition be obtained in the tree. From the long life and value of an apple tree, its propagation becomes of the first importance.

In nursery practice, the seeds of the apples are sown in rows and the seedling trees either budded or the pieces of the roots grafted with the desired varieties taken from the nursery rows. I always prefer to plant trees that have been grown from whole roots rather than piece roots.

Trees propagated in the former manner have no particular character. They are uneven in quality, and have little uniformity of bearing or general character of tree and fruit. In looking over most orchards, very few trees will be seen that are alike in form, while the fruit on the same tree will vary largely;

some apples will be round, others flat, of the same variety. This makes box packing most difficult.

Too little thought and attention have been given to the propagation of trees with reference to obtaining definite quality, as constitutional vigor, character of growth, and productiveness.

Twenty-one years ago, I was asked to address a nurserymen's convention where I advocated the value of propagating nursery trees, from the selected buds of well known bearing trees of the different varieties that had a record of years of production where their quality and habits were well known, claiming that by such means, a far more valuable and productive class of trees might be obtained.

A very large majority of the nurserymen present were opposed to the proposition and said that a bud was a bud, and a scion was a scion, and it mattered little from what source it came, it would make just as good a tree. They gave no consideration whatever to the individuality of trees, or to the differences or individuality of the buds on the different parts of a single tree.

That great variations in trees exist, is plainly to be seen in any orchard. There are no two trees that are alike. They differ in growth, in form, in productiveness, and their differences may be closely seen by observing the trees in any row of the same variety in any orchard and under the same general care and management.

For many years one of the largest apple orchards in the United States, planted and growing in the rich soil of Kansas, did not yield above an average of 22 barrels of apples per acre, and after more than a quarter of a century of such low production the orchards are cleared, and the land again devoted to wheat. On the other hand, there are orchards that are producing an average of six barrels to a tree, and 170 to 180 barrels to the acre. The present season individual trees have produced from 16 to 19 barrels of apples. It is reported that in New Hampshire, F. H. Gowen of Stratham picked 17 barrels from one tree, while George Gowen of the same place picked 19 barrels from one tree.

These illustrations show the great difference that is found in the production of fruit. The general practice among nurserymen is to take their buds or scions from the young trees grown in their nurseries to work on their seedling stocks.

Trees have two functions—one of growth, the other of production. The young nursery tree has a natural tendency toward growth, and if buds are taken from these, the vegetative tendency is transmitted to the seedling stocks in the nursery, and under the general management given to trees, orchards seldom produce much fruit before from twelve to fifteen years.

There are, however, varieties that will begin to bear sooner than others, as the Duchess, and Wealthy. Where trees are budded or grafted from the buds taken from mature bearing trees that have come into bearing early and have been persistent in bearing quality, there is a stronger tendency imparted to the young trees to begin bearing at an earlier age. We have selected buds from Rhode Island Greening trees of great bearing quality and at three years from the time of budding two-year nursery trees, have picked one-half bushel of fruit from them.

During the present season, from Wealthy trees, six years planted,two years old when planted, and budded on nursery seedling stock with buds from special selected trees of great bearing quality, we have netted $60.00 an acre for the fruit, after paying for barrels, picking, packing, freight, and commission in selling. The Newtown is a variety that is long in coming into bearing. We have an orchard budded with Newtown, on two-year-old nursery trees, from buds selected from very prolific trees, that are showing fine specimens of fruit, the third year. We judged the fruit at the American Institute from the trees from which the buds were taken, apples that took first prize for three years in succession, and the specimens thus far borne by these young trees show the same general character of good size, uniform shape and fine finish of skin.

That there is a large field for the improvement of the yield of apples from the careful selection of propagating material from strong ideal productive trees, there is no doubt.

Yields of potatoes, corn, and wheat have been largely increased through this principle of selection, and there is no reason why fruit trees may not be improved through the same method.

That certain diseases that attack some varieties of trees may be overcome by selection of both stock and scion, is quite conclusively demonstrated through more than twenty years of work along this line.

It is well known that the King tree as usually grown is subject to canker and is short-lived. Very few King orchards are planted for the reason that the tree fails early, and the blocks of this variety are badly broken, before they reach a profitable bearing age.

Twenty-one years ago, we planted a block of Northern Spy trees, for the foundation of a King orchard. We chose the Spy tree, because of its great vigor and hardiness. We then looked for the best specimens of the King trees that could be found, that had, at thirty years of age, vigor and freedom from disease, with large production of fruit of uniform good quality. The two-year-old Spy trees were grafted with the scions of these superior King trees, and up to the present time, there has been no appearance of canker, while the trees have borne regular crops of the finest fruit.

In top-working there is one important point to be considered, that of the right union between the stocks.

There is a difference in different varieties in regard to a congenial uniting of the stocks, and this is important to ascertain and to be understood. If there is not a strong and perfect union between the bud or scion and the stock, bacteria will get in their work and there will be a diseased tree in a few years.

The Tolman Sweet is also a stock upon which other varieties will unite well. More work and study are needed along this line to ascertain the kinds of stocks and varieties that will assimilate and make the best union in top-working, and in propagation in the nursery.

TILLAGE OF ORCHARDS.

In the East, the value of tillage to produce more and better apples is not fully understood. A great majority of orchards are in sod and the crop of apples is an irregular product. The growers of the Northwest are intensive cultivators and as the result of their better work and more attractive fruit they are steadily commanding the best trade of the world.

The secret of their success is small orchards. Many do not exceed five and ten acres, and to these frequent tillage is given, when large yields of high quality fruit are obtained.

There are many New England hillside orchards, too steep and rocky to admit of cultivation, or even spraying with machinery, and while they are more or less productive, and the flavor of the apple is better than the western grown apple, yet the best trade will not take them. To obtain the best fruit that will command the highest value, it will be wiser to take a few acres of the best land on the farm for future planting and give to them higher culture and more spraying.

In the soil survey and investigations that have been made in New York State, it has been found that the cultivated orchards yield 80% more fruit than an equal area in sod, and that the quality of the apple is better.

Tillage not only improves the soil, but conserves the moisture, which gives larger yields and better fruit.

INSECT CONTROL.

When we realize that there are over 300 different species of insects that attack the apple tree, the wonder is that there should be anything left for human use. Fortunately they are not all seriously injurious.

In attempting the control of insects, it is important to understand those which it is necessary to control.

There is much spraying done that is ineffective because the right materials and methods are not used.

There are two types of insects to keep in mind, which need entirely different treatment. One is the sucking class, which suck the sustenance from the wood, foliage and fruit. This is known as the plant lice type, the aphis, that curls up the leaves of the new growth. The San Jose scale belongs to this class, and is one of the most destructive in its work, now very generally spread over most of our country. For these insects, oily sprays need to be used. They are killed by contact of the material with their bodies. We have used kerosene emulsion extensively, but find Scalecide more convenient and for the San Jose scale, more effective. Lime and sulphur mixture is also effective if it is properly made and applied.

There are now many commercial brands put out, and while we have used them, they have not proved as effective as Scalecide. In a comparative test made a year ago, few scales were killed by lime and sulphur and the spread the past season was very great, while Scalecide used on the same day, in the same orchard, gave far better results.

For the apple aphis, one gallon of Scalecide to thirty-five of water will be effectual sprayed on as soon as the insect is discovered. For the scale, one gallon to fourteen of water, sprayed on the trees as soon as the foliage is off in the autumn, will kill it. Very thorough work must be done. Too much spraying is only half-way done.

The other class of insects to be understood, is the chewing and biting type. These are the apple-tree tent caterpillar, the canker worm, the gypsy and brown-tail moths, and others that eat foliage and fruit. For these a poison must be used. Arsenate of lead is one of the best materials to use, provided it is pure. It adheres better to the foliage than Paris green, and should be used at the rate of 2¼ pounds in 50 gallons of water, or in lime and sulphur in a summer spray. This should be used as soon as the blossoms fall and again in ten or twelve days. If the spraying is very thoroughly done, these two sprayings should destroy the codling moth and give 95 to 98% of perfect apples, free from worms or blemish. A third spraying about the middle of July should give protection wherever a second brood of this moth appears.

The brown-tail moth is a serious menace to New England orchards but it may be controlled. For several years I have had the directing of the development of one of the largest orchards in New Hampshire, planted by the late Wm. H. White, at Pittsfield.

In August several thousand apple trees are regularly sprayed with arsenate of lead, 2 pounds in 50 gallons of water, just as the young caterpillars begin to eat the foliage before hibernating for the winter.

One thorough application will clean them out effectually and before any damage is done by them. In a recent examination of this large and very promising young orchard, I found but two nests that had in them live caterpillars, so thoroughly had the spraying been done.

In the future planting of orchards, low headed trees should be adopted. For this policy there are several good reasons. Spraying can be done much better on low trees, the fruit can be picked much more rapidly and at less cost, and there will be far less loss of fruit from wind storms.

From old trees, thirty-five feet high, it costs 25 cents a barrel to pick the fruit that is left after storms, while the cost is but 6 cents a barrel on trees eighteen feet high.

THE ORCHARD PLAN.

There are many ways in which to plant trees. The general plan is to plant in squares 30x30 feet. Some are planted 25x25 and both of these distances are too close for most varieties. At Orchard Farm we plant standard permanent trees 40x40 feet, such as the Baldwin, Rhode Island Greening, Northern Spy, and McIntosh, and interplant with early-bearing kinds as Yellow Transparent, Duchess, Wealthy, and Wagener at 20 feet each way. This gives 110 trees to the acre.

It is expected to take out the interplanted or filler trees in about twelve years, as the conditions may demand and the permanent trees may require the entire space.

In planting, two-year-old trees are used, and they are headed down to within twenty-six to thirty inches of the ground, and the tops of the trees are well cut out in pruning. By pruning on the under side of the lower branches an upward tendency will be given to the growth. The base of these branches will be strong and for years cultivation can as readily be done as with trees headed up five or six feet. For this class of trees we need different tillage implements. These may run under low trees on extension beams, while the team may keep away from the trees.

We do not need to cultivate the soil deep about trees; light surface tillage is better.

PLANTING PLAN.

o	x	o	x	o	x	o	x	o	x	o
x	x	x	x	x	x	x	x	x	x	x
o	x	o	x	o	x	o	x	o	x	o
x	x	x	x	x	x	x	x	x	x	x
o	x	o	x	o	x	o	x	o	x	o

In this plan the *o* represents the permanent tree 40x40 feet, and the *x* the interplanted or filler trees. This will give 110 trees to the acre.

While this plan of planting orchards is yet largely experimental, we are getting some satisfactory results with trees planted six years on this plan. During the present season we have harvested Wealthy apples and other varieties that after paying for picking, packing, barrels, freight and commission have given a fair net profit per acre. This for six-year-old trees from planting, and two years old when planted, we consider pretty good results, and there are certainly six years more of crops to be had from these trees before the Northern Spies will need the space, and each year will give largely increased yields. At least one-half of the apples were thinned from the trees, and not enough fruit was then taken off.

In planting again I would change the distance and plant the permanent trees 45 feet apart. We have Duchess trees of the same age that did nearly as well as the Wealthy. This plan is to be cautiously advocated. I am advising and directing other large orchard plantings on this plan, but when the time comes that the filler trees should be taken out, they must go even though they are paying well.

The danger with this plan, is that many who would adopt it, would fail to take out the trees when necessary to do so, and thus ruin their entire enterprise. No man with a weak backbone should plant trees on this system.

DISEASES OF TREES.

As with insects, trees have to contend against diseases. These are mainly canker, collar rot, and twig blight. Also the fruit is more or less subject to the apple scab fungus, which disfigures it for the market.

Bordeaux mixture has been the main and most valuable material to use for these conditions, but for the last few years it has produced injurious effects upon apples by russeting the skin of the fruit to such an extent that by many it has been abandoned. Effort has been made to obtain substitutes for it and these have been found in lime and sulphur, and in a new material known as Sulfocide, made by B. G. Pratt Co., of New York; and other preparations are being put out. Arsenate of lead may be used with lime and sulphur, but only Paris green with Sulfocide. Along this line of work we need more knowledge.

From some unknown cause, all spray materials have done more or less damage to foliage and fruit the past season. The spring was unusually wet and cold, and the fruit and foliage were more tender and susceptible to injury from chemicals.

For summer spraying, 1 gallon of lime and sulphur to 35 gallons of water should give good results, and 1 gallon of Sulfocide to 200 of water, for apples and pears, and 1 to 300 for fruit rots, later in the season. For the apple scab, these sprays should be applied after the blossoms have fallen, and again in ten days.

New England has excellent soil and climatic conditions for the production of high grade apples. It is only necessary to use the better methods required to meet the greater exactions of the markets of present times, when every acre of land devoted to orchards will bring satisfactory returns to those who possess them.

With the educational work that is being done by this State Association, together with that of the other organizations of the State, Maine may in the future more than double her orchards, and the income that may be derived from them.

PRESIDENT TWITCHELL: Maine is fortunate, ladies and gentlemen, in the man who has been selected by the Commissioner of Agriculture to stand at the head of the department of entomology at Augusta; a man who has been trained from his boyhood through innate love for the work; a man who has been ready at all times to answer any call and to assist anywhere and everywhere. This meeting could not have been the success it is but for the services and the co-operation of this official, and it gives me great pleasure, as one of his associates, to present him as the speaker of the evening—Prof. Hitchings, a good worker for the promotion of pomology and protection from our insect pests.

A HALF HOUR AMONG MAINE ORCHARDS IN 1910.

Illustrated by Stereopticon.

By PROF. E. F. HITCHINGS.

(Extracts from stenographic report.)

In regard to this movement for better fruit—as many of you know it started with the New England Fruit Show last year and that movement has spread in one short year so that its influence extends, I think, from Maine to Oregon. It surely covers New England and our sister states New York and New Jersey.

We have among our fruit pests here in Maine one of the most common, and one that does perhaps the most serious damage to our fruit directly, the codling moth. In the picture before you, a female is seen in the act of laying her eggs on the apple, and an enlarged one by the side showing somewhat the colors of this moth, the adult insect. I will not take time to give the life history of this insect because it is familiar to you all. We must spray our orchards at the time when the fruit is erect as you see it, and the calyx cup open, to destroy this pest that does so much injury to our fruit.

The apple is here divided showing the work of the larva, the young of this moth, as it has done the work and emerged from the apple.

Here is a highly magnified illustration of the complete, fully developed larva before it goes into its cocoon to change to the adult insect.

Another pest that has done so much damage here. This is the curculio, the apple showing the crescent-shaped impression made by this beetle in the act of laying her eggs.

The next slide represents the adult insect highly magnified, showing quite a formidable insect.

Next we have the so-called railroad worm or trypeta, the adult being a two-winged fly about half the size of the ordinary house fly; the young of the same is shown at the bottom of the slide. The only way to control this pest is to keep sheep or hogs in the orchard, or to pick up the fallen fruit and feed it to the stock.

This is an insect that is familiar in the larval stage, perhaps not so much so in the adult stage, the borer. This beetle lays her eggs near the ground, the young of which remains two years in the tree. A very serious pest in some sections of the State.

We now come to the pest which has been so abundant this year, the so-called fall web worm. It has never caused so much destruction in any season before, as far as we know. This is the web made by the caterpillars.

The next slide will show you the adult caterpillars as they appear on the twigs; they are quick, active fellows.

The slide following shows the adult moth in the act of laying her eggs on the under side of a leaf. The moth is very similar to the so-called brown-tail moth, appearing about the same time, of similar habits, flying at night as most of our moths do, and depositing her eggs on the under side of the leaf, these appearing in a flat greenish cluster, covered with a white bloom.

This picture represents the pear covered with the so-called San Jose scale—a pest that has not reached Maine to any extent although this summer we have discovered it in three new sections. Before we have only known it to be in one orchard in the town of Limerick where it has existed for eight years, and there by proper spraying and treatment this year we think we have controlled it. While inspecting a Gregory orchard the other day my assistant found a tree infested with the living scale. A report has come to me of a tree infested at Northeast Harbor, and I found one in Gardiner this summer. These last were both dead. Although we have not formerly had this pest, while our neighboring states have been badly infested, we must be on the watch to destroy it, for it is the worst pest that can come to our orchards.

We now come to the brown-tail that has been mentioned tonight, a caterpillar that infests Maine more than any other New England state. Coming first to Massachusetts, it spread to Maine and today we have over 8000 square miles infested with this insect pest. It is, as you learned, easily controlled in the orchard. You never need have a single fall or winter nest of brown-tails if you treat your orchards properly by spraying with lead arsenate toward the end of July or the first of August, directing the spray on the under side of the leaves. You will then destroy the little fellows before they make their winter nests.

The next slide will show a cluster of the adult moths, the male and two females. The next shows the female in the act of finishing the cluster of eggs, a brownish deposit about the width of an ordinary lead pencil and from an inch to an inch and a quarter in length. This egg cluster may be found if you examine your orchards in the latter part of July.

Now pass from these pests to another condition in Maine. The winter of 1906-1907 has been referred to as being the climax of injury to Maine orchards. The condition shown here is of an orchard of perhaps four hundred trees, the picture being taken, as you see, in the summer time, and yet there are no leaves on the trees; an orchard completely destroyed in that one winter of 1906-1907. We had about a thousand orchards inspected and from examinations made under all conditions of slope, drainage, and soil conditions, we found that the Northern Spy and the Tolman Sweeting were the two varieties that stood up the best under all conditions. Since then we have been working along those lines and preaching the use of either the Spy or the Tolman for a stock for Maine. This orchard has been removed. There were just one or two trees that lived out that season—an orchard of good bearing age and productive.

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This slide shows a tree affected by canker, the picture taken a short time ago. It would have been in full foliage if it had been in a healthy condition. I took the picture in the month of September and you can see very scanty foliage. It is a type of one of those neglected trees which since that winter has been gradually dying, but if it had been treated properly it would be in a flourishing condition at the present time.

This represents one of the Gregory orchards, one out of about two hundred registered orchards under what we call the Gregory offer. This represents a portion of a lot of twenty-seven acres set by one man this year; he is standing by the side of the tree you see in the foreground. On each side is a cultivated section where he is raising on one side potatoes, on the other, beans; the section following is corn, next buckwheat. When I was there to inspect, this was the condition—two teams ploughing in the buckwheat that stood up to your knees, a dense growth. This view shows some of the nursery stock purchased for Maine. We have been trying to cut out such poor nursery stock and we have succeeded this year in eliminating one nursery that sold at least 10,000 trees last spring here in Maine. This nursery cannot secure another agent in Maine because our agents have to be licensed. We received word the other day from this agent who sold these trees, asking for a renewal, and we wrote him that under the circumstances we could not grant him a license. This same company has been doing business in New York State for thirty-five years.

This represents a nursery of one year whips as we call them. Much of the nursery stock comes from France, and is budded the first season. This shows the result of the one year's growth, the next slide shows two years' growth in the same nursery, and the one following three years' growth.

In our experimental work we have been attempting to establish, just as our speaker has demonstrated to us today, the value of special stock, and we have at home what we term selected stock. We have scions growing from the noted $50 Spy tree, from Uncle Solon Chase's orchard. We have the so-called Lowell Baldwin, a strain of Baldwins, the finest in the State. We have Wealthy stock selected from right up in God's sunlight in the top of a tree that has borne the best crops of Wealthy apples for the last ten years. And I believe that is the way for us to work. I hope you will all take the lesson that was given you this evening, and when you are top-working your orchards select your scions up in the top of the tree, don't reach for them on the ground; get the best that there are and set them as selected stock.

We now have a Lowell Baldwin scion, set this year. The scion has made a growth of three feet this season, and fully ripened, to the tip. This is one of many trees in an experimental plot that we are trying and every Lowell scion set this year has made that stocky growth. And that is what a selected stock will do. You dairymen don't go out and buy scrub stock. Why do you set any old thing for a scion in your orchard?

Here is an ordinary cold storage building that any farmer can construct, showing apples that are hauled in and kept in storage waiting for a better market.

This represents a cold storage plant, probably the most noted in the world, at Hilton, N. Y., fifteen miles north of Rochester. About thirty farmers united to build this cold storage plant. It was completed last year at a cost of $120,000, and has a capacity of 65,000 barrels. They can keep the temperature in the upper story as cool as in the lower, and that will average anywhere from 30 to 32 degrees the year round, if they want to keep it there. They charge 40 cents a barrel for storage for apples. That is what they are doing in this little section.

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The last view shows you something of Nature's painting. The blossoms and fruit here shown can only be fully appreciated and enjoyed by those who are near to Nature's heart.

THURSDAY—9.00 A. M.

The annual business meeting was called to order by President Twitchell. The secretary made his report as follows:

Mr. President, Ladies and Gentlemen:

On January 13th there was an executive committee meeting at the Elm House, Auburn; Mr. Leland, Mr. Hitchings, the president and secretary being present. The premium list was revised and other business done relating to the coming year's work.

A committee from the executive committee was chosen to select a place for the annual meeting and to secure special premiums.

Through the efforts of the president and a committee from the Auburn Board of Trade a long list of fine prizes was secured for the present Exhibition.

At the present time the Society has a membership of 124 life members and 60 annual members.

It seems hardly possible that a larger number of fruit growers cannot understand the necessity of joining an organization representing such a large and important industry as does the Maine State Pomological Society, not only for the influence it would give the Society in many directions of work, but for the education the Society can give the fruit growers. The larger the membership the larger the educational benefits will be.

There has been no field meeting held during the year, as the officers of our Society thought the State was so well covered with fruit meetings and other gatherings that a field meeting would hardly be necessary. From the inquiries coming from many places I think some means ought to be devised by which we can hold a field meeting at the Experiment Farm or some other place where the fruit growers can see and talk over practical things relative to the industry. If we could meet where the different methods of cultivation and spraying were used the lessons would be more lasting.

In conclusion let me suggest that as we are about to enter upon the opening of a Legislative session all the members not only use their influence for the enacting of such laws as will be a benefit to the agricultural interests of our State but see that no laws are enacted that will be an injury to our cause.

Respectfully submitted,

E. L. WHITE.

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

The president appointed E. L. White, T. M. Lombard and Will E. Leland a committee to receive, sort and count votes.

The following officers were elected for 1911:

President—G. M. Twitchell, Auburn.

First Vice President—H. L. Keyser, Greene.

Second Vice President—G. L. Palmer, South Livermore.

Secretary—E. L. White, Bowdoinham.

Treasurer—E. L. Lincoln, Wayne.

Member of Executive Committee for three years—Will E. Leland, Sangerville.

Member of Experiment Station Council—R. L. Cummings, West Paris.

Representative from Maine to the New England Fruit Exposition—E. F. Hitchings, Waterville.

Voted, that a committee of three be appointed to attend to the matter of the selection of a Board of Trustees and that this Society endorse their action.

The following committee was appointed:

George A. Yeaton of Augusta,
E. E. Hardy of Farmington,
F. H. Morse of Waterford.

H. L. Keyser, chairman of the Committee on President's Address, made the report for that committee and it was accepted.

Voted, that the executive committee with the president and secretary be a committee on legislation to secure such amendments to the present law as may be deemed advisable and such further enactments as may seem necessary.

Committee on Resolutions made the following report:

Resolved, by the Maine State Pomological Society, assembled in the city of Auburn, that we appreciate the cordial reception that we have received and wish to acknowledge the courtesy extended by Maine Central Railroad and Grand Trunk Railroad in granting excursion rates to all wishing to attend this meeting.

Be it further resolved, that we extend our thanks to the business men and citizens of Auburn and Lewiston and to the Maine Central Railroad for the excellent special prizes offered.

Be it further resolved, that we extend our thanks to the said railroad for establishing a flag station at Highmoor Farm, as the Society requested them to do one year ago.

JOHN W. TRUE,
V. R. GARDNER,
Committee.

Voted, that the report be accepted.

Welton Marks Munson came to this State in 1891. He died in Howell, Michigan, in September, 1910.

He was a life member of this Society and for fifteen years actively connected with its work. During these years he was not only one of its faithful and energetic workers, but as Professor of Horticulture at the State University and Horticulturist of the Experiment Station spent a large part of his entire time in serving the fruit-growing interests of the State.

While we bow to the Divine Will that has called him to a rest from his labors, we deplore his loss and seek in this way to pay some tribute to his memory.

V. R. GARDNER,
JOHN W. TRUE,
Committee.

The Board of Trade of Augusta extended an invitation to the Society to hold their annual exhibition in that city in 1911.

SMALL FRUITS AND HOW TO GROW THEM.

By WILFRID WHEELER, Concord, Mass.

Mr. President and Friends of the Maine Pomological Society:

I have enjoyed coming here very much, and seeing the great improvement in the fruit that is exhibited over that which I saw four years ago when I was here at a meeting in Gardiner. The improvement is so marked and so fine that I cannot refrain from speaking of it, especially the improvement in the packing of apples. We have a great deal to learn along that line, and it is these meetings, the meetings of the New England Fruit Show and these local meetings, that are going to do much for the fruit business in New England. I want to digress just a little from my subject and say that I think we ought to feel that all the New England fruit that is grown—the good fruit, I mean—ought to be grown and packed as New England fruit, not as Maine, or New Hampshire, or Massachusetts, or Rhode Island or Connecticut fruit. I think we have got to make this a point in this section of the country, and have the fruit go out as New England fruit and not as State fruit, because by the latter method we are going to divide the market up so that a person will be calling for Massachusetts fruit, or such and such a fruit, in the foreign markets, thus making a complex situation and not giving the right idea of the matter at all. But when we can get down to a good standard of fruit and a good packing standard, then I think we ought to grow New England fruit. Just before I left home the other day, to show the reputation Maine fruit has in Massachusetts at least, my little boy came to me and said "Dad, I want you to bring me some of those nice Maine apples." Evidently he appreciates good Maine apples, and I know we all do. At the same time, there are good apples grown all over the New England States. I have found them in my work this summer in Massachusetts; I have found apples growing at the extremity of Cape Cod where the sand is so deep I don't believe anybody could get to the bottom of it. I found them growing up in the Berkshire hills in the highest altitude we have in Massachusetts. I found them growing right in the city of Boston, and all over the State. And where the trees are being cared for in our State we are getting splendid fruit. So I don't think the question of locality counts nearly as much as the question of the men. I think that idea ought to be extended more, that it is the men who grow the fruit who really make it. The locality counts for something, to be sure, but I think that is of minor importance, if a man has his heart in the business and is doing it in a proper manner.

Now this subject I want to take up this morning, the subject of small fruits, is just as important as the subject of the apple and pear and the large orchard fruits is, to a good many. One of the particular things that I want to emphasize is the adaptability of the group of small fruits, composed of the strawberry, raspberry, blackberry, currant, gooseberry and a few others which are of minor importance, to growing in young orchards. We have always a problem in starting a young orchard to know just what to grow in it. Most of us agree that the young orchard should be cultivated thoroughly for at least four or five years so that the young trees will get a good start, and it is often a question of getting some crop that will pay while the young trees are coming into bearing. I think there is no crop that will pay better, especially if you are near a market where perishable fruits can be handled, than small fruits. And if you are not near a market, I think it would pay in districts like those we have in Maine and the northern parts of New Hampshire, where there is a special section adapted to the growing of these small fruits, to start canneries, so we can put them up and send them off in preserved form and realize nearly as much money out of it as we would by selling them in a fresh state. The small fruits all adapt themselves nicely to growing among young orchard trees, especially those fruits which require the same kind of cultivation and to which general orchard operations can be applied. The strawberry should be grown perhaps only for a year, or for a second year at the most, because it requires longer cultivation during the growing season. The season over which cultivation extends with the strawberry is too long for general orchard cultivation, so that I would advise planting strawberries only for the first two years, and then keeping them well away from the young trees. A couple, or perhaps three rows or four rows, through the orchard would be plenty, whereas you could plant bush fruits between the trees and use the land up very well with them. That is a very important thing to consider in our young orchard planting.

Then another thing, the general adaptability of small fruits to cultivation is a further recommendation for them. Not only for commercial planting but for the home garden they are very essential. Everybody who has a small garden, I don't care how small it is, can grow some of these fruits. I have a friend in Dorchester, Massachusetts, who has a garden of a very small area, yet he grows practically all the small fruits. He has gone to the extent of planting his strawberries in a barrel, by boring holes in it and filling it with soil, and he has had very good crops from that barrel, enough for his small family during the season. This shows what one can do if he has only a small city back yard. Currants, gooseberries, raspberries and blackberries will stand a good deal of shade and that is a great recommendation for them. It seems to me no one should be without fresh fruit on his table when these fruits can be so easily grown. I feel particularly sure that every one ought to grow the strawberry, it being a fruit that we can have over such a long season now, beginning with the middle of June in most sections. By using a variety which is an ever-bearing variety, Pan America, we began picking the middle of July and the last berries we had just before the heavy frost about a week ago. This shows that you can extend the season of these small fruits almost as long as any of the small crops can be grown.

The strawberry, the most important of the group probably, is adapted to more kinds of planting and to greater latitude and longitude, than any fruit that is known today. It grows in the highest altitudes and in the lowest valleys, and across the continent from east to west, and in South America, Europe, Asia,—it has been found in practically all parts of the world. And so it can be generally cultivated, probably more than any fruit that we know of, and should be grown more universally than it is at present. I believe a question of markets generally determines the growing of the strawberry, but so many of us have neglected to develop our own local markets that that is one of the reasons why we fail to grow them. We feel we cannot ship them long distances and perhaps we ought not to do so. Take a market like Boston, for instance. It is apt to be filled with strawberries from all over the country, and nine times out of ten the sections that are shipping to Boston are not supplying their own markets. Grocers and provision men are going to Boston and buying strawberries and shipping them back. No wonder they are not fit to eat. That is one of the important things that we have got to look up, the market in our locality, before we go into the raising of any of these perishable fruits. If the market can be developed, do it, and get a reputation in your own locality for growing good fruit, and I think the development of it is just simply a question of whether you keep up to the locality or not, because every locality wants these fruits. It is a matter of whether they can get them good or not. I find if we can send a limited number of very fine berries, particularly strawberries, into Boston, there is no question about disposing of them. It is the large quantity of poor stuff that comes into the market that overstocks it.

Now I said the strawberry would adapt itself to almost any location, but, at the same time, in choosing a situation for the strawberry I would get one where the land has a slight slope to it. It does not make so much difference which way the slope is—I would prefer not to have it directly north, and south would be a little too hot. Southeast, southwest, directly east or west is all right. But the great trouble with perfectly flat land that has no natural drainage is that the water will stand over the plants in the winter and you will get a great deal of winter-killing unless you devise some means of getting rid of that surface water. So in choosing a location, get, if you can, natural drainage of the surface, and if you cannot, improve it by artificial drainage. The strawberry responds to artificial drainage very nicely. As for the character of the soil I don't think it matters a great deal. I have seen the strawberry growing on Cape Cod, just as clear beach sand as you can get anywhere; I have seen it growing in other sections in New England, particularly in the southeast in clay, and in the heaviest black loam in the west. It does not seem to make much difference provided you can give it a certain amount of cultivation and the general care that the plants require. So I would not say a great deal about soils, providing they have got at the fruiting season the necessary amount of moisture in them. That is the test of the whole thing finally, because you can grow plants in any kind of soil, whether it is dry or wet, or gravel or loam, but you must have a place where there is plenty of moisture at the time the plants are fruiting, to ripen the crop. So in choosing a location, consider that if you cannot water the plants.

But the preparation of that soil is a very important point. I noticed Mr. Powell said yesterday that the preparation of orchard soil should be thorough. Well, if that should be thorough, I think the preparation of the soil for any of the small fruits should be more than thorough, because that counts practically all in the future cultivation. You can prepare the soil partly, plant strawberries in witchgrass and different kinds of biennial grass-roots, and the amount of labor you put on to that land in getting rid of those weeds after the plants are set will more than offset any gain that you can get. Whereas if the soil is perfectly prepared, no biennial weeds in it, no great amount of weed seed left, then you can take care of the soil with one-half the trouble and with a great deal less trying circumstances than you will where the soil is not well prepared. I like to plant strawberries as often as I can in land that has never had strawberries before, pasture soil or land that has been in grass for a number of years, broken up at least a year before I am ready to set plants. This is a very good plan for all the varieties of strawberries,—breaking up land in the spring, or two falls previous to the setting. The sod should be ploughed deeply and the land thoroughly harrowed the first year, and the first year's crop should be some crop that will stand a great deal of heavy cultivation, like corn, or potatoes, or beans. If the land is not in shape to plant any crops, use some such crop as buckwheat or clover or some of those crops that can be ploughed into the land and give it humus and put it into fine mechanical condition. This preparation applies not only to the strawberry but to all the small fruits. I know of no worse kind of soil preparation than to leave piper grass roots to plant currants and gooseberries in. I came across a place last summer where a man had set quite a large orchard and the land had not been thoroughly prepared. It was full of piper grass roots, and in among the orchard trees he had set gooseberries and currants, and the piper grass as we call it—it is witch grass in other places—was coming up so thick among the roots that it would be almost impossible at the end of the season to take care of those bushes. If any one has had any experience in killing that grass he knows how almost impossible it is to get rid of it even with clean cultivation. So the preparation for any of the small fruits should be as thorough as possible.

I always believe in setting strawberry plants in the spring for commercial purposes. In the garden I think the setting in the fall is very good, because oftentimes when your vegetable garden begins to go by about the first of September you can set strawberry plants and get some return from them the next season. A friend of mine who lived in Porto Rico told me that he could set strawberry plants in Porto Rico and have fruit in three months. I told him I could do it here in six weeks. He looked at me in astonishment and surprise. I said, "That is very simple; we set our strawberry plants from the first to the middle of May and get ripe strawberries on them any time during the fruiting season in June, provided we want to do that." But it is a tax on the plant. And whether you set in rows, matted rows or hills, is a question of how your land is, or a question as to whether you want to raise a large quantity of nice berries or a large quantity of poor ones. I believe absolutely in setting strawberries for fruit in hills, that is, not exactly the way we used to set them, two or three feet apart and then a row for the horse to cultivate through, but beds where the plants are set from fourteen to eighteen inches apart in the bed, three or four rows according to the width you set the plants in the rows. In that way you give the plants a good chance to develop evenly all around, you get a bed that you can cultivate with practically very little expense, and a bed that in the long run will produce almost twice the amount that matted rows will. Then of course there is the narrow matted row or the hedge row, which again is far preferable to the wide matted row you so often see in strawberries. The advantage of the hills, in the matter of cultivation, over anything else is that you do not have to do much of any work about weeding or caring for the plants or taking runners off. In this way I have cultivated practically half an acre each year in hills and have not had to do any hand pulling of weeds whatever. The beds are cultivated the long way with the wheel hoe and across with the hand wheel hoe. The plants are set regularly in square blocks so we can go across the whole bed one way and then the other way with the wheel hoe, alternating the kind of wheel. We can keep that land practically clean and a dust mulch on it which will conserve the moisture and in dry weather we have no difficulty. I use for the hand hoe a Planet Jr. and a Daisy hoe; one has a flat plate like a hoe, the other very fine teeth. We run the teeth one way one week, and the other way the next week, alternating with the scuffle hoe, as it is commonly called, and in that way we keep the ground in the most perfect condition mechanically. I have seen the time this summer when we have had periods of two months with no rain whatever, and our land is apt to dry out, and the strawberry plants did not suffer the least bit. I almost gave up the strawberry business because of the hard work there was in caring for the plants, weeding, cultivating, etc., after they began to make a mat of plants in the row. It was almost impossible to get men to do this work properly, particularly the setting of the runners or the pulling of the runners. Now the question comes down to simply pulling the runners off, and the ordinary Italians we can hire for $1.50 a day do that work just as well as a man who has been trained in the business can in setting the runners or pulling part of them off in the matted row. In the hedge system where you set only a few runners, that is easier than in the wide matted row. But if you are going to grow for good fruit keep the plants in hills, or keep some of the runners pulled off in the hedge row, so you will have more sunlight around the plants and consequently larger fruitage. From plants in bearing the first year in hills, we picked in some cases a quart and a half and the strawberries would average over a quart on such varieties as Glen Mary, Sample, Minute Man, Meade and Abington. From plants set in this way in hills, from 26,000 to 28,000 to the acre, according to the distance you put them, I do not think it would be out of the way to say that 20,000 quarts can be grown to the acre. Some claim as high as 30,000 to 35,000. You can not get every plant to yield exactly the same amount, any more than you can get every tree to yield the same. I believe that any one who is going into the business should plant strawberries in this way on a small scale. One-third of an acre or a quarter of an acre planted in this way will produce more fruit and require less attention than an acre of matted rows of any other system that I know of.

Now the variety of the strawberry you will grow depends entirely on the market to which you are going to cater. I have stated at different times that so far as the quality of the strawberry is concerned I don't think the difference amounts to anything. I think it is simply a matter of letting the fruit ripen. If you want to get strawberries for your home table, grow any of the varieties—I wouldn't pick out any names and say one was better than another—it is simply a matter of letting them get ripe. We are so apt to go out and pick the strawberry just as soon as it begins to grow red; the first of the season we never get a high quality of fruit. But if you go out at the end of the season every strawberry you pick tastes good. I fail to find any variety that will not be very good if it is thoroughly ripened on the plants. A friend came to me this summer from Amherst, and in tasting the different strawberries as he went across the bed, he asked me the different varieties as he came to them. He came to a kind which has always been considered one of the poorest quality berries we have, but it happened that at this time there were a good many very ripe berries on it and he pronounced it the best of the whole lot, and when I told him it was Glen Mary he seemed very much surprised because he said it had always been a very poor quality berry with him. I said, "Let it ripen thoroughly, the green tip becoming a good dark red, and there is just as good quality in that as in Marshall or Senator Dunlap or any of those varieties which we all consider very high quality." So for the home market grow a berry that is bright, that will not turn black, and a berry that has not a white tip. For a market a long distance off you have got to take into consideration that you must have a berry that will stand up. I think that no kinds have proved better for that purpose than the Glen Mary and Sample, for New England. I know in Maine and parts of New Hampshire the Warfield is a very good berry for ordinary purposes. With us it is apt to run small after the first picking, and I would not recommend it as a general thing. Of course you oftentimes find localities where one variety will do well and another will not, but I think Glen Mary has done very well all over the country, and should be planted very extensively, particularly for a berry to ship. For the home garden I would recommend Abington, Meade, Bubach, Parson's Beauty, Senator Dunlap, Barrymore and Minute Man. The Parson's Beauty is a very good quality berry with us, though it is apt to be rather light colored. Down on Cape Cod they grow the Marshall. They grow it very well in that sandy soil and often get it into the market before the other varieties come around us, and then it sells for as high as fifty cents a quart. So that is their one berry that they make money out of. While they do not grow big crops they get very good prices. I know a man in Marshfield who has a great many of them, and last season his Marshalls averaged him 22 cents a quart, where ordinary berries I think last year averaged less than eight cents. The variety is largely a matter of the market you are trying for. If you can work up a trade on a certain variety, stick to that. For shipping distances try some of the firmer berries, for the home market some of the finer quality, perhaps softer berries. The summer care of a strawberry bed after the plants are set is very simple—thorough cultivation in order to keep the soil well stirred up on top and give that dust mulch which retains the soil moisture so splendidly.

Fertilizing with us is done after the plants are set. When I plough the land the first time, if it is old land, I generally manure very heavily at the time of ploughing, and if that land has been fertilized with manure in the fall, that manure is well mixed with the soil so when it is ploughed in the spring prior to setting the plants it turns up in good shape and is where the plants can take it. I don't use any commercial fertilizer at all. I simply use chemicals, mixed or straight as the occasion may be, always applied to the plants as they are growing. We use a great deal of basic slag, dissolved bone black and sulphate of potash. Our soils do not require any of the very strong materials like nitrate of soda, but we use some tankage. Any of those chemicals applied very lightly in frequent doses will grow a better plant than to put the fertilizer on all at once. It is better to apply these fertilizers during a rain than when the plants are dry. I believe in frequent cultivation and fertilizers in small doses rather than a large dose of a chemical or mixed fertilizer at the time of setting. I have seen many beds hurt at the time of setting by putting plants in soil that has been heavily manured or fertilized. There is too much manure at that time and during a dry season the plants are apt to dry out before they get well rooted. If a great deal of fertilizer has been used, the small white roots of the plant are simply burned by it, or injured in some way.

In regard to the plant itself, you can take plants from your own grounds and set them the same day that they are dug. On plants that are shipped to you or that you buy from a distance, the roots should be cut very severely. As a rule in shipping, plants are more or less dried out, and the tips of the long roots are apt to be a little hard, so in setting they are liable to be doubled up, therefore the shortening of the root at least one-half, and the top in proportion, is very essential, particularly if the season is dry. The plant will take hold of the land a good deal quicker when the roots are shortened to that extent. As I said, frequent cultivation is absolutely necessary, and the more frequent the better. In dry weather such as we have had this season we always plan to cultivate twice a week in the beds which are in matted rows, and run the scuffle hoe and the wheel hoe through the hills at least every six days. Frequent cultivation seems to be the salvation of the plant in dry weather. Cultivation should not be carried on too late. It should cease as early as the 10th of October. In that way the plant gets a chance to harden its foliage a little better and to ripen off for the winter. We don't very often hear of winter injury to plants, because the snow and the protection we naturally give them keep them from severe injury; but at the same time if you get a big mass of foliage in the fall just at this time and then put on a cover, you are more likely to do the plants injury than if they were hardened off by stopping cultivation early in October. In our climate we cannot depend on the snow covering the plants. There must be some sort of winter protection, like the common wild grass that we get on the meadows, or leaves, or pine needles. Care should be taken in the use of these things not to cover the plants too deep. They are naturally hardy and need only enough protection to keep the ground frozen in the spring, when we have warm days (when the ground thaws out and breaks) and very severe nights. Freezing in March is what injures the strawberry plants more than any other cause I know of in climatic conditions. I have seen sticky ground that would crack open an inch during that month, and of course the roots of the plants have got to break, as the power of the frost is very great at that time of the year. So keep in mind that the idea of the mulch is not to keep the plants warm, but rather to keep them cold during that early spring season. In our section we generally uncover the plants about the first of April and then we are very safe because the weather after that time can be pretty well depended on. Our early fruiting varieties like the Marshall I would recommend keeping covered a good deal later than that to prevent early blossoming, because the Marshall is a variety that is very easily frozen, and the blossom starts earlier than any of the others.

In the spring as soon as the plants are uncovered and thoroughly thawed out, they ought to be cultivated pretty well to keep the ground in good condition, and at this season a dose of wood ashes and bone is a very good thing for the plants. I would not recommend any highly nitrogenous fertilizer at that period unless the plants lack foliage. If they do, put on some stimulating fertilizer like nitrate of soda. That ought to be used at the rate of not more than 250 pounds to the acre, applied in three doses, mixed with something like loam or sand and distributed fairly evenly. If it is applied just before the plants are in blossom or at the time there is green fruit on them, you are apt to get a large berry, very insipid in character and with practically no quality to it at all. So if you can keep it away from the plant at that season, all the better. Try to grow your foliage the year before, and never use any highly nitrogenous fertilizer in the spring. But generally potash and phosphoric acid ought to be given in some mild form. Wood ashes, bone meal, or a little dissolved bone black is a very good thing to use at that time.

Now the question of picking comes up very seriously to many of us, because oftentimes we grow more berries than we can pick. Again you have got to consider your locality, how you can manage help at that season, because if you cannot get help to pick the berries it is no use to grow them. We have to employ the Italians now a great deal. They are the best pickers we can get. We are trying to eliminate the children, that we used to have, because they do a great deal more damage as a rule than good. They will pick for a little while very nicely but get tired quickly, and like all children they want to go and play for a while. But I find the Italians are the most satisfactory help we can get. They will work fourteen hours a day during the season when we are extremely busy and they pick the berries very carefully. We always pick in two qualities. And there is something I want to emphasize very strongly. All berries that are to be sorted should be sorted in the field, never handled twice. Each picker should always take two baskets and pick the poor ones into one and the good ones into the other, and in that way the berries are handled less and they are in better condition when they arrive in the market, even though the market may be very near by. Take a box that has been rehandled and look on the inside of it and it is practically red with the juice of the berries that have been bruised. So be sure to have all the sorting done in the field. In the picking of fancy berries you have to be very careful that whoever does the picking, handles the berries with the stem. That is one of the things we have to be much more careful about than we used to. The berry should be broken from the plant by the stem and laid in the box without touching it at all. In that way we can get the berries to market in splendid condition.

The matter of packages I consider is one of the most important things we have to plan for. We should have clean new boxes made of white wood—the very best quart baskets we can get are none too good, and I object very much to the use of the secondhand crate that we have to use, or do use so much in New England. In our own town I think practically one-third of the berries are put into these secondhand crates, and those are generally the poorer berries. In some cases some of the growers make three qualities. The better qualities are packed either in a ten, sixteen or twenty-one quart tray, and in those trays the berries are carried in to market so that there is no layer above them. Each box sets above the other and is cleated so that it does not set into it. In that way practically all the better quality berries in the vicinity of Boston are handled in the market and bring anywhere from three to ten cents a quart more than the berries packed in crates. You know that in taking the berries out of a crate, 32, 48 or 64, you will find a good many of those in the lower tiers are crushed by the weight of the fruit on the carrier between them. So I think in local markets where you can take from your own team into the market the use of some of those packages like the 21-quart tray particularly, that packs very nicely and takes the same space in width as the bushel box only twice as long, is to be recommended. It is being used in our section much more than the 32-quart tray. I have used a 16-quart tray which has two layers. That is a great improvement on the 32-quart for fancy fruit and looks a good deal like one of these apple boxes, not quite so high and a little longer. Then in all these packages we ought to have the same kind of a label that will show just the quality, the same as you would in your apples, and in that way we are building up a business which is going to call for more of that fruit.

I have not spoken much about the diseases or insects that bother the strawberries. There are not many and they are easily controlled. There are practically no diseases of the strawberry which cannot be controlled by spraying and it is a very easy plant to spray. Blight, leaf spot and fungous diseases respond very rapidly to bordeaux mixture. Practically the worst of the insects is the white grub. I know of no insect I am more afraid of than that, on the strawberry plants. But by the proper rotation of crops on the land you can practically get rid of it. It is not wise to plant strawberries right after grass. The land is apt to be full of the eggs of the white grub, laid by the ordinary June beetle, and you are likely to get them on your strawberry plants. So if you can get in a year between grass and strawberries with some such crop as corn, beans, or anything of the sort, you will be sure to get rid of the white grub. There is hardly any chance of its being in the same land a long time providing there are crops grown that it cannot eat, but strawberries after strawberries in a continual line is a very bad policy. Then there is the ordinary cut worm which we have to contend with, but I have found that spraying with arsenate of lead or Paris green will practically get rid of it. The cut worm comes up out of the ground as a rule and eats the tender leaves of the plant just in the early spring and spraying with some arsenical poison will dispose of this pest.

So much for the strawberry. The raspberry is probably not as important commercially as the strawberry, but still it is grown in great quantities in the West where in certain sections it is used for canning or drying. Here in New England we practically depend on the West for our fresh raspberries, and it is a fruit that ought never to be shipped any long distance. You see in the Boston market raspberries that come in there in very bad condition. The nature of the fruit is such that the least bit of weight on it settles the berries together and by the time they have traveled a couple of hundred miles, or even fifty miles, they have settled so they hardly half fill the boxes, and even by the use of pint boxes, or cups, one-fourth quarts, and all those different varieties of packages, we don't overcome this difficulty very much; so that the raspberry ought to be grown close to the market; more so, almost, than any other fruit. In certain sections it requires a good deal of winter protection, but aside from that it is very easy to grow. I believe in setting raspberries in young orchards a good deal more than is done at present. Set them in hills not less than six to eight feet apart so they can be cultivated both ways. By putting a stick in each hill we can easily keep the canes tied to it and the plant won't be lying on the ground at the time of fruiting. With us almost every winter we get some winter-killing, and the canes ought to be laid down. I understand that here in Maine, with plenty of snow you do not need that sort of thing. I would recommend that the red varieties be planted almost exclusively. The black and the purple kinds, or the hybrids as we call them, are not as salable as the red varieties. The preparation of the soil should be just as thorough for the raspberry as for the strawberry. The planting can be done in the spring perhaps better than in the fall. When the cane is planted it ought to be cut back to the ground so that we will not get a growth started six or eight inches or even a foot above ground. We want the new growth to come from underneath. Oftentimes in planting raspberries, particularly with a person who has never done it before, they are allowed to branch out above the ground and they make no new growth underneath. That is true of the blackberry also. Cut them back to the surface of the ground and make them come up from underneath. The propagation of that particular bush shows this, because we can get the very best plants from root cuttings as they are called. The old roots are taken up, cut up into pieces from two to three inches long and planted out in rows and the buds develop along those roots and we get better plants than those ordinarily taken up as suckers.

The raspberry I think will probably stand more manure than the strawberry. I believe that fertilizer in the form of manure in the fall or early spring is the best. The addition of potash salt or wood ashes is also a great benefit in giving color and vigor to the plant. The raspberry is a splendid plant to grow in connection with the poultry business, because if you cannot cultivate for a few years generally the bushes grow together so it is almost impossible to cultivate, and it is a very good plan to let the hens run through those bushes, scratching up the weeds and eating the green stuff that naturally grows underneath, so that we get both cultivation and a good place for the hens in hot weather. I have seen that done a good deal in the southern part of Massachusetts. A great many of the small fruit growers there have poultry in connection with their business. In that way they have made a great success with raspberries in a small way. The first year in raspberry planting, or blackberry either, if planted 6x8, 6x6, or something like that, a couple of rows of vegetables can be grown in among the bushes to give some return from the land while the plants are developing. I think that peas, carrots, turnips, cabbages or a similar crop are excellent to grow in this way, and as in all the small fruits you have to consider getting a quick return, this is one way to get it from the raspberry or blackberry, currant or gooseberry. I planted this year a good many gooseberries. I took enough early beets off the land to pay for the first cost of planting and the bushes. It didn't injure the plants the least bit. While they were catching hold the beets were growing and the land was fertilized highly enough to take care of the beets at the same time. So we can readily get some return from the land the first year, and with raspberries that bear the second year we ought to get a fair amount of return the second year, and if the pruning and cultivating are kept up they ought to grow to the seventh, eighth or even tenth year. In pruning, all the old wood that has borne should be taken out at once. It is not a good idea to leave it in, because insects and diseases harbor in that dying wood and are apt to cause trouble later on. A good many people leave the old wood in during the winter, thinking that the protection that wood gives to the plants is of some benefit, but I think the benefit is very doubful and I remove both blackberry and raspberry canes after they have fruited, cutting them out with a good heavy pair of pruning shears. You will find that in pruning blackberries a person needs to wear a heavy pair of gloves.

The same rule about packages holds good in the raspberry and blackberry as in the strawberry. We have got to pack in clean packages, and in small enough packages so that the berries won't settle together very badly.

In regard to the varieties, here in New England there are no better red varieties than the Cuthbert, and possibly the Herbert which is being tested now a good deal. I have had it fruiting on my place for two years and am very much pleased with it.

It seems to be a hardy variety, of good quality, fine looking, not too seedy, and a berry that does not break apart like some of the new varieties we have had lately. I tried the Cardinal and found that while large and productive the fruit was very seedy and when picked was apt to crumble up. That was a great trouble with the Marlborough with us. It is perfectly hardy but the berry was so unattractive when in the market that it was discarded entirely in favor of Cuthbert. The possibilities in canning the raspberry ought to be looked into a little more carefully. A friend of mine who was traveling in the north of England a few years ago said that practically the whole of the north of England, near the line between Scotland and England, was devoted to the growing of raspberries, where they are preserved and kept entirely for the use of the English army. One of the contracts every year for the English army by the Government is for so many thousand pounds of raspberry jam. That is served to the soldiers in place of any other sweet substance, and they consider that the food value of the raspberry jam is higher than almost any other form of sweet that they can give to the men, with pure sugar. The English Government is very, very careful about this particular product, that there shall be no adulteration in it, that the jam shall be made from pure sugar and pure, fresh fruit. So these canneries have been started right beside a splendid market that would take every bit of the fresh fruit. There are thousands of crates of raspberries grown up there and during the fruiting season practically the whole of the shifting element of the cities in that section goes out and picks raspberries from six to eight weeks. So I think in our remote sections that possibility ought to be looked into a good deal more. We have not half developed the question of canning these small fruits in this country. You find today those canned fruits that sell for the most money in the largest cities are put up by women in their own homes. I know of two or three firms in Boston who handle quantities of these small fruits put up in the homes by women who make their pin money in this way. It ought to be done on a larger scale. If we could guarantee pure, fresh fruit, there would be no end of the sale of it. We import a great deal of canned fruit today from the other side. This ought to be grown and put up in sections of our own country. Where there is plenty of good land it does not seem right to pay money out to other sections for fruit we can grow so easily ourselves.

The handling of the blackberry is so nearly like that of the raspberry that I will not stop very long on that, but I do want to bring up the subject of the currant and gooseberry a little more to you. I think that both the currant and the gooseberry are not developed in this country the way they should be. These last few years the markets of our large cities have been supplied with currants from New York, Nova Scotia, New Jersey,—everywhere but New England. I failed this year to find in the Boston market, enough currants to supply the market any one day, that were grown in New England. This is a fruit that ought to be grown more, particularly among the small trees, and it can be grown to good advantage here as well as in other states. I know in New York at the time the vineyards were planted there, a great many currants were put out, and at one time the market overflowed with them, but now things have evened up more, and besides more people are getting to use them. The foreign population require them, so we must grow them on a larger scale ourselves. Any good soil that is fairly cool and moist will grow currants very nicely. I would not advise planting them in light sandy soil, but a soil that has good depth and plenty of moisture and is cool during the summer will grow splendid currants. They can be planted about at the rate of 800 to 1000 bushes to the acre. And the same holds good of the gooseberry. In England where the gooseberry is at home and probably in its native element more than anywhere else, everybody has gooseberries as commonly as strawberries. The same is true in Germany and Denmark. They think the gooseberry is one of the finest fruits grown. We are apt to think of it as a little, sour, hard fruit, only fit for preserving. But I assure you we can grow just as good gooseberries of the large eating varieties as can be grown in England. I know of a young Danish fellow in Malden who has hybridized a great deal in gooseberries. He has produced a berry which runs almost an inch and a half long, has a very thin skin, and one of the highest quality berries that you ever tasted. He sent some of the bushes he has produced from this variety to his brother in Denmark where they know gooseberries from A to Z, and there he was awarded a gold medal from the Royal Horticultural Society of Copenhagen for this particular variety. Here it would be impossible for him to be recognized. People would not consider a new variety of gooseberry worth looking after. But when they give a gold medal for a gooseberry in Denmark we certainly ought to recognize that there is some value to this fruit over here. I have found that this particular variety I have spoken of has produced on the place of this young Danish man at the rate of $2000 to the acre. If he can do that, there are lots of us who have even better conditions than he has to work with and can certainly do as much. I find the common Downing which is grown so much in this country is practically the best one for marketing, because it can be marketed green and hard and shipped almost any distance. Nova Scotia supplies the Boston market almost entirely with these, and last year they sold at from $2.50 to $3.50 a bushel. At the rate of half a bushel to a bush you can see that is a pretty good crop. And it can be done here if it can in Nova Scotia. So I recommend, wherever you can create a market for them, planting some gooseberries and experimenting with them in a small way, particularly for your own use. The English varieties, like the Industry and Crown Bob are the best eating ones, while we have some splendid large American hybrids, the Columbus, Chautauqua and Pearl. And the Downing when it is thoroughly ripe is as nice today as almost any of the gooseberries. One great advantage of either gooseberries or currants is that you have not got to market them the day that they seem to be ripe. You can let them stand on the bushes almost indefinitely. I have picked gooseberries as late as the first of September that were in splendid condition on my place, and the week of September 8th I visited a friend of mine just south of Boston and he was still picking his currants. They had covered the bushes with a piece of cheesecloth to keep the hot sun off them. We do not make half enough of these small fruits. In some places there are a good many wild fruits that may take their place, but I think that in small cities and towns where we have to depend so much on the Italian fruit seller we ought to grow more of this kind of fruit for ourselves, for we can have such high quality and have it easily.

The pruning of both gooseberries and currants should be very severe, the old wood being taken out. As most of the varieties produce their very best fruit on the two-year-old wood, anything over three years old should be cut off. We are so apt to think a currant or gooseberry goes by in a very short time. That is not true if we keep out the old wood. I have bushes ten years old now and I think they are good for ten years more, by the way they look now. And we must not let grass, or sod, or heavy weeds grow up around them to take their vigor or in any way rob them. They need careful cultivation, clean cultivation, and there is no reason why they should not last a great many years. The reason so many currant and gooseberry plants run out is the fact that the grass has been allowed to grow in around them.

The same thing that was spoken of with regard to other small fruits holds true in marketing gooseberries and currants. They should be marketed in clean, attractive packages. Grow the large cherry variety of currant rather than the old fashioned Dutch varieties. The latter are so small no one cares for them for eating. Such varieties in the currant as Fay's, Cherry, Wilder and Perfection are the ones to grow. If you want splendid fruit for your garden, grow some of the white varieties. Some of them are very excellent. They are not as acid as the red ones, but very splendid eating for table use. I think there is no better summer fruit than a combination of currants and raspberries; thoroughly ripe currants and raspberries together on a hot day are the most refreshing of our summer fruits. I think we ought to go more extensively into this small fruit business, not so much perhaps as a commercial proposition at present, though working toward that end, but planting them in our gardens for our own home fruit and in that way getting rid of some of the poor fruit trash we get in the market.

I thank you for your attention.

MR. MERRILL OF AUBURN: I would like to ask Mr. Wheeler how near together he sets his strawberry plants in the hill system.

MR. WHEELER: Most of the plants are set in four rows 14 inches apart each way in the bed. And then there is a space of three feet between the beds which is used for a path and to cultivate between with a horse. The plants that are set fourteen inches apart can only be cultivated by hand labor, with wheel hoes and hand tools. In some varieties which grow a very large plant I am setting only three rows, eighteen inches apart each way; but in either case making a bed about four feet across. In that way we can pick the plants from each side. We don't attempt to pick first on one side and then on the other; we pick two plants into the bed, each picker picking that way.

QUESTION: I would like to ask if there is any more danger of their winter-killing under the hill system than in matted rows?

MR. WHEELER: I have not found it so. You see there is enough foliage made by the plants to cover the ground completely, so that practically the hill system in this way is a wide matted row, with the advantage of having each plant by itself, so that when the berries ripen they lie right around the plant instead of being covered entirely by the immense quantity of foliage you get in a matted row. I find that one particular advantage in the hill system over the matted row is the ease with which you can pick the berries. In the matted row you have got to look all the foliage over to get the berries underneath; in the hill system the berries lie right round the plants, are easily seen and easily picked. There is no more danger, as far as I can see, of winter-killing than in the matted rows.

MR. MERRILL: Do you use the same varieties in the hill system as in the matted row?

MR. WHEELER: I prefer Glen Mary for the hill system over any other variety I have tried; possibly Sample is the second. The gentleman asked about Senator Dunlap—the great trouble with that is that it makes such an abundance of runners that it keeps you busy all the season pulling runners. I would rather not use that variety for the hill system, though it is a very good berry.

QUESTION: You say "pulling the runners." Do you pull them off?

MR. WHEELER: By putting your hand on the crown of the plant, you can take twenty-five runners in the other hand and pull them all off, pulling a little sideways so as not to break the crown.

QUESTION: When you are troubled with white grubs, do you reset other plants?

MR. WHEELER: Yes, when a plant is eaten out by a white grub, I reset another plant taken from another field, or in the hill system when a plant is missing, let the next plant make one runner to fill in that space if I haven't got plants to take out from another bed. Always reset them so as to keep the beds full. The white grub can easily be taken out; generally there is only one in a place. Even if there are a good many you can often save a bed by taking these pests out. I don't know of any insect poison, or anything of that sort, that will attack the white grub under ground. I have heard of the use of bi-sulphide of carbon injected into the soil where they are, but it would take a great deal longer to do that than to dig the grubs out.

HANDLING THE FRUIT CROP.

By PROF. T. M. LOMBARD, Auburn.

I will confine myself to strawberries, though I believe a large part of what may be said about berries applies as well to fruit of all kinds, and in fact, to much of the market garden truck grown and sold in such quantities in these two cities.

Handling the crop is a large problem. In the first place, harvesting the strawberry is of very great importance.

Quite a proportion of the strawberries raised about here never find the market, having been destroyed by the knees or feet of the picker, or left on the vines to rot. Quarts of berries that do find the market, so far as looks go, have been ruined in the field.

To gather in a crop of three, five or ten thousand quarts of strawberries, requires about all the children in a neighborhood, and to do it properly requires a man able to control his whole picking force, and govern his own soul. Due consideration of little details is every time rewarded. Painstaking care in the harvest attracts attention in the market places. A berry when picked should be immediately dropped into the box, never retained in the hand, till more berries are taken off. Once in the box, *let it alone.* Berries picked and left waiting in the sun are sure to show the effects in the market. To me, small crates are preferable to large ones. I am not in love with any of the crates that are in use here. I would never have anything rest, or press on top of a box of berries of any kind,—especially the strawberry. New boxes should be used and these should hold one quart.

Most of our berries after they come to the market are roughly handled, and most shamefully exhibited. Before the wide open doors of commission houses, on tables and in crates outside our stores, are displayed for sale berries and fruits of all kinds, subjected not only to the dust and dirt of city streets but to the feet of the fly.

We bring to our market good berries, poor berries and good-for-nothing berries picked into the same box and packed in the same crate. Different sized boxes are in the market most of the time. Three-fourths of these boxes of berries are never found filled to the top when on sale in the store. Right here is where we, as growers of the berry, fail to do our part. Most of us do not fill our boxes, and none of us grade our berries. We as growers, having gathered our crops with all possible care, must grade them before going to market. Proper grading of crops will bring better returns both in cash and self-satisfaction. The day of judgment will surely come and he who does not grade his crop in an honest manner will wake up some day to find himself down the line.

Now, in conclusion, what do we need—what ought we to do to bring about better and more systematic market conditions everywhere? Active and honest commission houses are good aids for this purpose. Such houses, however, often become indifferent and careless, forgetting the real thing, and our products are left to the mercy of time, and finally dropped in a bunch to pedlers. Therefore, to my mind, better than all commission houses, better than the ability of any one man to sell his own crop, would be a genuine, up-to-date *Fruit Growers' Association,*—some co-operative organization to the headquarters of which we may take our berries, or fruit, and have them cared for and disposed of for us in a profitable and honest manner.

Many times our market price is much reduced by some fellow from the country, ten miles or more out. He comes here with a load of berries. He has been on the road half the night, perhaps. Tired, anxious to get back home, knowing nothing of the market conditions he scatters his load over the town. Would not some organized selling place be better for him?

I have no favor for trusts. I am not talking about any trust company combined for selfish ends and greed of money, but true co-operation, pure and simple, that welcomes sincere competition and recognizes in each man who produces, the inherent or divine right to a just proportion of the price paid for that product in the market. Go into the creamery just over the hill. Notice what they are doing there. Set in motion a fruit packing and selling plant here in one of these two cities, and before long, in addition to its first and particular product, will be coming from inside its walls more by-products than can possibly come from any creamery in the world.

Organizations of some sort are springing up the country over. Can anyone give a good and sufficient reason why the fruit growers in this state or county, or town even, should not combine and co-operate. *Let's do it.*

PRUNING.

HON. GEORGE T. POWELL: A number of questions have been asked this morning in regard to the proper pruning of trees. I was asked if I would give some illustrations as to how a tree should be pruned.

The question of pruning is a very important one. From the beginning, when you purchase your trees, they should be put in the proper shape for planting. That means that the roots should first of all be pruned. All the roots should be cut back at least one-third of their length, no matter what the size of the tree is. One-third of the roots should come off whether it is a large tree or a small one. That will be a very good proposition for the root system of the tree. Now it is very important in receiving a lot of trees that they be not exposed to the wind or the sunshine, because these delicate, fine roots are very soon destroyed by exposure. Hence let this work of preparing the roots be done under cover, in a shed or somewhere out of the wind and sun.

Take the entire broken piece off, no matter where it is. Then turn the tree around and begin to cut back one-third. The small roots don't need much pruning. The tree should be planted at least one inch deeper than where it was budded. That puts the tree down a little lower than it grew in the nursery.

Some nurserymen recommend not to prune the tops at all, but to set the tree out just as it came from the nursery. I don't believe in it, because the tree has a greater proportion of top to support than it has root to support it. The theory on the part of the nurserymen is this,—that you must have foliage to draw the sap, and hence if there is an abundance of foliage in the top of the tree it stimulates root growth. Well, that depends upon conditions. If there is a moist season, plenty of rain-fall, and an abundance of moisture in the soil, that tree will grow and support the whole top, but if there is a dry season following the planting, there will be ten or fifteen per cent loss when the whole tops are left upon the trees. I plant a thousand trees at a time and have not lost one tree out of a thousand, and my practice has been simply to go through and prune back at least two-thirds of the top—the roots one-third and the tops two-thirds—cutting down to a bud that shall have an outward growth. There is sufficient root, having two-thirds of the root and one-third of the top; there is no reason why a thousand trees should not grow when a thousand trees are planted. There will be sufficient foliage to draw sap. If this is planted next spring, there should be at least a growth of two feet by next autumn.

QUESTION: Would you cover these cuts with anything?

MR. POWELL: No, it is not necessary; so small a cut as these will heal over.

QUESTION: Haven't you found, having it so close to the bud, that in a dry season it will go back to the next bud?

MR. POWELL: If it does, I should reprune. Once in a while the bud may fail to grow. Then I should prune back as soon as I discovered it was not growing.

QUESTION: Was that tree propagated from a piece of a root or a full plant?

MR. POWELL: I should say that this tree was propagated from a whole root for the reason that I cut off a long tap root.

When you get the piece root trees you get a sort of one-sided root. A tree that is one-sided does not have the tap root formation, so this is a tree grown upon the whole roots, and a great deal better tree.

Here is a tree that is a little different. This tree is drier. It has been out of the ground a good while and it has dried a good deal, hasn't so much of a root. Now there is a tree that would want different treatment. I should prune that tree as lightly as possible, just clipping off the ends so as to save as much of the root as possible, just simply clipping these lacerated ends so we may get readily a new formation of growth from these roots. That is all I prune this for, to get a new fresh cut from the bottom of the root in order to start out a new system of root growth. Because of the absence of the fibrous roots there would be a question as to whether this tree would pull through or not, hence in order to insure the growth I would leave a little more. Now the root has the entire opportunity of forcing out a few buds, and if about three or four buds are forced out it will make a splendid tree, but if the whole top was left on nine times out of ten that tree would die because the root could not support so much top as there was on the tree. So these are points that one needs to take into account in receiving a lot of trees, in the matter of pruning, in order to insure the growth of every tree.

These trees illustrate the difference between a whole root tree and a piece root tree. There may not always be quite so much difference as this, but a great deal of the time the piece root tree will have a very light root formation, and I don't like them on that account. I would rather give fifty cents for that whole root tree than to pay ten cents for this piece root one. That would be my judgment as between the value of those two types of trees propagated as they are.

Now just a few points on how to prune after the trees have been set. I have on my farm at the present time about 10,000 apple trees and I am heading them all down within as near as I can two and one-half to three feet of the ground, which are really low-headed trees. For the first four years after an apple tree has been set there is very little pruning to do; simply take out a cross branch. If we begin to prune these young trees from the time we set them out, we are going to push the tree forward too much into the air, we are going to get tall growing trees. In that way we sacrifice the tendency of that tree to produce fruit spurs early. Now if we do not prune these trees when they are young the tendency is to produce fruit spurs upon the low branches. As the low branches are growing out and upward the energy of that tree will constantly tend toward the development of fruit spurs upon the lower branches, but if we cut off these lower branches and keep pruning up, the tree is going to shoot up into the air and keep on growing, and will not develop the fruit spur system. So I don't like to prune young trees much of any for four years. At the end of four years we begin to do our pruning, beginning at the top, and cutting out all the branches that are inclined to grow up straight. All the lower branches that are growing in an outward direction are setting up heavy with fruit spurs, and there is no reason why we here in the East cannot under this system of management get young orchards into bearing in six and seven years profitably. There is where the West has the advantage of us,—they bring in their orchards so much sooner than we do here in the East, their orchards paying them well at five, six and seven years. We may not be able to bring our trees into bearing quite as quickly as can be done in the West, but there is no reason why we cannot do it in many years' less time than it takes at present, by this system of heading down our trees, after they begin to get four and five and six years old, still leaving the growth upward. Another point, in pruning the lower branches, prune to a bud that is on the upper side. In that way we change the tendency of the lower branch. Instead of growing outward and downward, the tendency will be upward. And by cutting back these lower branches, preventing a too long growth outward and downward, you are strengthening the growth of the branch next to the tree. Every time you prune to this upward bud, you are throwing the growth back and creating a strong branch. And I can actually cultivate my low-headed trees today that are eight and nine years old under this system easier than I can my high-headed trees pruned up four and five feet, because the growth in the low-headed trees next the trunk is so strong that it has held the branches up, while in the other case the growth has not been so strong and as they bear the limbs come down close to the ground. We have just as much fruit on the ground from the high-headed trees, and I think even more than we have on the low branches of the low-headed trees, because of the upward growth of the lower system of branches on the latter.

HOW I RECLAIMED A NEGLECTED ORCHARD.

By C. E. Hardy, Hollis, N. H.

Mr. President, Ladies and Gentlemen:

It gives me great pleasure to visit your fruit exposition and see such a fine display of apples as you have here today. It is certainly, for one of our New England States, a great exhibition and a grand success. When I see such an exhibition of fruit, it proves to me that the farmers of New England, and of the State of Maine in particular, are beginning to realize the possibilities that lie before them in the raising of fruit, and especially apples. Also when I see such an exhibition and listen to the remarks of the expert fruit growers who have been talking to you yesterday and this morning, it makes me feel rather small and out of place, to come down here from New Hampshire and undertake to talk to you in any way in regard to raising fruit, for I am not an expert in any sense of the word; in fact, I had but very little experience in this line previous to four years ago, and in the matter of setting out trees and raising fruit from them have had no experience whatever. But Dr. Twitchell asked me to come down here and tell the story of how I have reclaimed an old and neglected orchard, and that I can tell you in a very short time. It is simply the work of four years.

The farm in Hollis, N. H., which is now my home, is my old native place where I was born and brought up. I worked on the place as a boy and a young man for my father up to something like twenty-one or twenty-two years ago, when, like a good many young men, becoming dissatisfied with the methods that my father used in carrying on the farm, and also with a good deal of the work I had to do, I thought I could do better in other business. I stopped work on the farm and went into business, and from that time up to four years ago knew but little about the work that was actually carried on on the place, although the old farm was still my home. I was not there during the day time, simply at night. Things went on in this way until the fall of 1906, when my father, who was growing old and feeble, requested me to take the place and carry it on to suit myself. This I consented to do, disposed of my other business, and took the place.

About the first work that was attended to was the harvesting of the apples. I remember way back in 1896, I think it was, my father harvested something like 1200 barrels of apples. People thought it was a large crop. But they were very poor apples, small and green, and he sold them and realized ninety-six cents a barrel at the station. That was a year of tremendous crops in apples. From that time on he declared that he would have nothing more to do with fruit, and paid no attention whatever to his trees,—simply had the fruit picked when the time came. In harvesting the apples in 1906 there were about 300 barrels that were in fairly good condition to sell as mixed apples. In picking those apples I found a good many trees the fruit on which was completely covered with San Jose scale, so that I had to shake the apples off and put them into cider; I found other trees that showed more or less scale on the fruit. While picking the fruit I did not know what the trouble was, but my son, who was then a student in the New Hampshire College taking the agricultural course, was at home for a vacation over Sunday and I brought his attention to the condition of the apples we were picking, and the condition of the trees in some cases. After examining them, he said he thought it was the San Jose scale, although he wasn't sure; that they had been studying that at the school, but hadn't had samples while he had been there, so he could not tell exactly how it looked. He took some of the apples and the twigs that were the worst affected back with him to the college, and I soon learned that I had the San Jose scale in bad shape. I realized what I had got for I had read about the insect and knew something of what it would do and the condition in which it would leave the trees if not taken care of—that they would soon die—and I made up my mind that I had got more on my hands than I could handle and about decided to dig those trees out,—the worst of them, at any rate. My son said so much against this operation, however, that I finally thought I would see if I could save them, but I hadn't much faith in the work.

My father was a man who, like three-quarters or more of our New England farmers, did not believe in pruning his trees. The only thing that he would ever allow the hired man to do, or would allow me to do when I was a young man at home, in regard to pruning trees, was to cut out the dead wood and some of the suckers or water sprouts. So you can see how those trees had been growing for years and in what condition they were. And in addition to that, half or two-thirds of them were badly infested with the scale. When I made up my mind to see what I could do with the trees the first winter, the winter of 1906-7, I started in pruning them what I could. With the condition the trees were in, I only got over a few trees during that winter, with what other work I had to attend to.

There were then about 700 trees on the place. About the first of March I ordered a barrel of Scalecide. I thought I would try to spray the worst of those trees for the San Jose scale. I took a barrel pump and my man and myself went over a few of the worst trees and disposed of that barrel of Scalecide. Then my son stepped in again and said: "Why don't you spray for the codling moth and see if you can raise some good fruit?" Well, I considered that a while and finally I ordered two 100 lb. kegs of Bowker's Pyrox manufactured by the Bowker Insecticide Company of Boston, and my hired man and myself went to work on one of my orchards to spray the trees.

To explain the condition of things, I will have to explain the position of the orchard on that farm. There are two orchards; one at the south end of the farm, which we call the south orchard, contains something over 300 trees; 125 of these are trees that are twenty-one and twenty-two years old, which my father set out. He kept that ground cultivated for two or three years and then it went into grass and has remained so ever since. In the remainder of the orchard the trees are at least sixty and I don't know but more than seventy years old. The north orchard contains a little more than 200 trees and they are all old trees, sixty or more years old. In a part of that orchard the trees are only about twenty-five feet apart and they run up high.

You can imagine what condition they were in. There are also about 200 other trees on the place, scattered over the rest of the farm in rows along by the walls and in single trees through the mowing.

When I commenced spraying for the codling moth my man and I went to work in the south orchard. It took us four days with that pump to go over the orchard. There were a great many high trees in the old part and we tried our best to hit the tops of them. We did fairly well, I think, for a barrel pump and with the nozzle we had that threw streams instead of an even spray. At the end of four days we got over the orchard. The man said: "Are you going over the other one?" I told him no, the work was pressing, and that old pump did work hard. I said if there was any good in spraying we would find it out. Both orchards blossomed apparently alike and my scattering trees the same. I watched the difference between the two orchards through the summer, and I could very soon see that there was a big difference. And when we came to harvest the apples in the fall, from the south orchard I harvested a little over 600 barrels of good, nice, smooth apples which would practically all go for No. 1. There might have been eight or ten per cent that would not. I sold them as mixed apples, as we were in the habit of doing at that time, and got a good price for them. There were only from 30 to 35 bushels of cider apples that came out of that whole lot. In the north orchard I harvested a little over 100 barrels of not nearly as good apples and I sold over five hundred bushels of cider apples out of that orchard. This convinced me that spraying paid, and I made up my mind then to take hold of it in good earnest and do what I could with what trees I had. That fall I decided that if I was going to spray I must get some sort of a power sprayer. I purchased a power sprayer of the Friend Manufacturing Company of Gasport, N. Y., and I decided to use lime and sulphur to spray for the scale. I put in a cooking plant of my own and cooked my own lime and sulphur, putting in a steam boiler and a tank for cooking, and then running the lime-sulphur wash off into my spray tank, and during the month of December, up to about Christmas time, I got over my trees.

It is quite a serious job to spray for San Jose scale and do it in good shape. One who has never done it or handled the lime and sulphur wash hardly realizes what it is. We are obliged to spray with the wind, and there is always plenty of wind any time during the months that the trees are dormant. Every bit of the wood has to be covered in order to smother the scale. It took me the whole month of December, what weather I could get that was suitable, to spray. In the following March I went all over my trees again and gave them a good, thorough soaking. And of course in May when the trees blossomed I sprayed for the codling moth as before, and two weeks afterwards went over them with another lot of Pyrox. The result was that I harvested 1150 barrels from my orchards and they were all fairly good market apples,—not nearly as many cider apples as I had the year before.

In the spring of 1909 I went through these same operations again, spraying the trees for the San Jose scale, and of course spraying for the codling moth, with the exception that for my McIntosh apples I sprayed before the buds opened; just as they were getting good and pink I gave them a good spraying with Pyrox, and after spraying the first time for the codling moth, in spraying two weeks afterwards I used clear lead arsenate instead of the Pyrox as before, and I think that made quite a difference in regard to the brown-tails on them. A few of my scattering trees I did not spray the second time because they were in fields where the grass was heavy and I did not care to go through the fields, and those trees had the brown-tail moths on them quite thick. But there were scarcely any brown-tails on those trees on which I used the lead arsenate for the second spraying. That arsenate stayed on the leaves and I think destroyed the insects. This last spring of 1910 of course I went through the same process, with fairly good results.

Now in regard to fertilizing my trees. I have taken up two or three different ways in different orchards. My north orchard, in which I spoke of the trees as being close together, the first two years I fertilized with manure from the barn, put on with the manure spreader at the rate of about ten loads to the acre. I ploughed that in, running the plough shallow, not more than three or four inches deep, and kept that harrowed down the greater part of the season. I did that for two years, 1907 and 1908, with that orchard. The south orchard and my scattering trees, I put on for the first two years bone and potash, mixing them half and half, and putting on about twenty pounds to the tree, not putting it nearer the body of the tree perhaps than three or four feet, and extending out quite a distance beyond the limbs. In 1909 and 1910 I used ashes and bone. In 1909 I put on thirteen tons of Canada hard wood ashes, four tons of bone, and about three-quarters of a ton of nitrate of soda, mixed together and put on with the manure spreader, broadcast over the ground. The north orchard I ploughed again, as I had the two years before. This last year I did not plough it but left it just as it was.

There is a question in my mind in regard to the cultivation of old orchards like these. It has been agitated here that you get better fruit to cultivate the orchards. I think that is true with young orchards, if you follow the cultivation along. But I have had a little experience that seems to indicate that it does not agree with old orchards. These old trees in the north orchard I kept cultivated for three years. I ploughed it each spring and kept it harrowed down, and the fruit of that orchard has been very green. It is possible that I fertilized it too heavily. The foliage has been very heavy, the leaves in a good many cases being half to two-thirds as large as the palm of your hand and just as thick as they could be. The apples set thick and I ought to have thinned them but the trees were high and hard to get at and we were always busy in the spring. I could not get nearly the value per barrel for those apples, and I don't think I got as many apples to the tree as I did in my south orchard. The latter orchard I have not cultivated at all, but kept it in grass, and have done all the fertilizing as a top dressing.

In regard to pruning the trees. After the first year, in which I had got good returns for spraying the south orchard, I hired a man who understood pruning pretty well, and we went to work and did all we could during that winter, up to the time we commenced the spring's work, on pruning. After the first spraying for San Jose scale with the power sprayer, I found my trees were too high. We would use a thirty-foot ladder to pick some of the apples from many of those old trees and then we couldn't reach within five or ten feet of the top. In pruning I cut the tops of those trees out, cutting ten, fifteen, and even twenty feet off the top, and I have also cut the side limbs where you could not get near enough to throw the spray into the center of the tree from the tower of the machine. We would throw up from the ground as far as we could. Since then I have been able to get near my trees.

I spoke of fertilizing and putting on thirteen tons of ashes. This last spring I put on eighteen tons and only two tons of bone and left out the nitrate of soda altogether; I think I did better by putting on more of the potash and leaving out the nitrate of soda, and perhaps the bone.

What was the result of these four years' work? The first year I harvested 835 barrels of good market apples; 1908, 1150 barrels; 1909, a little over 1000; and this year there is something over 800, though they have not all gone to market yet. In the year 1907 the 835 barrels returned me a little over $2400 at my station; in 1908 I received a little over $2500 at my station; last year the 1000 barrels were all sold in Boston. Part of them were sold in the fall soon after they were packed and the remainder went into cold storage and were sold out in February and some as late as the first of March. I realized something over $3000 for those. This year I can't tell you what I will realize because they are not nearly all sold, but I have established something of a mail order system and more than 75% of my best apples have gone in that way at a good price, so I am satisfied that even at a smaller price for the poorer fruit which I have left I will realize a great deal more than I have ever done before.

I will say this,—that I should never have gone into this work if my son had not taken an agricultural course at the New Hampshire college. He is very much interested in the farm work and realized from his studies, I suppose, that there was a great future in fruit for New England people; he knew we had those old trees and said so much that I went to work on them. If any of you farmers have sons who want to go to college, influence them to go to the agricultural college and take an agricultural course, if you can. I tried to dissuade my son from this before he went, but it was either go and take the agricultural course in our State College or not go at all, and I think it has been a good thing in that way. The western people are doing all they can to advertise their western fruits in our markets. If our New England farmers would brace up and take care of their old neglected orchards, there is no reason why they should not have the same success that I have; and there is plenty of room for new orchards, and with the same care and attention that the western people give, there is no reason why they would not do as well. Perhaps we cannot come up to them on size of fruit, but we can surely beat them on the flavor, and we ought to be able to supply our own markets and supply our share of the foreign trade.

PRESIDENT TWITCHELL: I wish Mr. Hardy might give us a little more in regard to his faith in the sod system with his old trees, it being contrary to the generally accepted idea.

MR. HARDY: I will say in regard to the south orchard, I have cut the grass and taken it into the barn. The crop has been very light until this last year. After top dressing with these fertilizers, the bone and potash, using so much last year, the crop of grass was quite a good deal heavier. I did think about leaving it on the ground as a mulch, and then I was afraid of fire running over it and spoiling the trees, and I put it in like any other hay. Now last year my prize apples on which I took the cup at the New England fruit show, came from the young trees in the south orchard. They are not so large as they ought to be for their age from the fact that they have never been cultivated. They were bearing anywhere from four to six or seven barrels to the tree, and I was obliged to put twenty or thirty props under some of the trees and then they would break down in spite of me. It is a question in my mind. I have some idea of ploughing a part of that orchard but I am almost afraid to do it from the fact that I am afraid it will result as it did in the old orchard and that I won't get the color.

PRESIDENT TWITCHELL: Prof. Gardner of Orono was appointed to open the discussion on the subject of insect pests. He has kindly consented to follow Mr. Hardy at this time.

PROFESSOR V. R. GARDNER:

Mr. President, Ladies and Gentlemen:

After two days, or two days and a half of such a program as we have had, with the lectures and with all the questions that have been asked and the answers given, there is hardly anything left to say for the last man that is scheduled to come on the program, so that I shall probably have to be excused with a very few remarks.

If there has been one thing that has been emphasized in this meeting thus far more than anything else, it has been the necessity of spraying thoroughly to control our insect pests, and if there is one thing that needs emphasis more than anything else it is that very thing. For I doubt if there is one factor that is more important than that in building up a better and more promising and more successful fruit industry in the State. There are a number of factors which enter into the development of an important and a successful and a modern fruit industry. Good pruning is one. Good fertilization is another. The proper selection of nursery stock is another. All of these have been mentioned, but as I say, the emphasis at this meeting has been put upon spraying, and rightly so, because that probably is the most important of any single factor.

There is one side of the insect and disease control problem, however, to which comparatively little attention has been called, and it may well be mentioned for a moment at this time, and that is the matter of good orchard sanitation. We can control most of our orchard insects and most of our orchard diseases by means of the spray pump and arsenate of lead and lime and sulphur, with other materials that go along with them, but there are certain pests which the spray pump is not able to reach. We have got to handle these pests in another way. I refer especially to the railroad worm, the trypeta, the apple maggot, as it is variously called, and to another pest which though perhaps not quite as serious is still doing a great deal of damage in most of our apple orchards, viz., the curculio. Those are two serious apple insects in this State. I don't remember of having been in an orchard where I have carefully looked at the fruit but that I have seen more or less of the work of both of these pests. I have been in some orchards in the State where perhaps 50% to 75% of the apples on a single tree would be injured by the curculio, and I have been in other orchards where 100% of the apples upon the tree, and probably 98% of the apples in the whole orchard were not only injured but ruined by the apple maggot. Now what are we going to do to control these pests? Are we going to be able to meet them? To meet these pests at the present time is not exactly an easy proposition, but it is within our reach, and the remedy, as I suggested a moment ago, is that of clean culture or good orchard sanitation. By clean culture I do not necessarily mean ploughing the orchard every spring and using the harrow and keeping the ground clean and free from growth of any kind until the fall and letting the orchard go into winter in bare soil. But certainly for the first part of the season the orchard should be ploughed and harrowed a few times,—at least those orchards should where these pests are doing very much damage.

A few weeks ago, about the middle of September, a number of orchard growers wanted me to look at some of their trees, and tell them what was the matter with the fruit. We found that practically all the trouble was the trouble that was illustrated by this Northern Spy apple that you just had before you. As Prof. Bonns has said, those apples have all the appearance of being infested with the railroad worms. It is possible, however, that it may be another species of a closely related insect that is troubling them. But whether it is the apple maggot, or the curculio, or another closely related pest, the remedy is precisely the same. It is clean orchard culture. Most fortunately indeed in this trip a few weeks ago that I mentioned, absolutely clean culture had been practiced in the orchard that I went into, this season and also the season before—an orchard almost within your own city limits. And that orchard, surrounded by other orchards of the same varieties that were badly infested with this trouble, was almost practically free from it. Perhaps five per cent, perhaps in the case of trees near the other orchards ten or even fifteen per cent of the apples upon those trees were infested with this trouble, but there is a great difference between 90% or 95% sound fruit and 90% or 95% blemished fruit. So whatever that particular species may eventually be found to be, that is causing this trouble in our Northern Spies and some of our other varieties, that remedy seems to be the one which will do the work.

There is another thing in connection with orchard sanitation that should be mentioned. A great many of our orchards are not set in block form. The trees are scattered along stone walls or along fences in such a position that they are not only difficult to spray but it is almost impossible to cultivate close to them. Perhaps we cannot get within four or five feet on either side. Under such circumstances, if the railroad worm or the apple curculio gets into our fruit we have a very difficult task to get rid of it. Perhaps if we can turn hogs or sheep into the orchard or the fields where these trees border we may be able to control the trouble partially; but it will only be a partial control. I think there are many places in the State where trees are growing along fences and along stone walls, that year in and year out are producing perhaps half a peck to a peck of sound fruit and a bushel to five bushels of blemished fruit, that it would be a great deal better for the fruit grower to cut down and burn these than to leave them to be a menace to his orchard and to his neighbors' orchards. If these particular pests, viz., the railroad worm and the apple maggot and the apple curculio, and perhaps others that work in a similar manner are not troubling the trees along such places we can fight off the other pests by means of the spray pump, driving right along each side in most cases, and control the caterpillars, the codling moth, the scab and probably the canker; but in those places where we cannot reach the tree satisfactorily with the spray pump, or where the trees are affected by pests that cannot be reached by means of a spray, I think good sanitation, protection for the rest of our trees demands that we dispose of them and start trees in another place. It is a profitable thing to have trees along the fences if we can grow sound fruit there; but if we cannot grow sound fruit there, if the trees are a menace to the rest of our orchard, it is not a paying business proposition to have them. These two pests we have just been mentioning, the curculio and the railroad worm, spend the winter near the surface of the soil, in beds of sod, or under sticks, or under stones, and then come out early the next spring to infest another year's crop. And unless we can turn the soil over and bury these pests so deeply that they can't come out the chances are we shall have them the following season and instead of decreasing in numbers they will increase.

Another point that may be mentioned in connection with orchard sanitation and which bears directly upon the control of our insects and diseases is great care in the pruning of our trees, in the removal of all dead or dying limbs. Sometimes we see a limb towards the outside or the top of a tree that has died back six inches. It is only a small limb but something has destroyed it. We think it is too far out or too much bother to remove it. If that limb is left there, probably by the end of another season it will infest several other limbs, or will have died back much further. It is canker in the majority of cases that is killing back the limbs of our trees, and in pruning we cannot be too careful to remove the ends of all these dying limbs. Cut them well back into the living tissue and get rid of that source of the disease to the other healthy portions of the tree and to the other healthy trees in the orchard. In the same connection it should be said that where we prune small branches infested in that way, great care should be taken to carefully rake up and burn all the prunings, for if these things are left to lie upon the land, with insects and birds lighting upon them and then flying back to the trees, they become nearly as bad a source of infection for other live healthy wood on the ground as they would be if they were left upon the tree. Of course in the case of an orchard which is cultivated, the smallest twigs would probably be ploughed under and the source of infection destroyed in that way. But we cannot be too careful about sanitation in our orchards. Good sanitation is something which goes right along with good spraying, and good spraying cannot have its highest efficiency unless good sanitation accompanies it. It seems to me, in connection with the control of our orchard pests and our orchard insects, that is the one thing that should be emphasized in addition to what already has been emphasized in the various sessions of the meeting.

PRESIDENT TWITCHELL: We are now coming to the closing moments of this session. I want to thank those present for their promptness in attendance and for the excellent order which has been maintained throughout, and for the freedom with which we have participated in the discussion. It seems to me that this may be a fruitful time which we have spent together.

PROF. E. F. HITCHINGS: I have been asked to say a few words in relation to Maine's position in the New England Fruit Show. At our annual meeting held three weeks ago in New Hampshire, we voted to hold the next annual exhibit in Boston next fall, during the last week in October or the first week in November. The date has not been set but it will be later than last year for the benefit of the states who worked at a disadvantage last year. The meeting was held so early that most of the leading varieties of Maine apples had not colored as they should, and were not in a condition to exhibit. The exhibit last year was the first ever attempted in New England, and but few of our orchard men had ever attempted to pack apples in boxes. We have here today 110 boxes, most of them packed by our own orchardists. I think we are seeing results from this movement for better fruit. The future of the New England fruit question, so far as Maine is concerned, I believe rests with you who are interested in orcharding, you who will go to Boston with your fruit next October or November. Possibly we shall not have any more fruit than we had at the first exhibition; there may not be room for it, as other states will send their carload lots, but it is the quality which will tell. We have much to learn in relation to the packing of the fancy box if we are to secure the same rights and privileges and conditions that the people who send us apples from Oregon have; and the same with the barrels. There are certain requirements for a first-class barrel pack and also for a first-class box pack. We must come up to these requirements. I hope you are all interested to the extent that you want to see better fruit in Maine. Let us raise the best quality of fruit, and then see that we come up to the requirements for first-class packing, and Maine will have a name throughout the length of the land for her fruit, as she does for her grain and potatoes, especially the Aroostook potato.

I hope that every member of this association will make up his mind to go to Boston next year and show them that Maine is still in the fight for better fruit. Lots of blue ribbons came to Maine last year, and we are proud of it. It is not so much the value of the premium as the name, and the honor of knowing that we can raise fruit.

I want to say that in two years from now the New England Fruit Show will be associated with our Pomological Society in its meeting, and of course that meeting will have to be in a location that will be accessible to New England. The project is that it shall be a biennial exhibit, and the alternate year the members shall meet with and take an interest in the Pomological Meeting in one of the other states. This year we met with New Hampshire, and I was very much surprised not to find a single box, barrel or plate of apples from Maine at that exhibit. I think this was a mistake. Two years from now, wherever that meeting is held, let us go there with an exhibit to compete with New England. And in the next year, before we go to Boston, let us learn to pack our apples, and I assure you that if Maine goes there with the right kind of package she will win her share of blue ribbons.

A pleasing banquet closed the week's sessions and proved the interest of the city in the work of this society.

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The Abbreviation "Pom." signifies the Pomological Report.